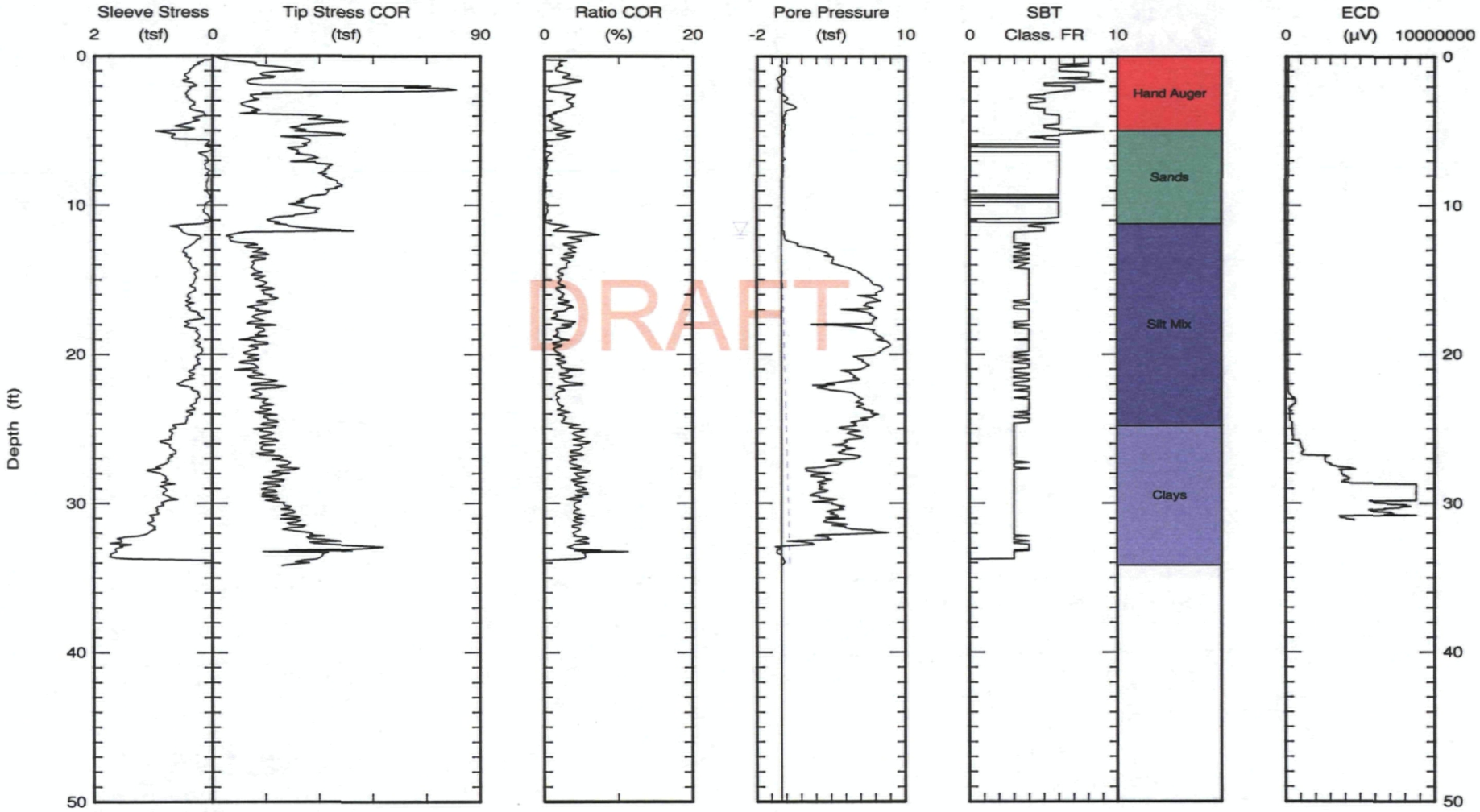
| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VINYL CHLORIDE | 0.043 | 0 | UG/M3 | 1.7 | 0.0044 | 0.043 | U | N | | | | X | U | 0.0044 | 0.043 | SLOP-6317-IA-NE | NONE | MS7061008 |
| TRANS-1,2-DICHLOROETHENE | 0.043 | 0 | UG/M3 | 1.7 | 0.0048 | 0.043 | U | N | | | | X | U | 0.0048 | 0.043 | SLOP-6317-IA-NE | NONE | MS7061008 |
| cis-1,2-DICHLOROETHYLENE | 0.058 | 0 | UG/M3 | 1.7 | 0.0048 | 0.043 | = | N | | | | X | = | 0.0048 | 0.043 | SLOP-6317-IA-NE | NONE | MS7061008 |
| 1,2-DICHLOROETHANE | 0.062 | 0 | UG/M3 | 1.7 | 0.0048 | 0.043 | = | N | | | | X | = | 0.0048 | 0.043 | SLOP-6317-IA-NE | NONE | MS7061008 |
| TRICHLOROETHYLENE (TCE) | 0.16 | 0 | UG/M3 | 1.7 | 0.0049 | 0.017 | = | N | | | | X | = | 0.0049 | 0.017 | SLOP-6317-IA-NE | NONE | MS7061008 |
| TETRACHLOROETHYLENE(PCE) | 0.12 | 0 | UG/M3 | 1.7 | 0.0046 | 0.043 | = | N | | | | X | = | 0.0046 | 0.043 | SLOP-6317-IA-NE | NONE | MS7061008 |
| VINYL CHLORIDE | 0.036 | 0 | UG/M3 | 1.44 | 0.0037 | 0.036 | U | N | | | | X | U | 0.0037 | 0.036 | SLOP-6317-IA-SW | NONE | MS7061008 |
| TRANS-1,2-DICHLOROETHENE | 0.036 | 0 | UG/M3 | 1.44 | 0.004 | 0.036 | U | N | | | | X | U | 0.004 | 0.036 | SLOP-6317-IA-SW | NONE | MS7061008 |
| cis-1,2-DICHLOROETHYLENE | 0.044 | 0 | UG/M3 | 1.44 | 0.004 | 0.036 | = | N | | | | X | = | 0.004 | 0.036 | SLOP-6317-IA-SW | NONE | MS7061008 |
| 1,2-DICHLOROETHANE | 0.063 | 0 | UG/M3 | 1.44 | 0.004 | 0.036 | = | N | | | | X | = | 0.004 | 0.036 | SLOP-6317-IA-SW | NONE | MS7061008 |
| TRICHLOROETHYLENE (TCE) | 0.13 | 0 | UG/M3 | 1.44 | 0.0042 | 0.014 | = | N | | | | X | = | 0.0042 | 0.014 | SLOP-6317-IA-SW | NONE | MS7061008 |
| TETRACHLOROETHYLENE(PCE) | 0.1 | 0 | UG/M3 | 1.44 | 0.0039 | 0.036 | = | N | | | | X | = | 0.0039 | 0.036 | SLOP-6317-IA-SW | NONE | MS7061008 |
| VINYL CHLORIDE | 0.043 | 0 | UG/M3 | 1.72 | 0.0045 | 0.043 | U | N | | | | X | U | 0.0045 | 0.043 | SLOP-6317-IA-SW-FD | NONE | MS7061008 |
| TRANS-1,2-DICHLOROETHENE | 0.043 | 0 | UG/M3 | 1.72 | 0.0048 | 0.043 | U | N | | | | X | U | 0.0048 | 0.043 | SLOP-6317-IA-SW-FD | NONE | MS7061008 |
| cis-1,2-DICHLOROETHYLENE | 0.046 | 0 | UG/M3 | 1.72 | 0.0048 | 0.043 | = | N | | | | X | = | 0.0048 | 0.043 | SLOP-6317-IA-SW-FD | NONE | MS7061008 |
| 1,2-DICHLOROETHANE | 0.058 | 0 | UG/M3 | 1.72 | 0.0048 | 0.043 | = | N | | | | X | = | 0.0048 | 0.043 | SLOP-6317-IA-SW-FD | NONE | MS7061008 |
| TRICHLOROETHYLENE (TCE) | 0.14 | 0 | UG/M3 | 1.72 | 0.005 | 0.017 | = | N | | | | X | = | 0.005 | 0.017 | SLOP-6317-IA-SW-FD | NONE | MS7061008 |
| TETRACHLOROETHYLENE(PCE) | 0.11 | 0 | UG/M3 | 1.72 | 0.0046 | 0.043 | = | N | | | | X | = | 0.0046 | 0.043 | SLOP-6317-IA-SW-FD | NONE | MS7061008 |
| VINYL CHLORIDE | 0.025 | 0 | UG/M3 | 1 | 0.0026 | 0.025 | U | N | | | | X | U | 0.0026 | 0.025 | TB-052908A | NONE | MS7061008 |
| TRANS-1,2-DICHLOROETHENE | 0.025 | 0 | UG/M3 | 1 | 0.0028 | 0.025 | U | N | | | | X | U | 0.0028 | 0.025 | TB-052908A | NONE | MS7061008 |
| cis-1,2-DICHLOROETHYLENE | 0.025 | 0 | UG/M3 | 1 | 0.0028 | 0.025 | U | N | | | | X | U | 0.0028 | 0.025 | TB-052908A | NONE | MS7061008 |
| 1,2-DICHLOROETHANE | 0.003 | 0 | UG/M3 | 1 | 0.0028 | 0.025 | J | N | | | | X | J | 0.0028 | 0.025 | TB-052908A | NONE | MS7061008 |
| TRICHLOROETHYLENE (TCE) | 0.0031 | 0 | UG/M3 | 1 | 0.0029 | 0.01 | J | N | | | | X | J | 0.0029 | 0.01 | TB-052908A | NONE | MS7061008 |
| TETRACHLOROETHYLENE(PCE) | 0.025 | 0 | UG/M3 | 1 | 0.0027 | 0.025 | U | N | | | | X | U | 0.0027 | 0.025 | TB-052908A | NONE | MS7061008 |
| VINYL CHLORIDE | 0.025 | 0 | UG/M3 | 1 | 0.0026 | 0.025 | U | N | | | | X | U | 0.0026 | 0.025 | | NONE | MS7061008 |
| TRANS-1,2-DICHLOROETHENE | 0.025 | 0 | UG/M3 | 1 | 0.0028 | 0.025 | U | N | | | | X | U | 0.0028 | 0.025 | | NONE | MS7061008 |
| cis-1,2-DICHLOROETHYLENE | 0.025 | 0 | UG/M3 | 1 | 0.0028 | 0.025 | U | N | | | | X | U | 0.0028 | 0.025 | | NONE | MS7061008 |
| 1,2-DICHLOROETHANE | 0.025 | 0 | UG/M3 | 1 | 0.0028 | 0.025 | U | N | | | | X | U | 0.0028 | 0.025 | | NONE | MS7061008 |
| TRICHLOROETHYLENE (TCE) | 0.01 | 0 | UG/M3 | 1 | 0.0029 | 0.01 | U | N | | | | X | U | 0.0029 | 0.01 | | NONE | MS7061008 |
| TETRACHLOROETHYLENE(PCE) | 0.025 | 0 | UG/M3 | 1 | 0.0027 | 0.025 | U | N | | | | X | U | 0.0027 | 0.025 | | NONE | MS7061008 |
| 1,2-DICHLOROETHANE-D4 | 98 | 100 | PERCENT | 1 | | | = | Y | 98 | 70 | 130 | X | = | | | | NONE | MS7061008 |
| TOLUENE-D8 | 100 | 100 | PERCENT | 1 | | | = | Y | 100 | 70 | 130 | X | = | | | | NONE | MS7061008 |
| 1-BROMO-4-FLUOROBENZENE (4-BROMOFLUOROBENZENE) | 100 | 100 | PERCENT | 1 | | | = | Y | 100 | 70 | 130 | X | = | | | | NONE | MS7061008 |
| 1,2-DICHLOROETHANE-D4 | 100 | 100 | PERCENT | 1 | | | = | Y | 100 | 70 | 130 | X | = | | | | NONE | MS7061008 |
| TOLUENE-D8 | 102 | 100 | PERCENT | 1 | | | = | Y | 102 | 70 | 130 | X | = | | | | NONE | MS7061008 |
| 1-BROMO-4-FLUOROBENZENE (4-BROMOFLUOROBENZENE) | 100 | 100 | PERCENT | 1 | | | = | Y | 100 | 70 | 130 | X | = | | | | NONE | MS7061008 |
| 1,2-DICHLOROETHANE-D4 | 98 | 100 | PERCENT | 1.7 | | | = | Y | 98 | 70 | 130 | X | = | | | SLOP-6317-IA-NE | NONE | MS7061008 |
| TOLUENE-D8 | 99 | 100 | PERCENT | 1.7 | | | = | Y | 99 | 70 | 130 | X | = | | | SLOP-6317-IA-NE | NONE | MS7061008 |
| 1-BROMO-4-FLUOROBENZENE (4-BROMOFLUOROBENZENE) | 99 | 100 | PERCENT | 1.7 | | | = | Y | 99 | 70 | 130 | X | = | | | SLOP-6317-IA-NE | NONE | MS7061008 |
| 1,2-DICHLOROETHANE-D4 | 96 | 100 | PERCENT | 1.7 | | | = | Y | 96 | 70 | 130 | X | = | | | SLOP-6317-IA-NE | NONE | MS7061008 |
| TOLUENE-D8 | 100 | 100 | PERCENT | 1.7 | | | = | Y | 100 | 70 | 130 | X | = | | | SLOP-6317-IA-NE | NONE | MS7061008 |
| 1-BROMO-4-FLUOROBENZENE (4-BROMOFLUOROBENZENE) | 100 | 100 | PERCENT | 1.7 | | | = | Y | 100 | 70 | 130 | X | = | | | SLOP-6317-IA-NE | NONE | MS7061008 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-SW | SLOP-6317-IA-SW | N | AIR | P0801629-002 | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 17:23 | 0 | MS7061008 | 17060-07-0 | DCA12D4 |
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-SW | SLOP-6317-IA-SW | N | AIR | P0801629-002 | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 17:23 | 0 | MS7061008 | 2037-26-5 | BZMED8 |
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-SW | SLOP-6317-IA-SW | N | AIR | P0801629-002 | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 17:23 | 0 | MS7061008 | 460-00-4 | BR4FBZ |
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-SW-FD | SLOP-6317-IA-SW-FD | N | AIR | P0801629-003 | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 16:13 | 0 | MS7061008 | 17060-07-0 | DCA12D4 |
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-SW-FD | SLOP-6317-IA-SW-FD | N | AIR | P0801629-003 | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 16:13 | 0 | MS7061008 | 2037-26-5 | BZMED8 |
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-SW-FD | SLOP-6317-IA-SW-FD | N | AIR | P0801629-003 | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 16:13 | 0 | MS7061008 | 460-00-4 | BR4FBZ |
| 4.00AFCEE3 | CASS | P0801629 | TB-052908A | TB-052908A | N | AIR | P0801629-004 | TO15SIM | NONE | 5/29/2008 | 10:00 | 5/30/2008 | 6/10/2008 | 19:22 | 0 | MS7061008 | 17060-07-0 | DCA12D4 |
| 4.00AFCEE3 | CASS | P0801629 | TB-052908A | TB-052908A | N | AIR | P0801629-004 | TO15SIM | NONE | 5/29/2008 | 10:00 | 5/30/2008 | 6/10/2008 | 19:22 | 0 | MS7061008 | 2037-26-5 | BZMED8 |
| 4.00AFCEE3 | CASS | P0801629 | TB-052908A | TB-052908A | N | AIR | P0801629-004 | TO15SIM | NONE | 5/29/2008 | 10:00 | 5/30/2008 | 6/10/2008 | 19:22 | 0 | MS7061008 | 460-00-4 | BR4FBZ |
| 4.00AFCEE3 | CASS | P0801629 | MS7061008LCS1 | MS7061008 | BS | AIR | P080610-LCS | TO15SIM | NONE | | | | 6/10/2008 | 11:48 | 0 | MS7061008 | 75-01-4 | VC |
| 4.00AFCEE3 | CASS | P0801629 | MS7061008LCS1 | MS7061008 | BS | AIR | P080610-LCS | TO15SIM | NONE | | | | 6/10/2008 | 11:48 | 0 | MS7061008 | 156-60-5 | DCE12T |
| 4.00AFCEE3 | CASS | P0801629 | MS7061008LCS1 | MS7061008 | BS | AIR | P080610-LCS | TO15SIM | NONE | | | | 6/10/2008 | 11:48 | 0 | MS7061008 | 156-59-2 | DCE12C |
| 4.00AFCEE3 | CASS | P0801629 | MS7061008LCS1 | MS7061008 | BS | AIR | P080610-LCS | TO15SIM | NONE | | | | 6/10/2008 | 11:48 | 0 | MS7061008 | 107-06-2 | DCA12 |
| 4.00AFCEE3 | CASS | P0801629 | MS7061008LCS1 | MS7061008 | BS | AIR | P080610-LCS | TO15SIM | NONE | | | | 6/10/2008 | 11:48 | 0 | MS7061008 | 79-01-6 | TCE |
| 4.00AFCEE3 | CASS | P0801629 | MS7061008LCS1 | MS7061008 | BS | AIR | P080610-LCS | TO15SIM | NONE | | | | 6/10/2008 | 11:48 | 0 | MS7061008 | 127-18-4 | PCE |
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-NE | SLOP-6317-IA-NE | LR | AIR | P080162901DU | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 15:05 | 0 | MS7061008 | 75-01-4 | VC |
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-NE | SLOP-6317-IA-NE | LR | AIR | P080162901DU | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 15:05 | 0 | MS7061008 | 156-60-5 | DCE12T |
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-NE | SLOP-6317-IA-NE | LR | AIR | P080162901DU | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 15:05 | 0 | MS7061008 | 156-59-2 | DCE12C |
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-NE | SLOP-6317-IA-NE | LR | AIR | P080162901DU | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 15:05 | 0 | MS7061008 | 107-06-2 | DCA12 |
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-NE | SLOP-6317-IA-NE | LR | AIR | P080162901DU | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 15:05 | 0 | MS7061008 | 79-01-6 | TCE |
| 4.00AFCEE3 | CASS | P0801629 | SLOP-6317-IA-NE | SLOP-6317-IA-NE | LR | AIR | P080162901DU | TO15SIM | NONE | 5/29/2008 | 8:52 | 5/30/2008 | 6/10/2008 | 15:05 | 0 | MS7061008 | 127-18-4 | PCE |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,2-DICHLOROETHANE-D4 | 98 | 100 | PERCENT | 1.44 | | | = | Y | 98 | 70 | 130 | X | = | | | SLOP-6317-IA-SW | NONE | MS7061008 |
| TOLUENE-D8 | 99 | 100 | PERCENT | 1.44 | | | = | Y | 99 | 70 | 130 | X | = | | | SLOP-6317-IA-SW | NONE | MS7061008 |
| 1-BROMO-4-FLUOROBENZENE (4-BROMOFLUOROBENZENE) | 101 | 100 | PERCENT | 1.44 | | | = | Y | 101 | 70 | 130 | X | = | | | SLOP-6317-IA-SW | NONE | MS7061008 |
| 1,2-DICHLOROETHANE-D4 | 98 | 100 | PERCENT | 1.72 | | | = | Y | 98 | 70 | 130 | X | = | | | SLOP-6317-IA-SW-FD | NONE | MS7061008 |
| TOLUENE-D8 | 100 | 100 | PERCENT | 1.72 | | | = | Y | 100 | 70 | 130 | X | = | | | SLOP-6317-IA-SW-FD | NONE | MS7061008 |
| 1-BROMO-4-FLUOROBENZENE (4-BROMOFLUOROBENZENE) | 99 | 100 | PERCENT | 1.72 | | | = | Y | 99 | 70 | 130 | X | = | | | SLOP-6317-IA-SW-FD | NONE | MS7061008 |
| 1,2-DICHLOROETHANE-D4 | 96 | 100 | PERCENT | 45.5 | | | = | Y | 96 | 70 | 130 | X | = | | | TB-052908A | NONE | MS7061008 |
| TOLUENE-D8 | 100 | 100 | PERCENT | 45.5 | | | = | Y | 100 | 70 | 130 | X | = | | | TB-052908A | NONE | MS7061008 |
| 1-BROMO-4-FLUOROBENZENE (4-BROMOFLUOROBENZENE) | 100 | 100 | PERCENT | 45.5 | | | = | Y | 100 | 70 | 130 | X | = | | | TB-052908A | NONE | MS7061008 |
| VINYL CHLORIDE | 412 | 495 | PG | 1 | 0.0000026 | 0.000025 | = | N | 83 | 64 | 125 | X | = | 0.0000026 | 0.000025 | | NONE | MS7061008 |
| TRANS-1,2-DICHLOROETHENE | 478 | 530 | PG | 1 | 0.0000028 | 0.000025 | = | N | 90 | 67 | 111 | X | = | 0.0000028 | 0.000025 | | NONE | MS7061008 |
| cis-1,2-DICHLOROETHYLENE | 488 | 540 | PG | 1 | 0.0000028 | 0.000025 | = | N | 90 | 62 | 121 | X | = | 0.0000028 | 0.000025 | | NONE | MS7061008 |
| 1,2-DICHLOROETHANE | 462 | 525 | PG | 1 | 0.0000028 | 0.000025 | = | N | 88 | 62 | 120 | X | = | 0.0000028 | 0.000025 | | NONE | MS7061008 |
| TRICHLOROETHYLENE (TCE) | 478 | 545 | PG | 1 | 0.0000029 | 0.00001 | = | N | 88 | 67 | 116 | X | = | 0.0000029 | 0.00001 | | NONE | MS7061008 |
| TETRACHLOROETHYLENE(PCE) | 478 | 520 | PG | 1 | 0.0000027 | 0.000025 | = | N | 92 | 56 | 133 | X | = | 0.0000027 | 0.000025 | | NONE | MS7061008 |
| VINYL CHLORIDE | 0.043 | ND | UG/M3 | 1.7 | 0.0044 | 0.043 | U | N | | | | X | U | 0.0044 | 0.043 | SLOP-6317-IA-NE | NONE | MS7061008 |
| TRANS-1,2-DICHLOROETHENE | 0.043 | ND | UG/M3 | 1.7 | 0.0048 | 0.043 | U | N | | | | X | U | 0.0048 | 0.043 | SLOP-6317-IA-NE | NONE | MS7061008 |
| cis-1,2-DICHLOROETHYLENE | 0.0564 | 0.058 | UG/M3 | 1.7 | 0.0048 | 0.043 | = | N | | | | X | = | 0.0048 | 0.043 | SLOP-6317-IA-NE | NONE | MS7061008 |
| 1,2-DICHLOROETHANE | 0.06 | 0.062 | UG/M3 | 1.7 | 0.0048 | 0.043 | = | N | | | | X | = | 0.0048 | 0.043 | SLOP-6317-IA-NE | NONE | MS7061008 |
| TRICHLOROETHYLENE (TCE) | 0.163 | 0.16 | UG/M3 | 1.7 | 0.0049 | 0.017 | = | N | | | | X | = | 0.0049 | 0.017 | SLOP-6317-IA-NE | NONE | MS7061008 |
| TETRACHLOROETHYLENE(PCE) | 0.119 | 0.12 | UG/M3 | 1.7 | 0.0046 | 0.043 | = | N | | | | X | = | 0.0046 | 0.043 | SLOP-6317-IA-NE | NONE | MS7061008 |

# MIP/CPT Logs

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP | Date: 14/May/2008<br>Test ID: MIP-01<br>Project: SLOP |



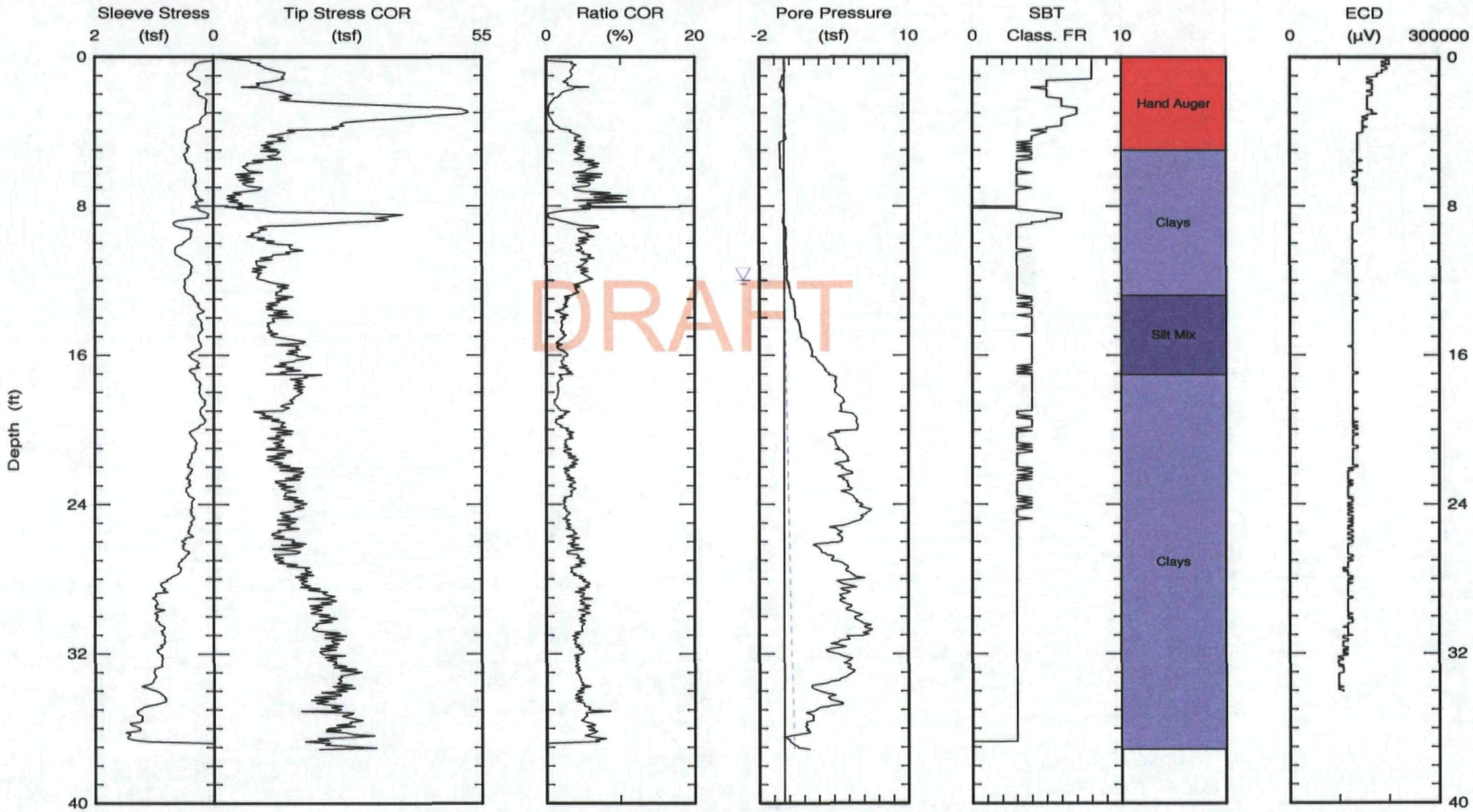

Maximum depth: 34.17 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-01
File: MIP-01~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>... there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 14/May/2008<br>Test ID: MIP-02<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |



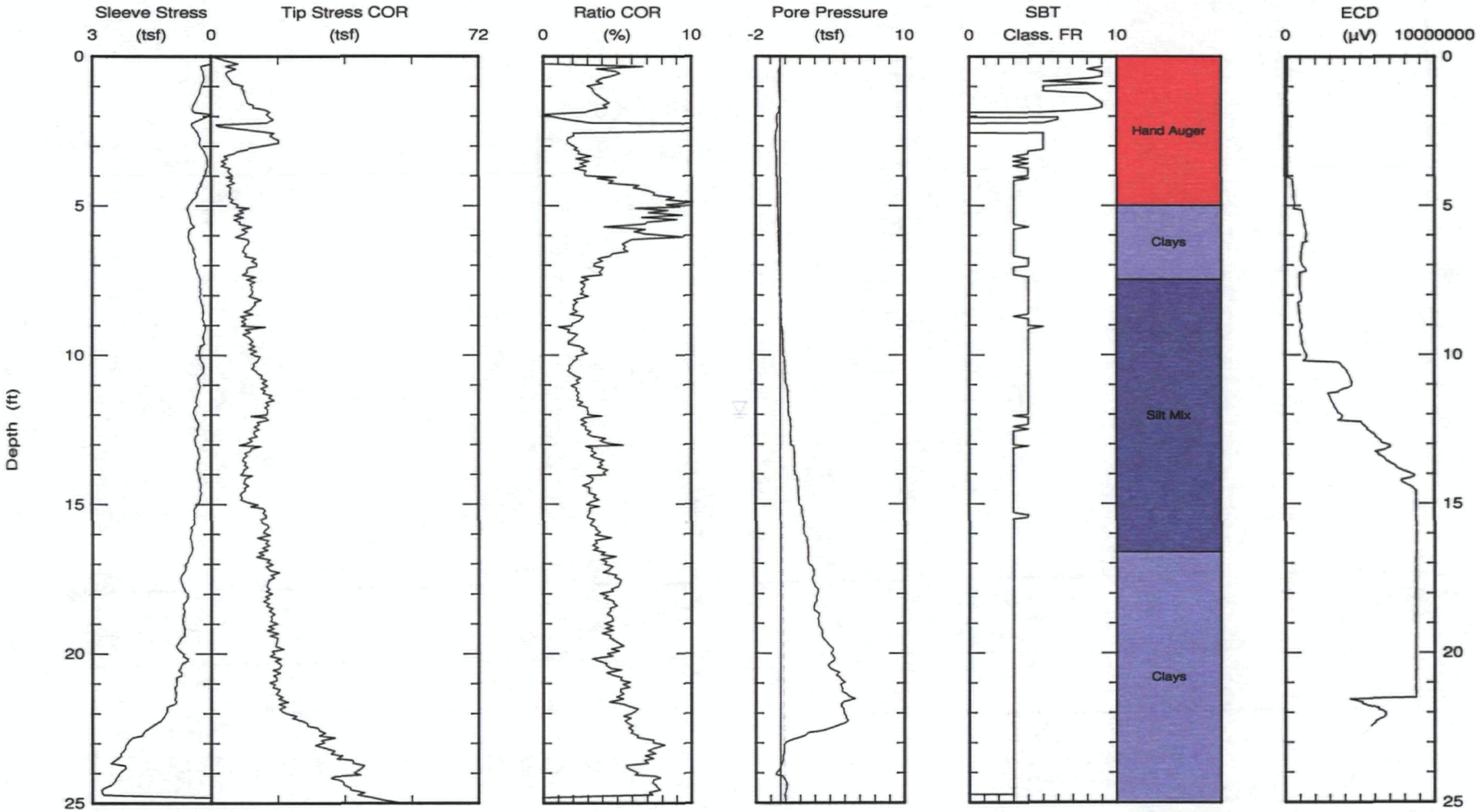

Maximum depth: 37.11 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

▽ Estimated Phreatic Surface

Test ID: MIP-02
File: MIP-02~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP | Date: 14/May/2008<br>Test ID: MIP-03<br>Project: SLOP |




Maximum depth: 25.13 (ft)

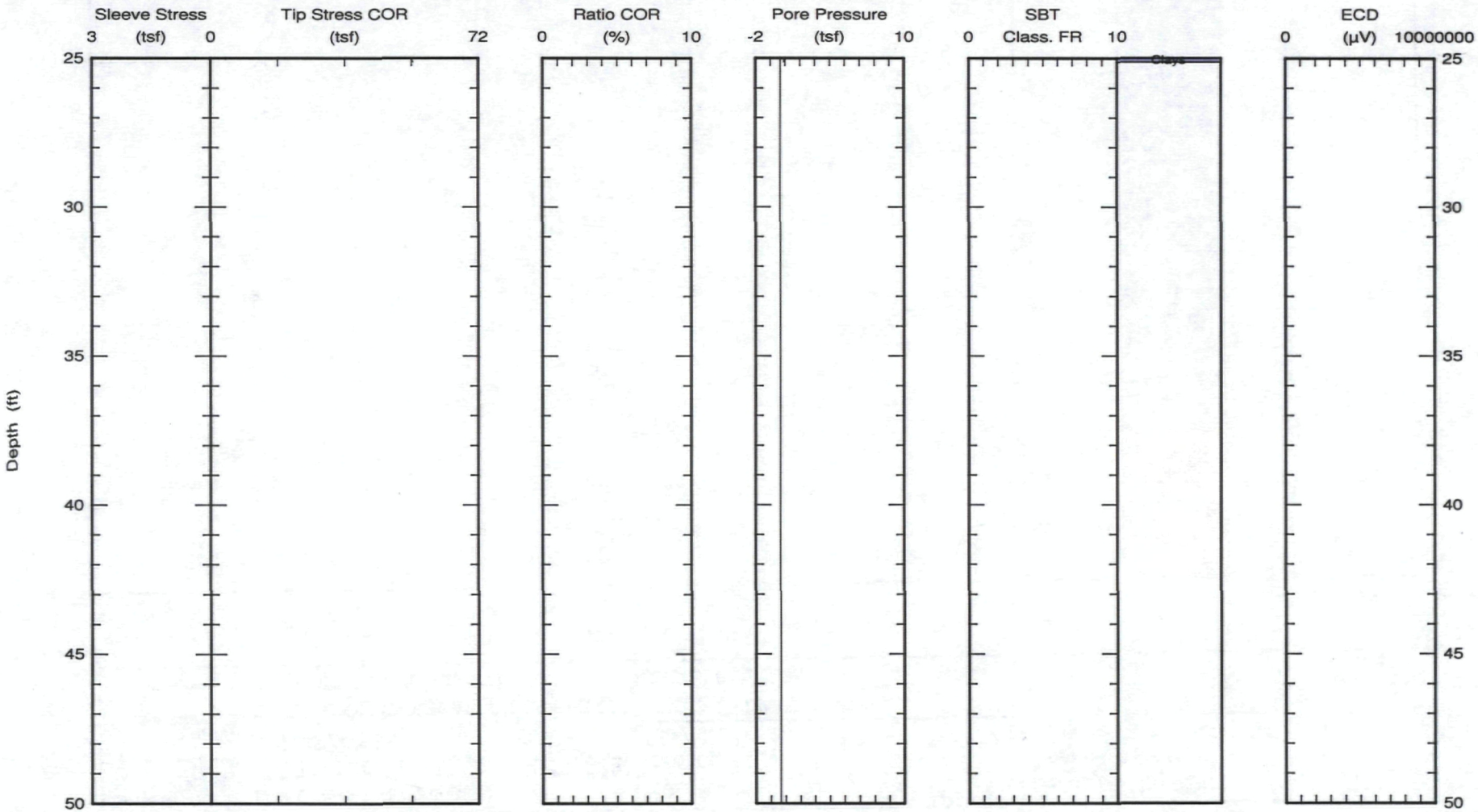
Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface



Test ID: MIP-03
File: MIP-03~1.CSV

| | | |
|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP |
| | | Date: 14/May/2008<br>Test ID: MIP-03<br>Project: SLOP |



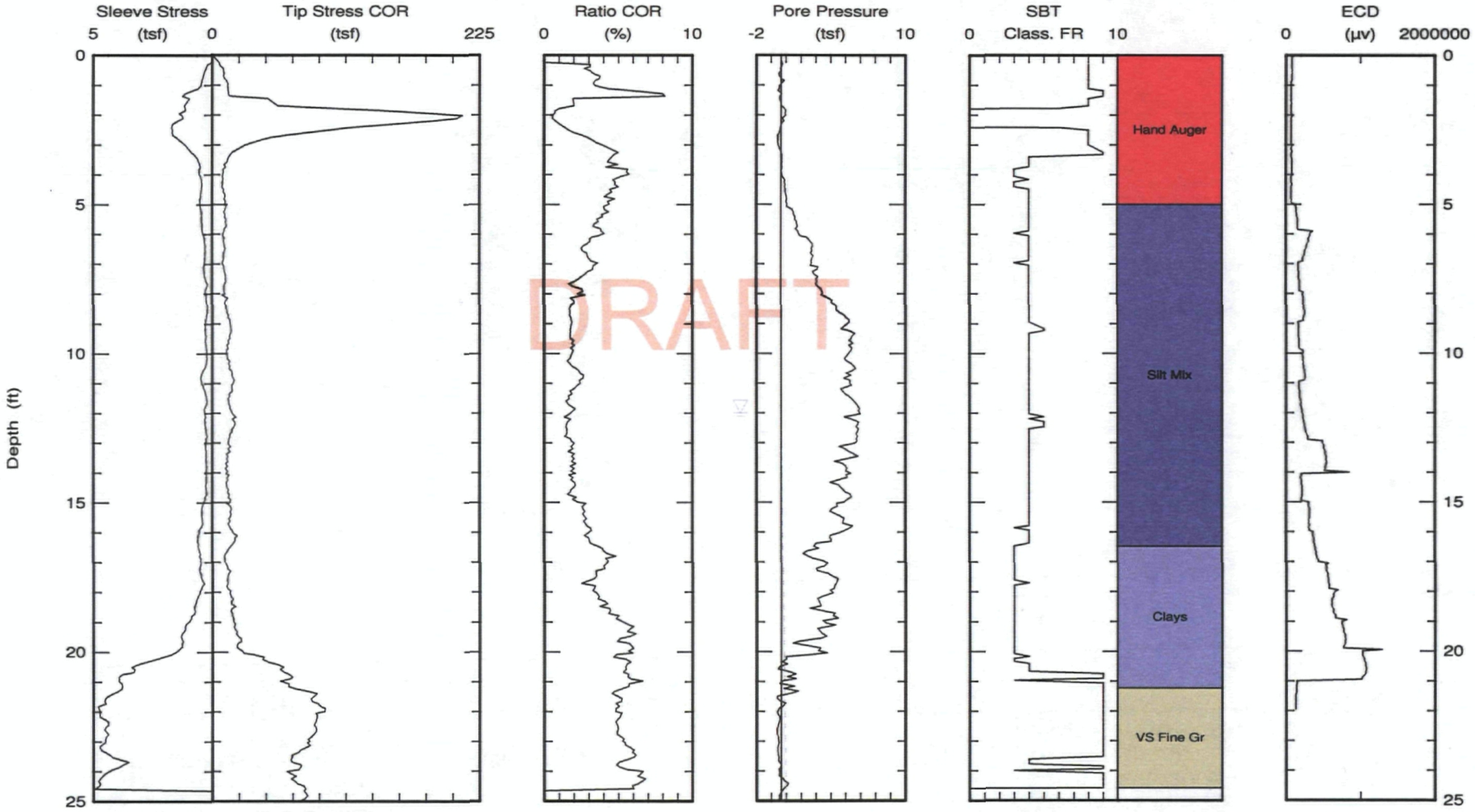

Maximum depth: 25.13 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)



Test ID: MIP-03
File: MIP-03~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 15/May/2008<br>Test ID: MIP-04<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |



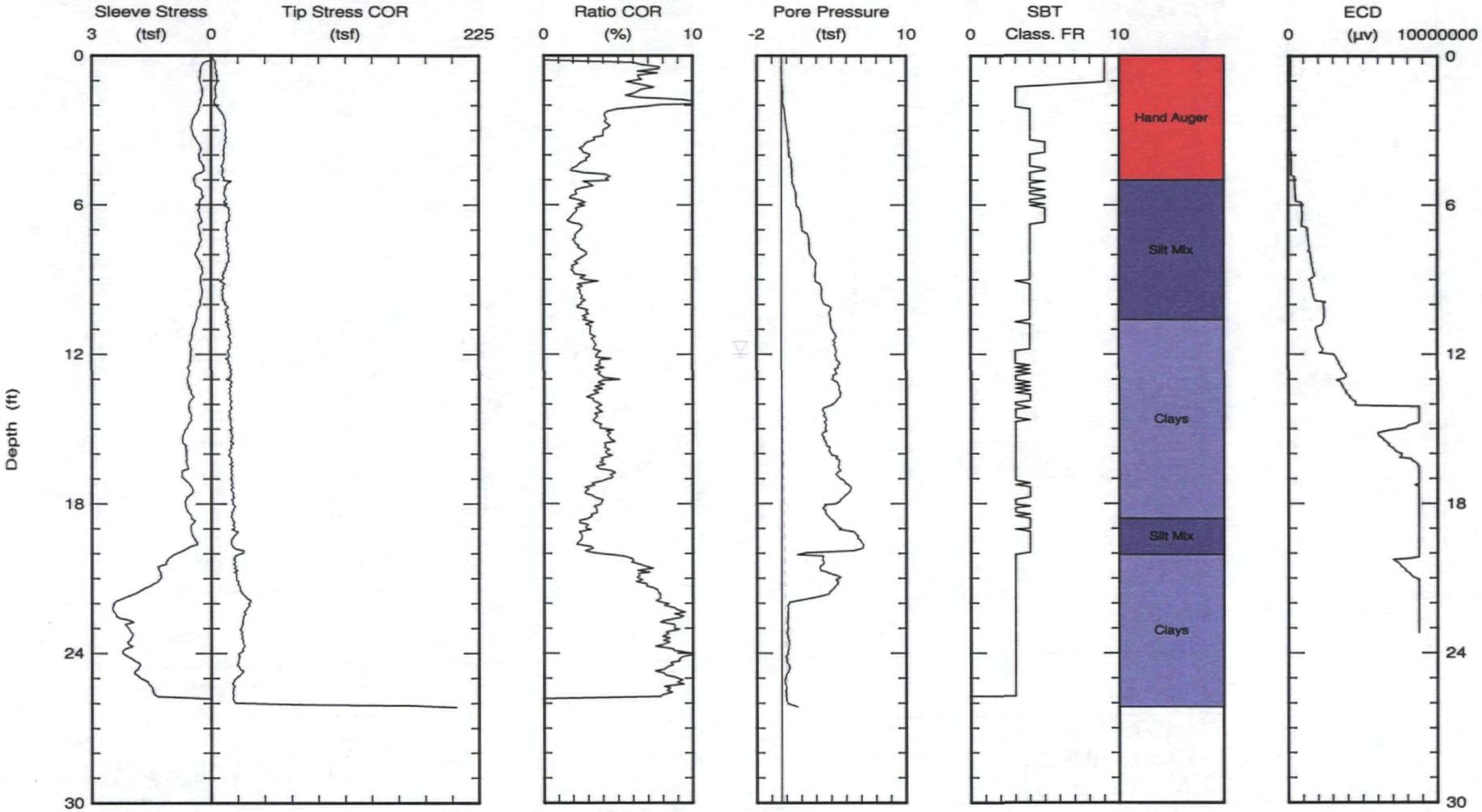

Maximum depth: 24.99 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-04
File: MIP-04~1.CSV

| | | |
|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP |
| | | Date: 15/May/2008<br>Test ID: MIP-05<br>Project: SLOP |

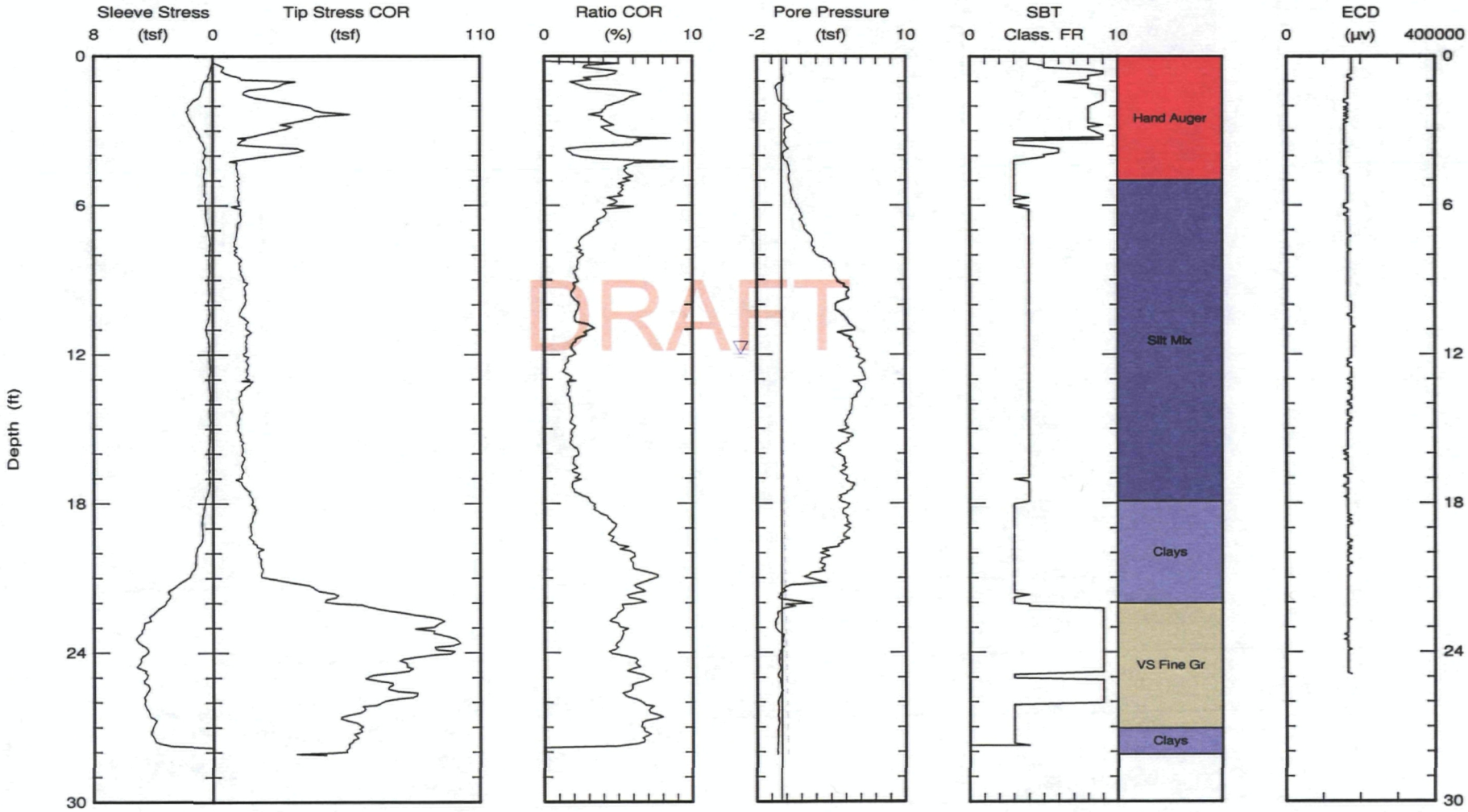



Maximum depth: 26.16 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP | Date: 16/May/2008<br>Test ID: MIP-06<br>Project: SLOP |



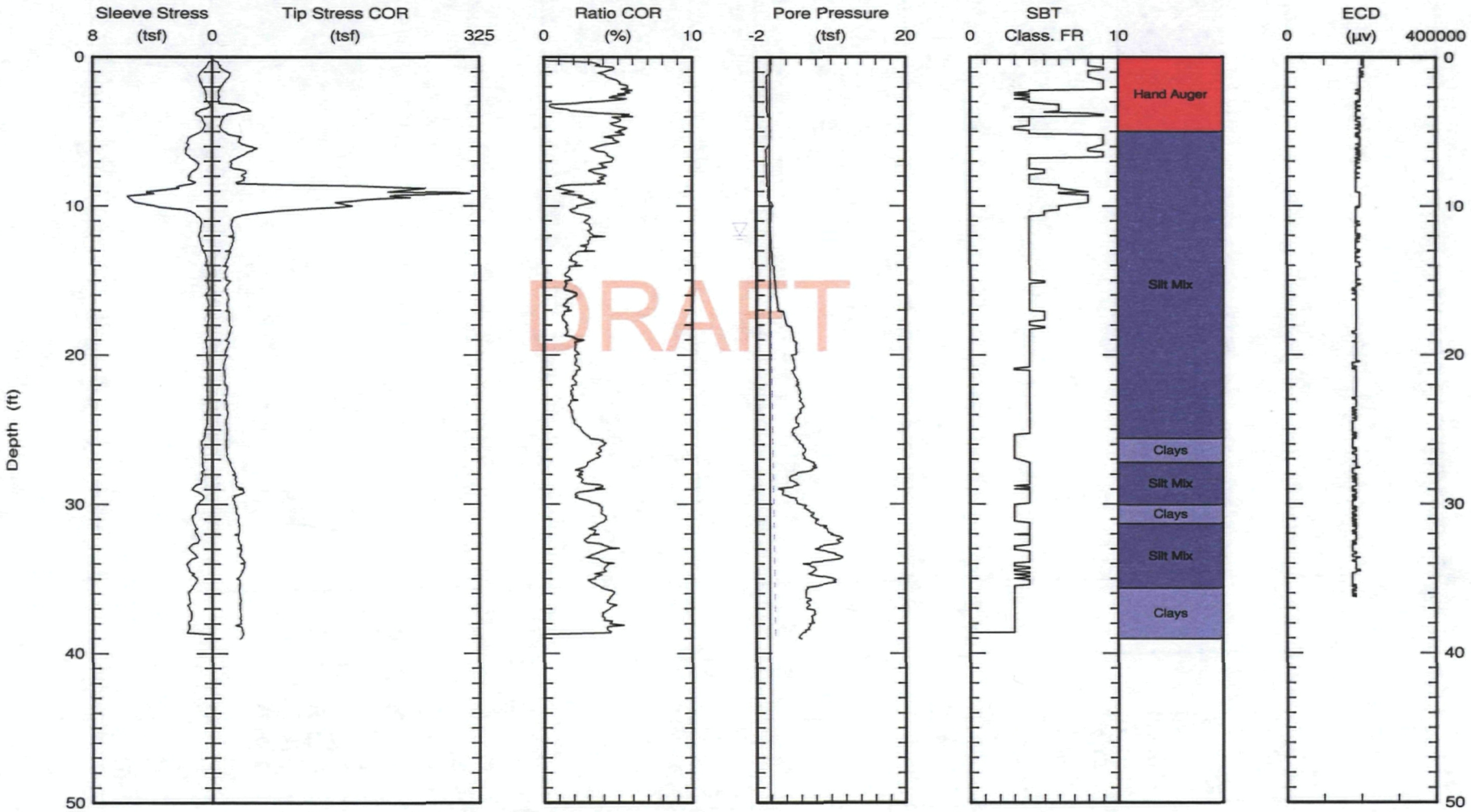

Maximum depth: 28.11 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-06
File: MIP-06~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 16/May/2008<br>Test ID: MIP-07<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |



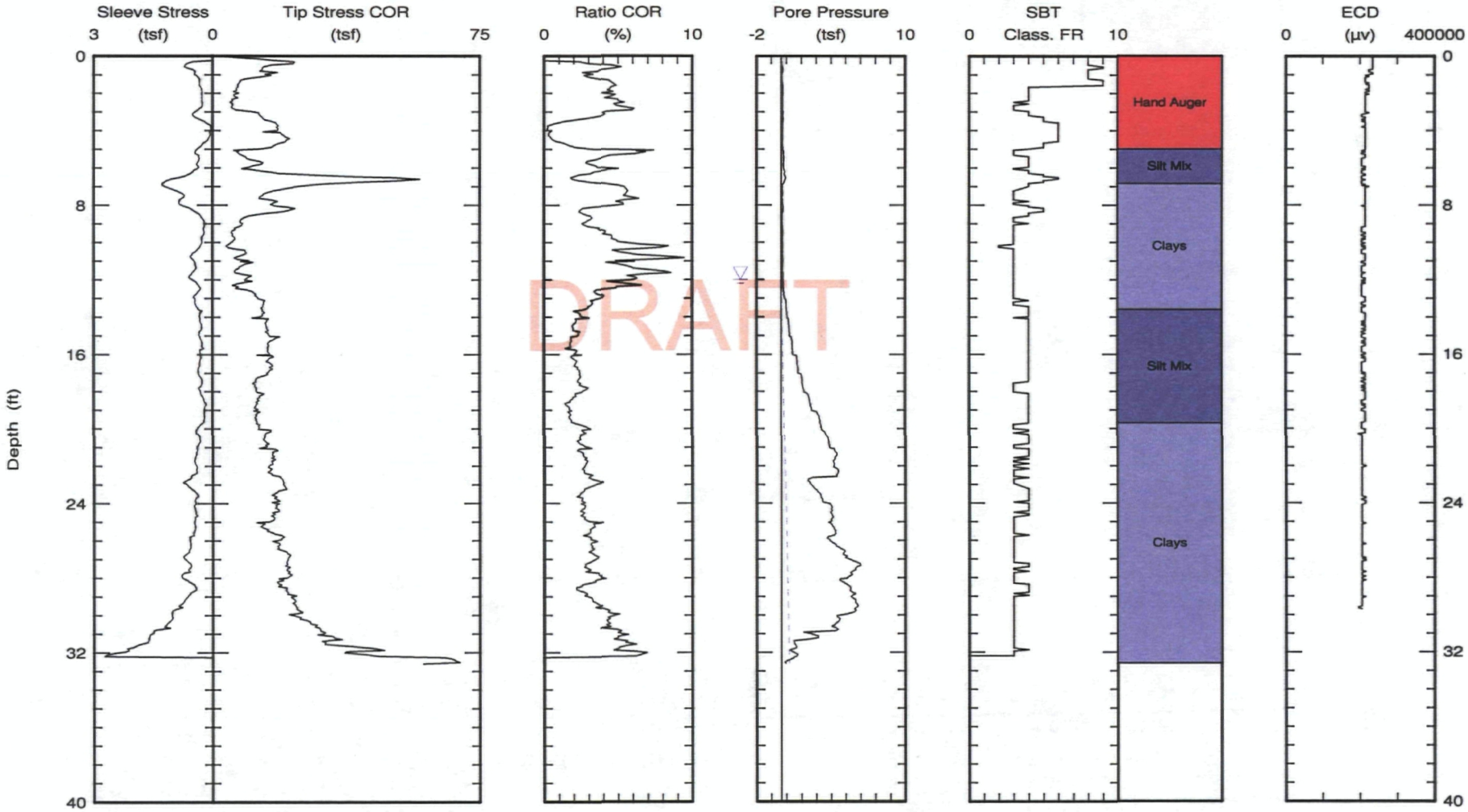

Maximum depth: 39.04 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-07
File: MIP-07~1.CSV

| | | |
|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP |
| | | Date: 16/May/2008<br>Test ID: MIP-08<br>Project: SLOP |



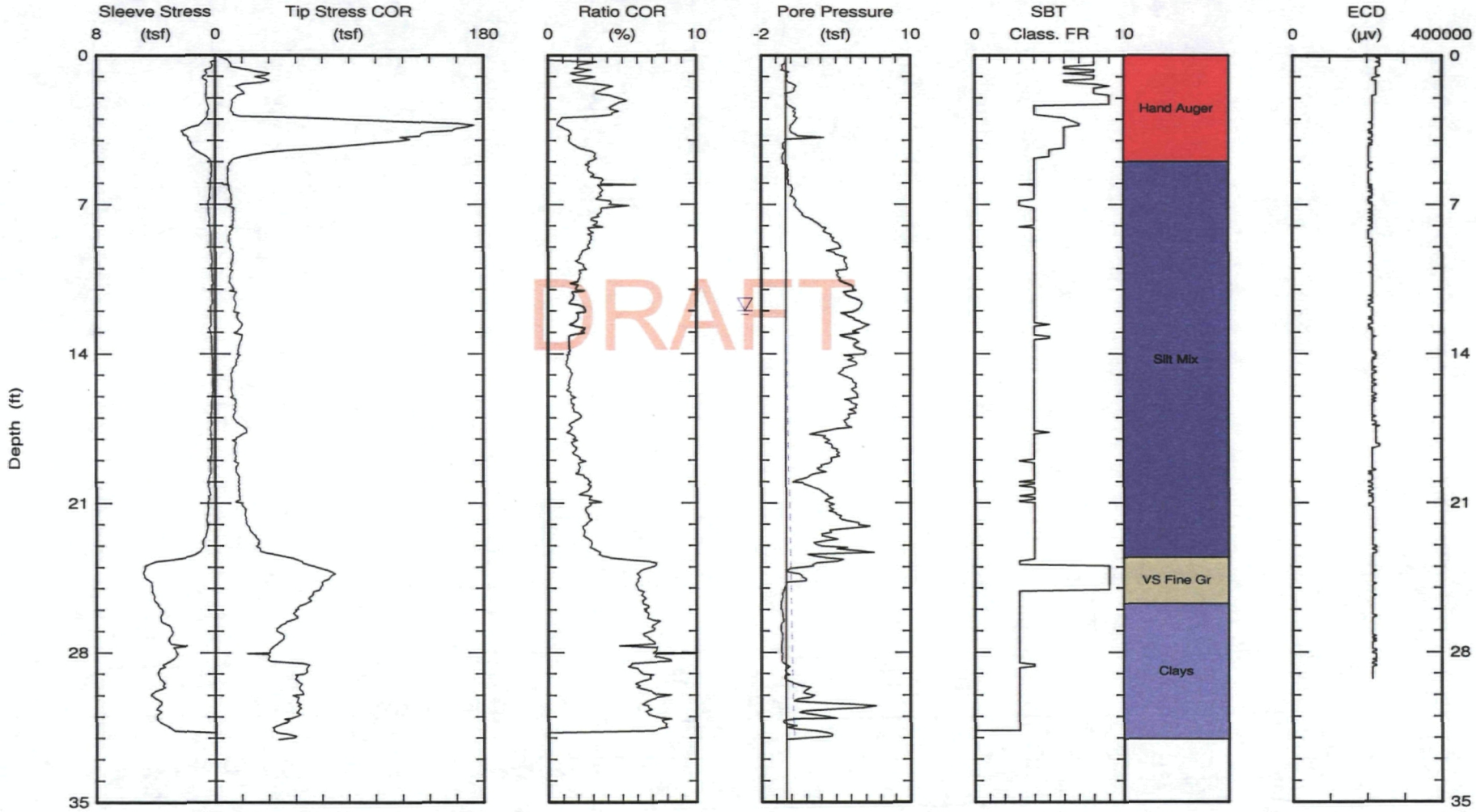

Maximum depth: 32.60 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-08
File: MIP-08~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 17/May/2008<br>Test ID: MIP-09<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |

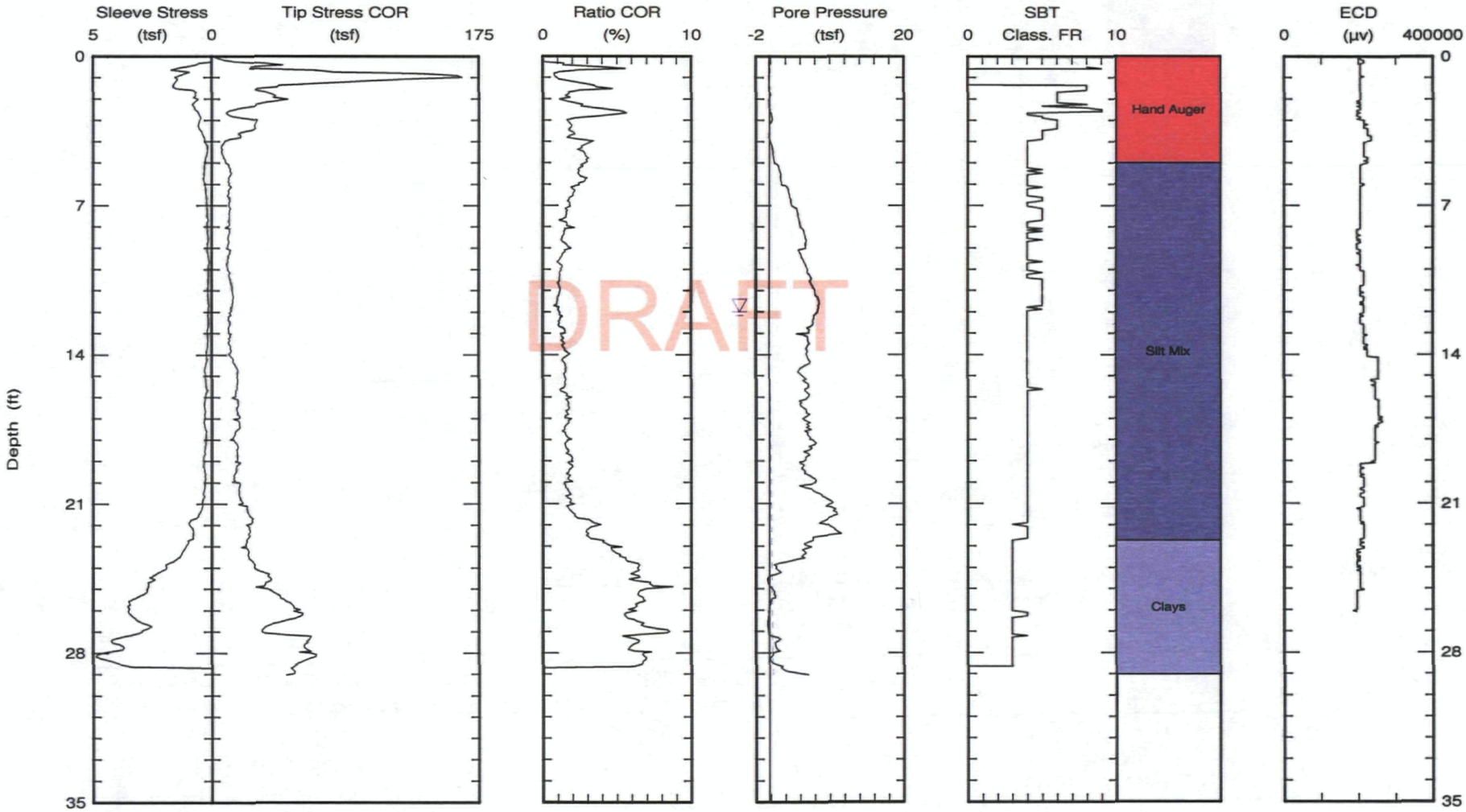



Maximum depth: 32.07 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

| | | |
|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP |
| | | Date: 17/May/2008<br>Test ID: MIP-10<br>Project: SLOP |



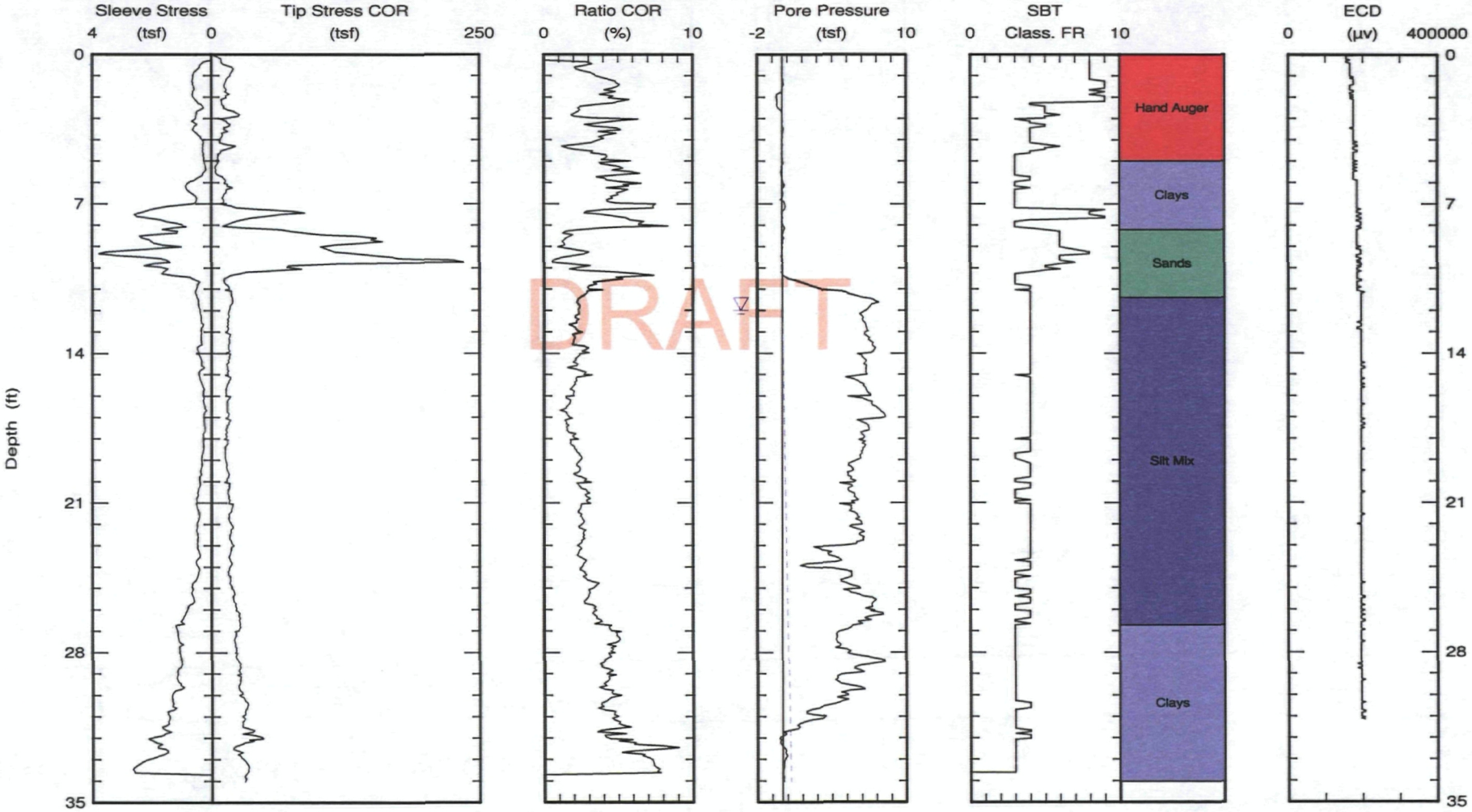

Maximum depth: 29.03 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-10
File: MIP-10~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 17/May/2008<br>Test ID: MIP-11<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |



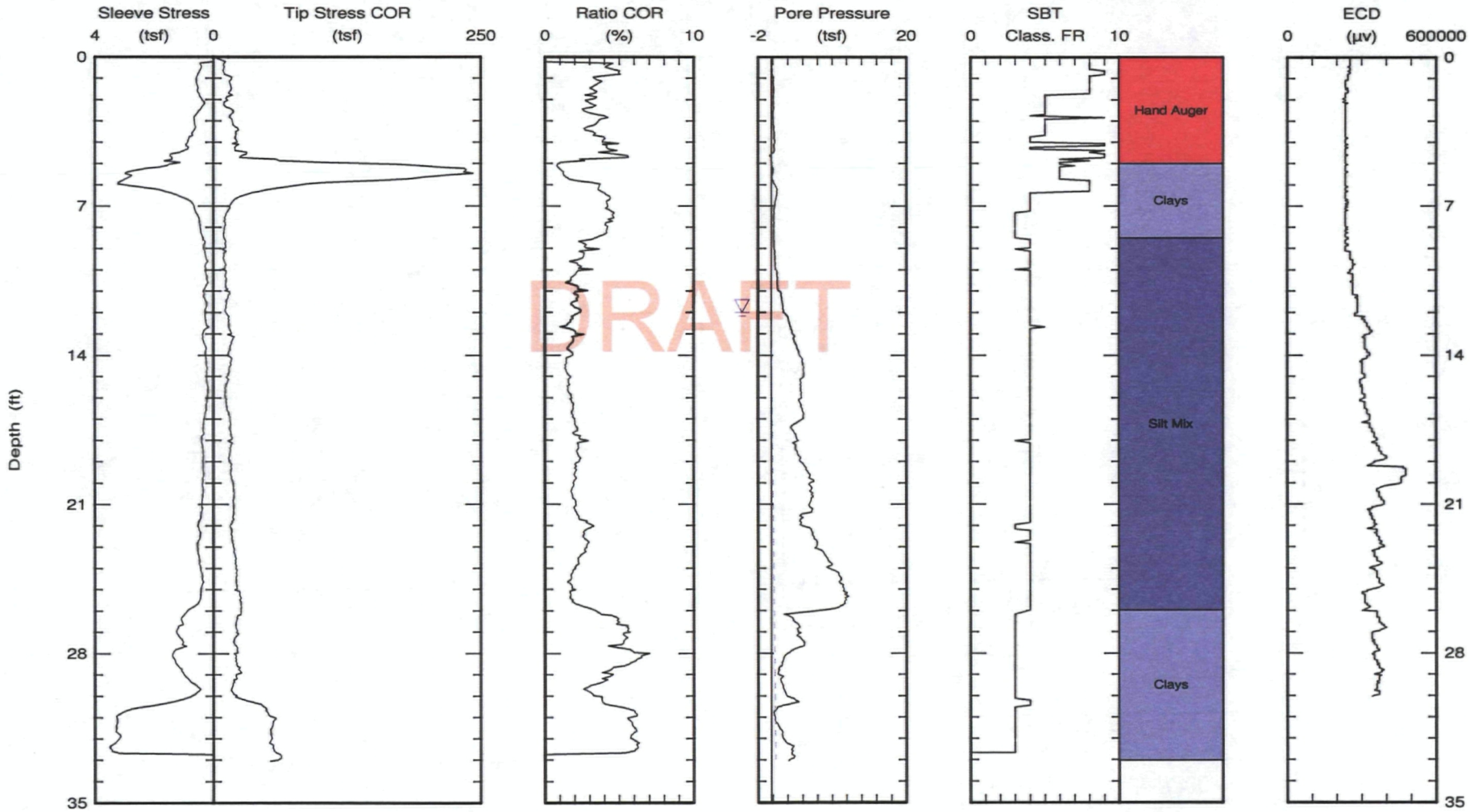

Maximum depth: 34.04 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-11
File: MIP-11~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 17/May/2008<br>Test ID: MIP-12<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |



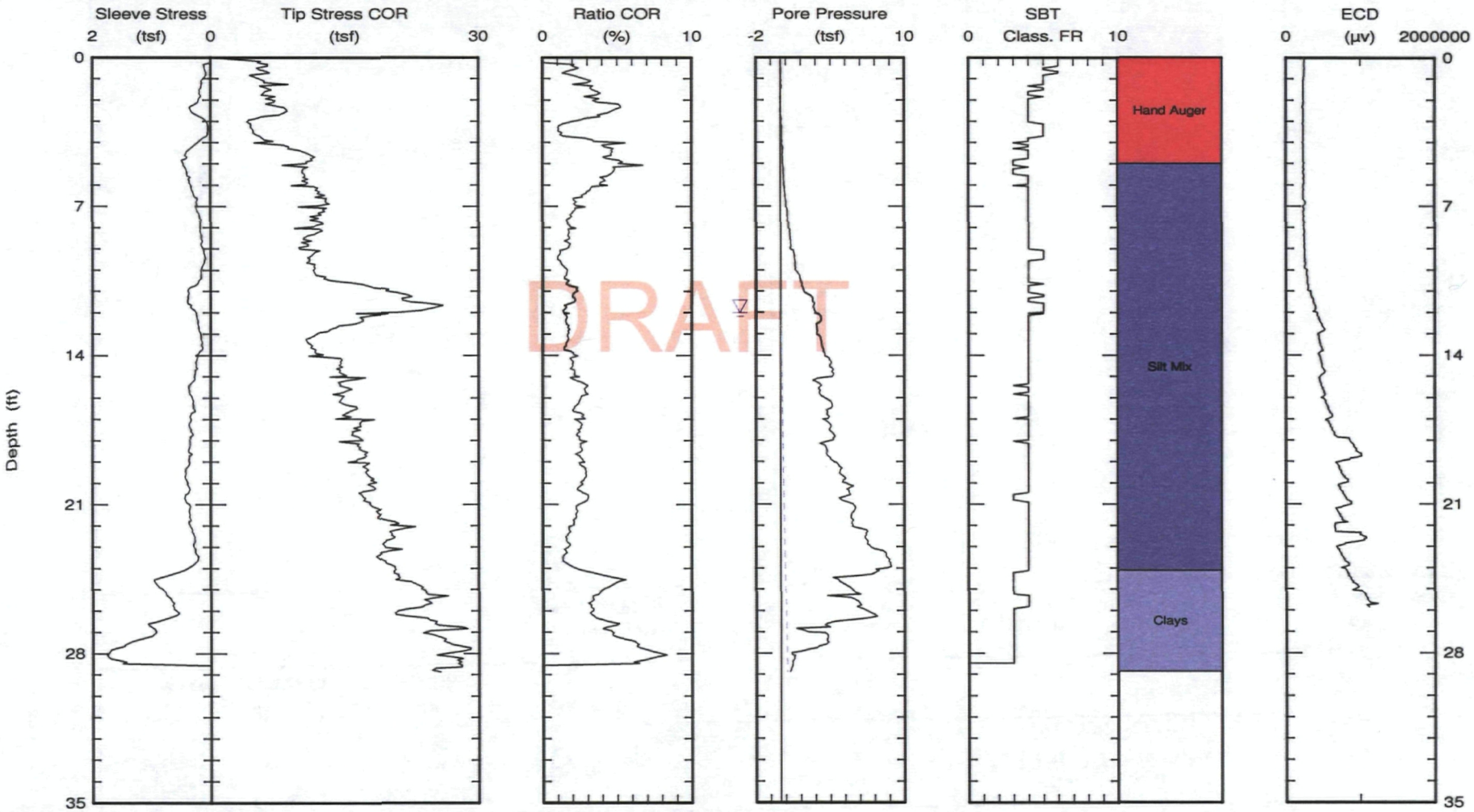

Maximum depth: 33.04 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-12
File: MIP-12~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 17/May/2008<br>Test ID: MIP-13<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |



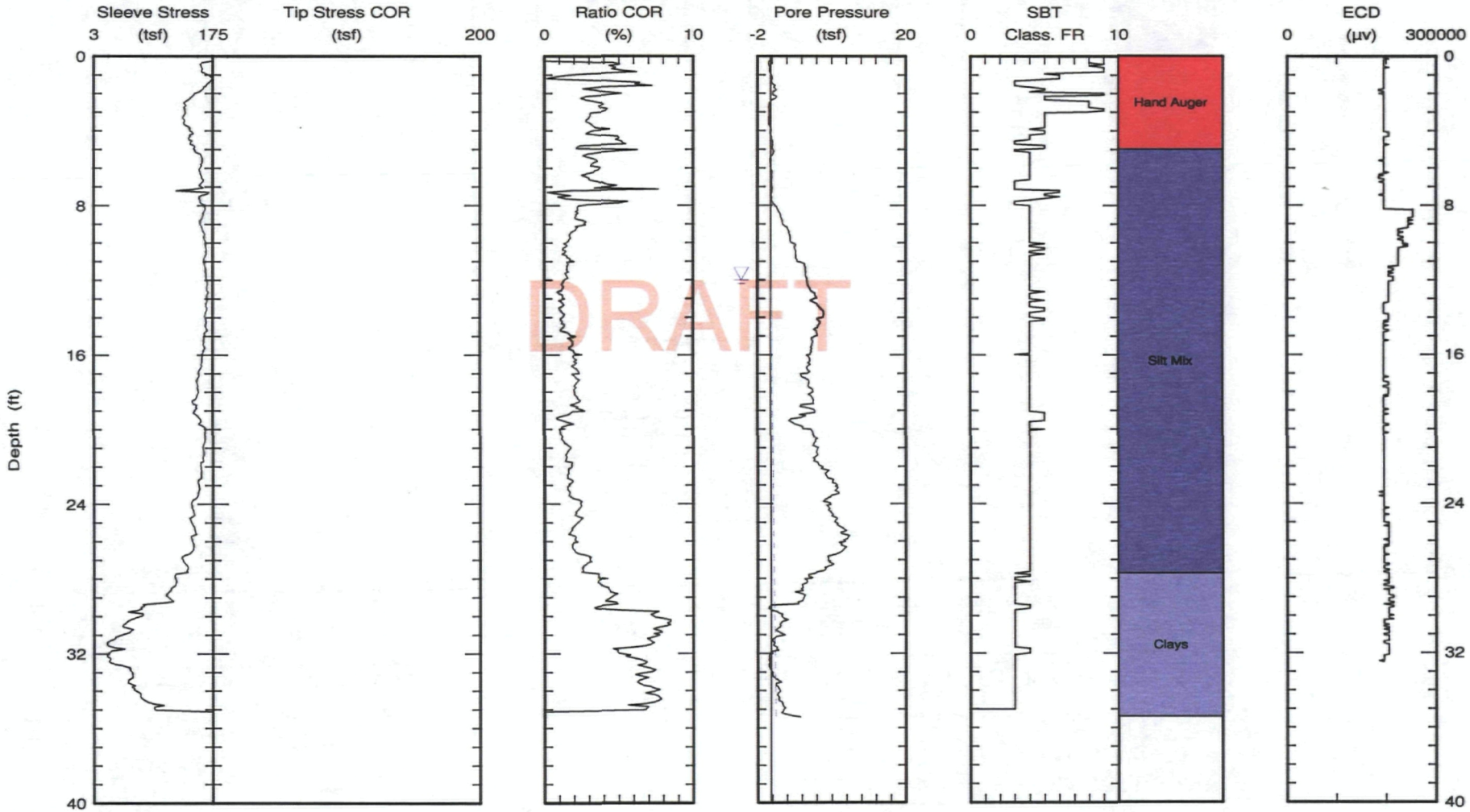

Maximum depth: 28.87 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-13
File: MIP-13~1.CSV

| | | |
|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP |
| | | Date: 18/May/2008<br>Test ID: MIP-14<br>Project: SLOP |



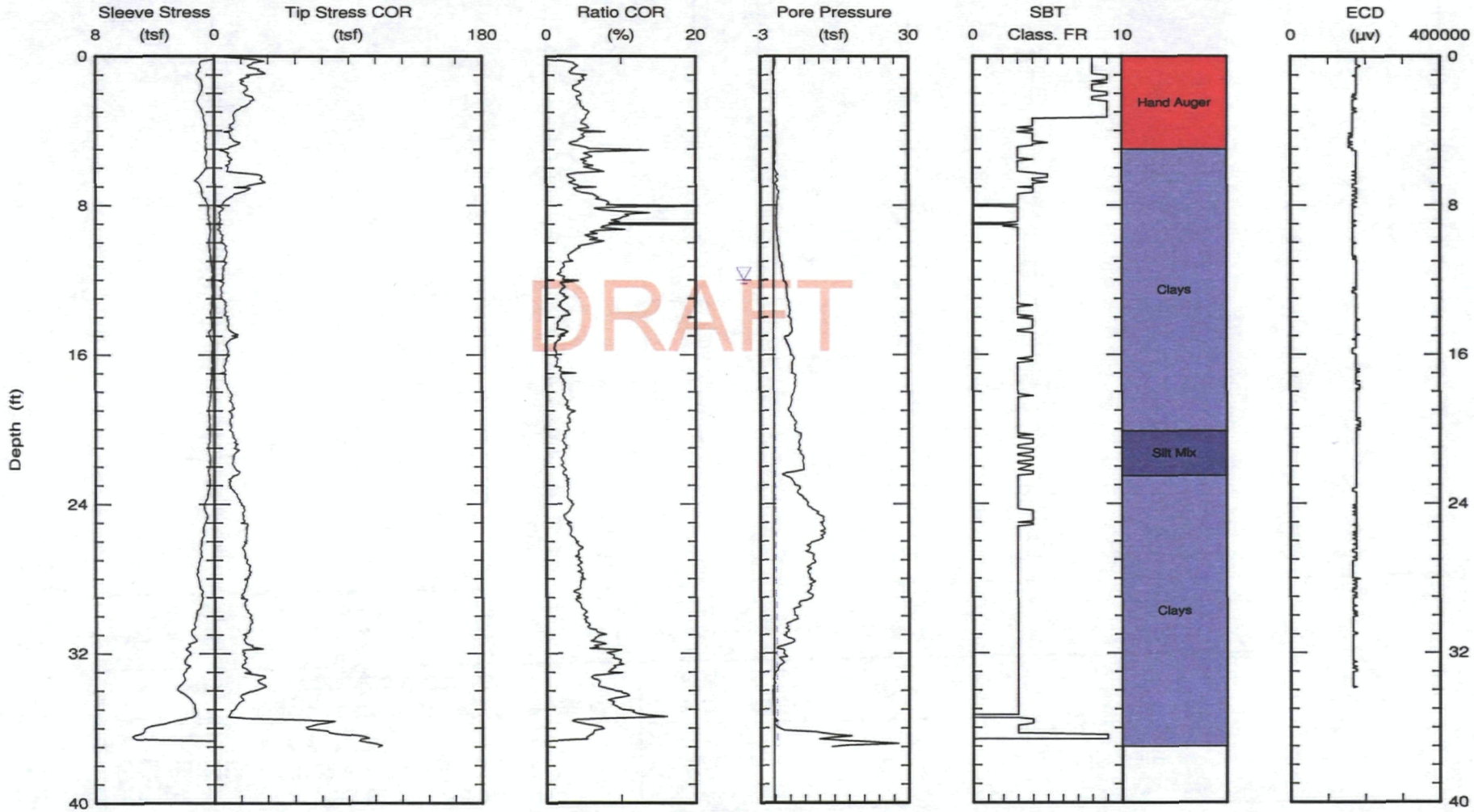

Maximum depth: 35.42 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-14
File: MIP-14~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 18/May/2008<br>Test ID: MIP-15<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |



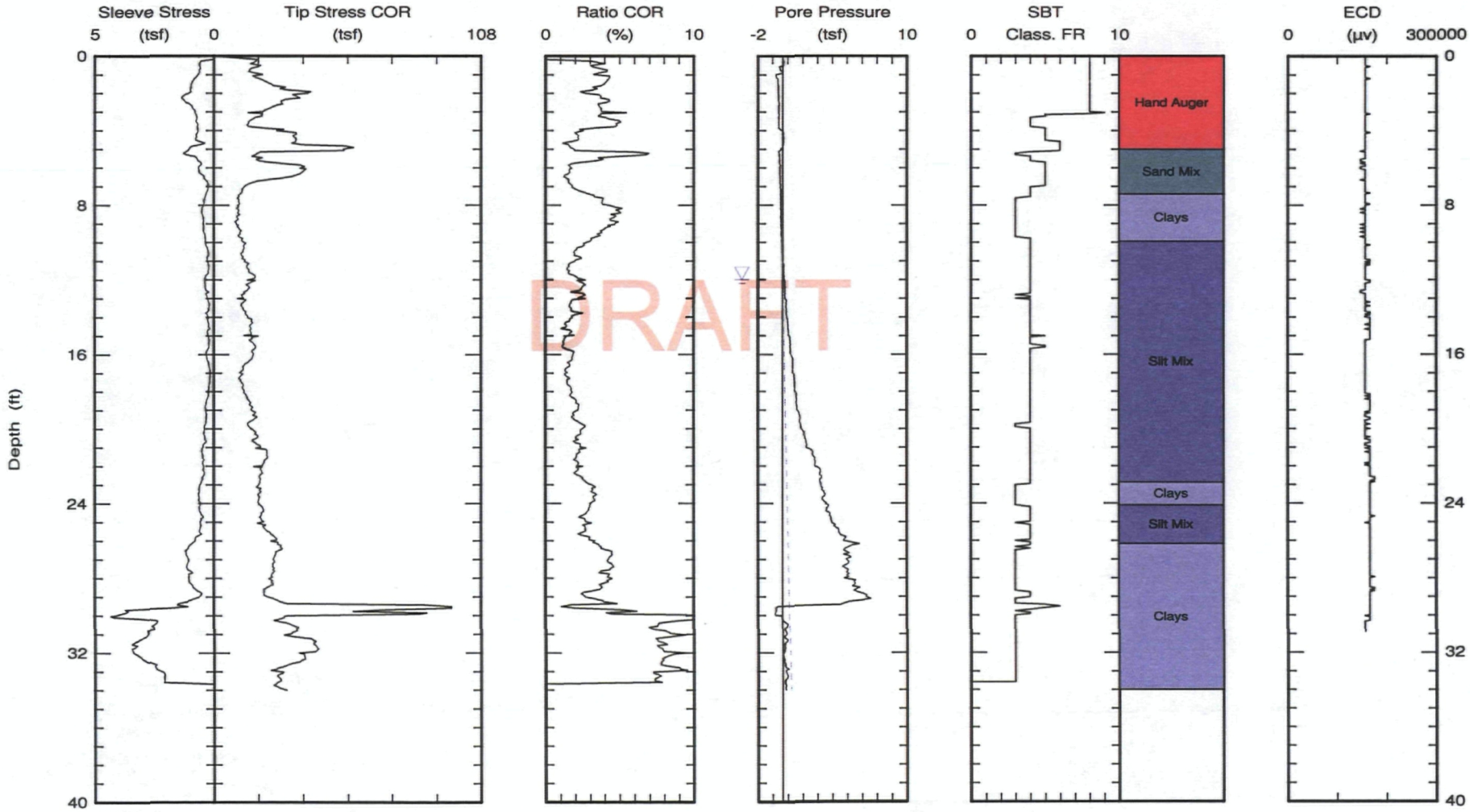

Maximum depth: 37.01 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-15
File: MIP-15~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP | Date: 18/May/2008<br>Test ID: MIP-16<br>Project: SLOP |



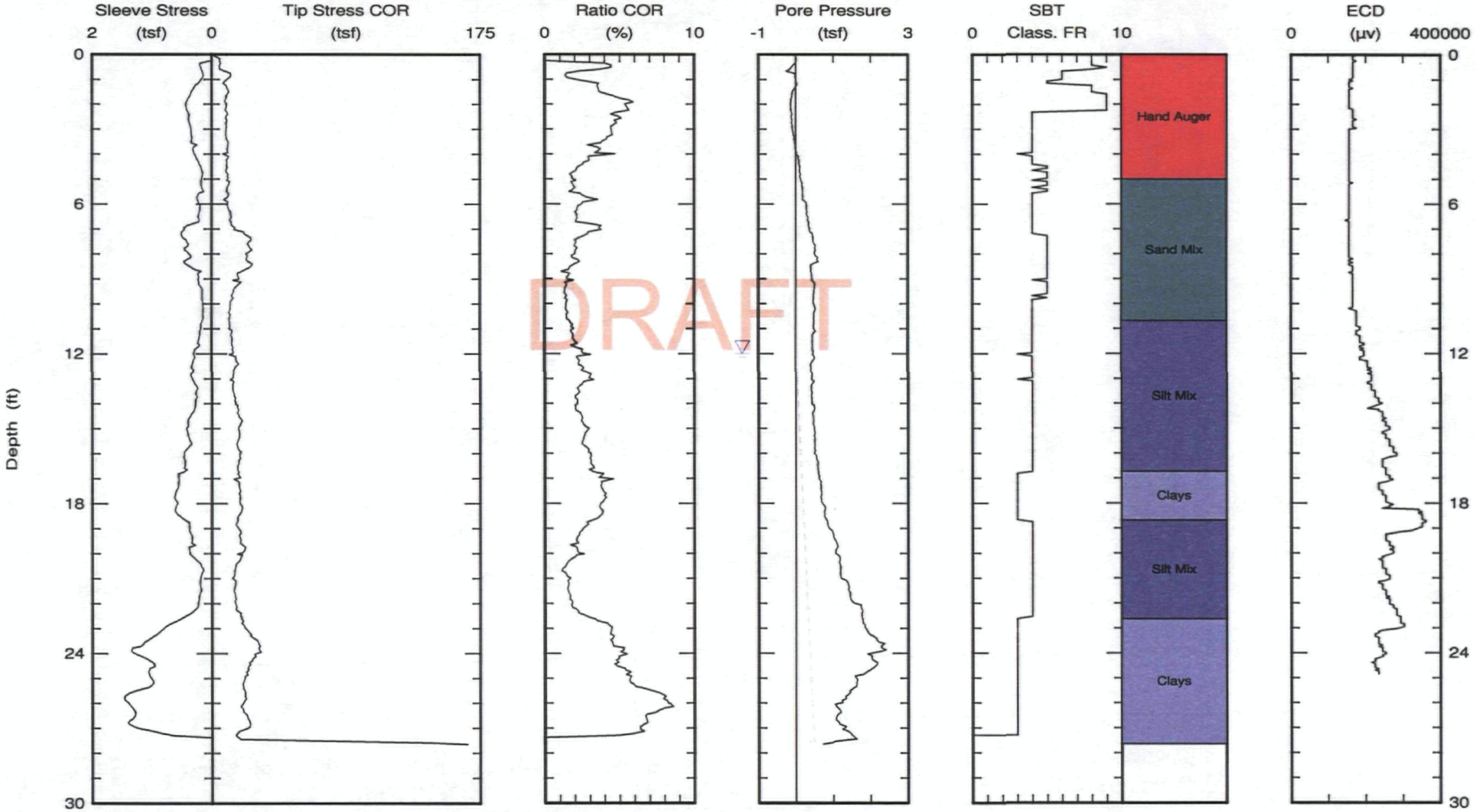

Maximum depth: 33.99 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-16
File: MIP-16~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 18/May/2008<br>Test ID: MIP-17<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |



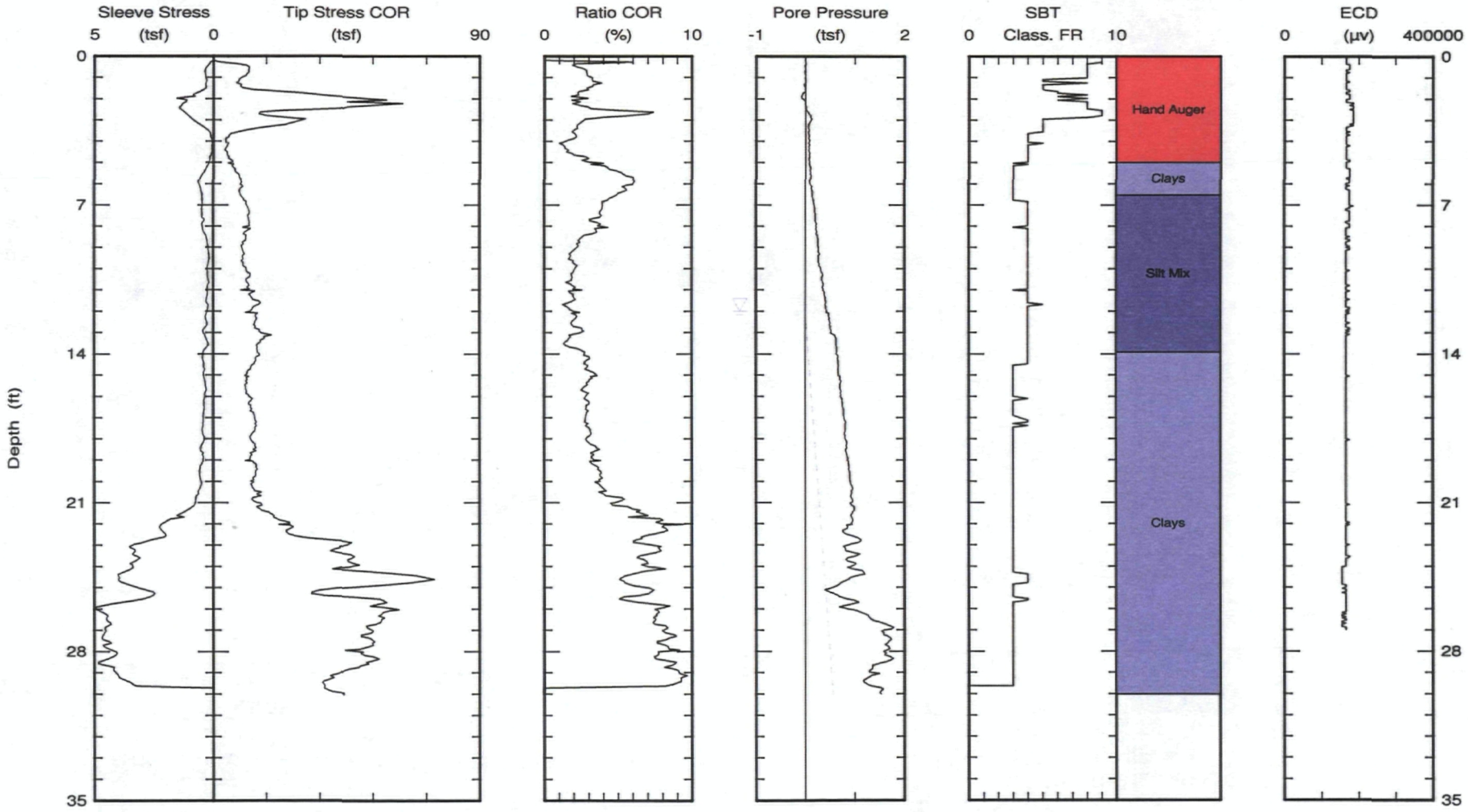

Maximum depth: 27.64 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-17
File: MIP-17-1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP | Date: 18/May/2008<br>Test ID: MIP-18<br>Project: SLOP |



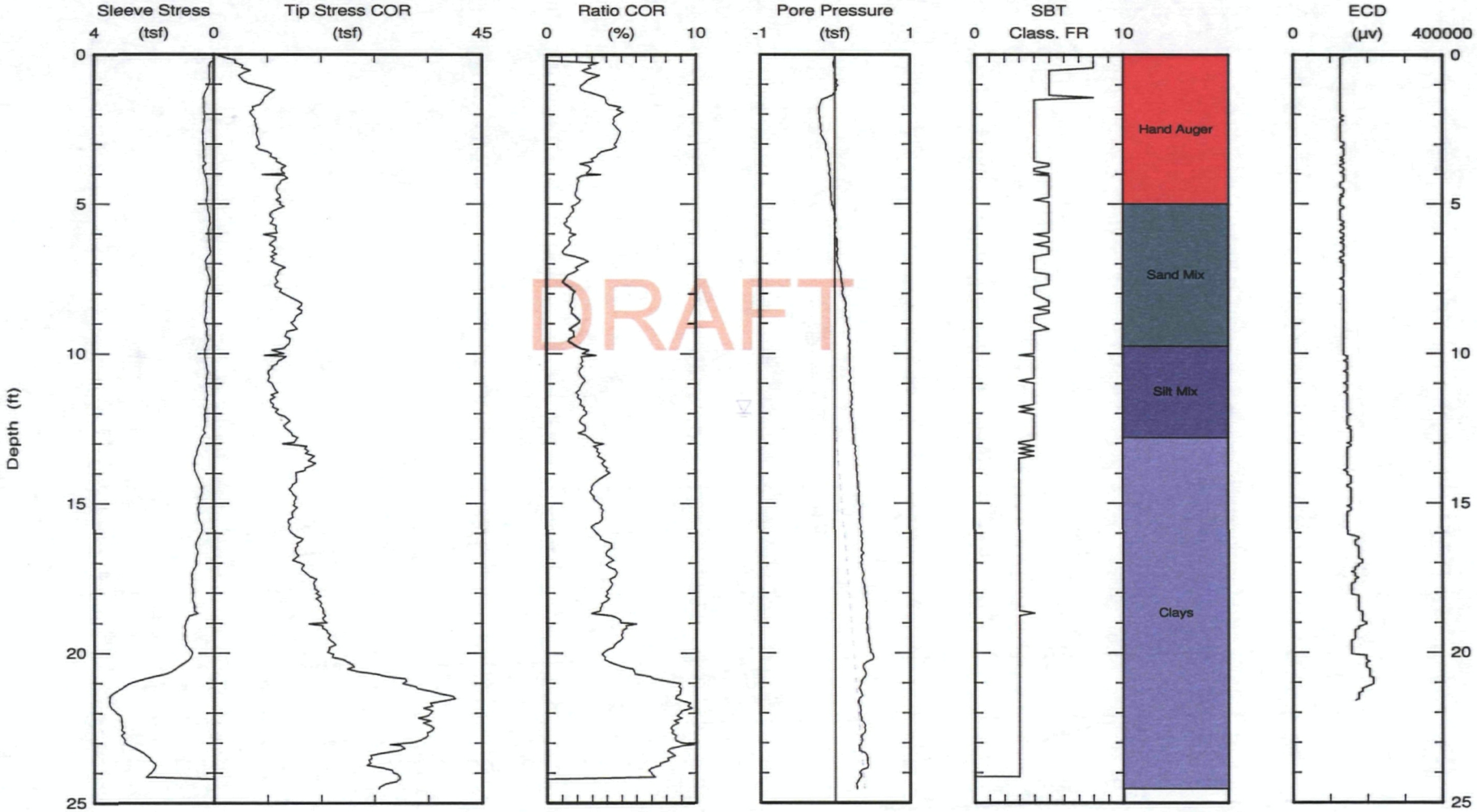

Maximum depth: 30.02 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-18
File: MIP-18~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 18/May/2008<br>Test ID: MIP-19<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |

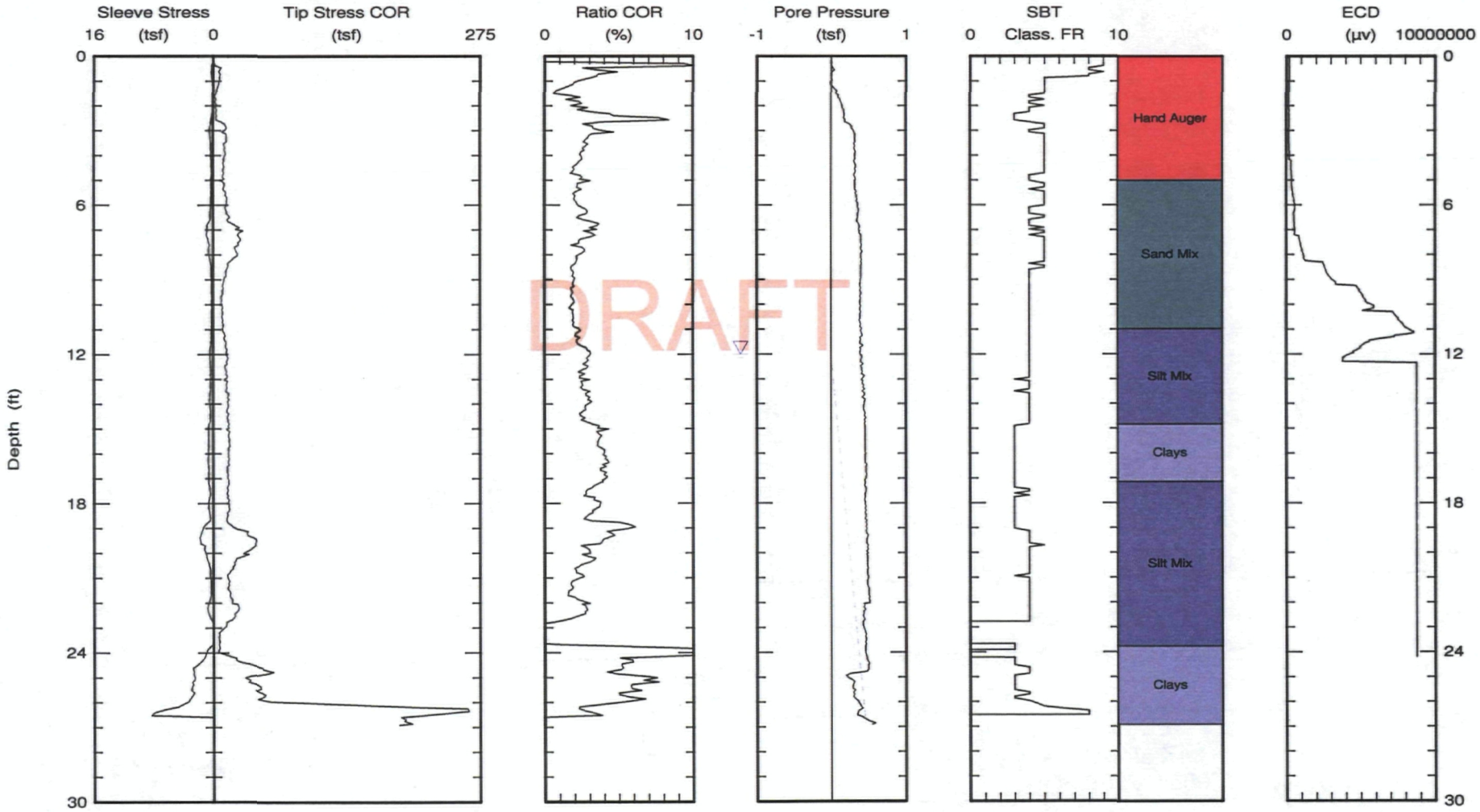



Maximum depth: 24.54 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP | Date: 19/May/2008<br>Test ID: MIP-20<br>Project: SLOP |



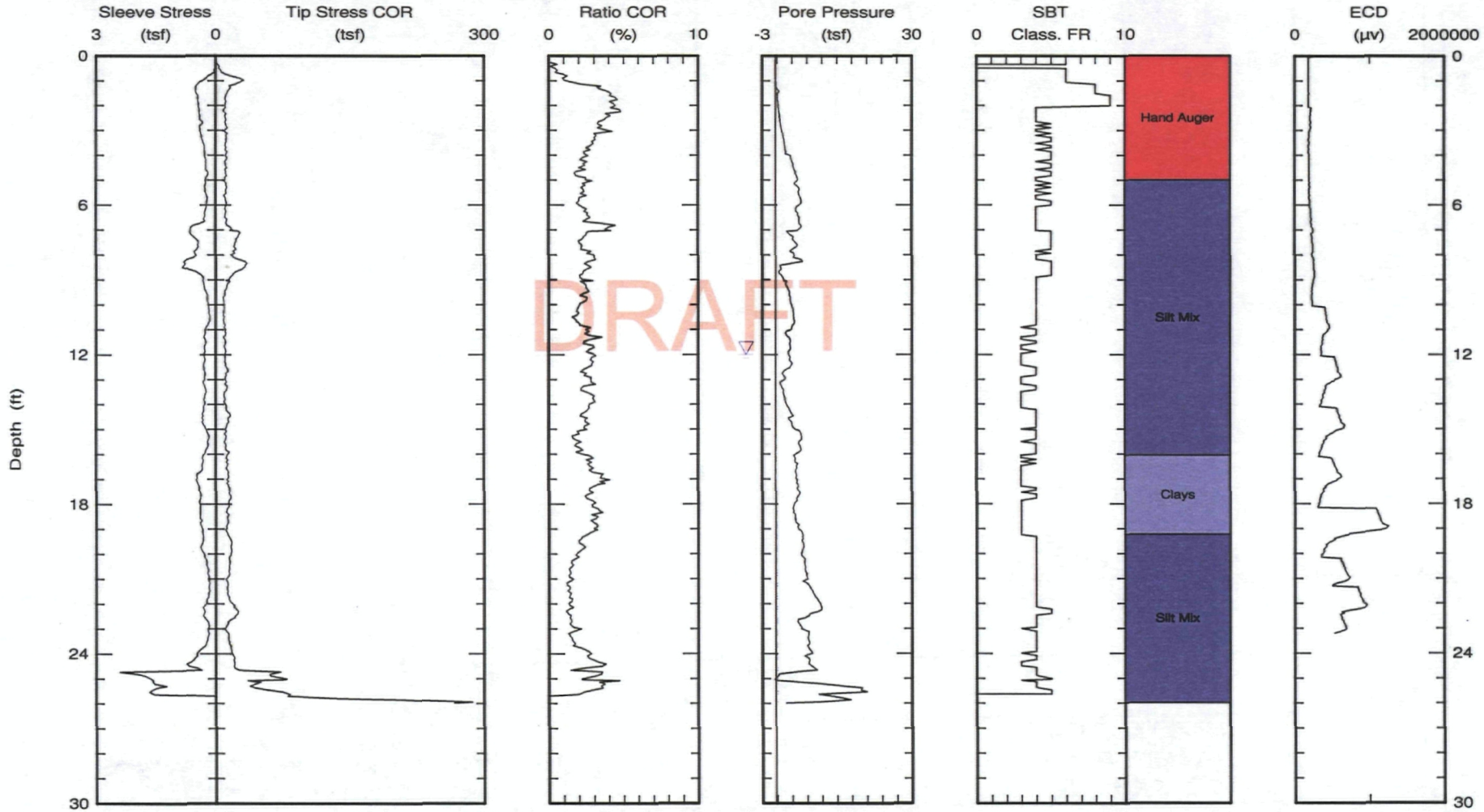

Maximum depth: 26.91 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-20
File: MIP-20~1.CSV

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 19/May/2008<br>Test ID: MIP-21<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |

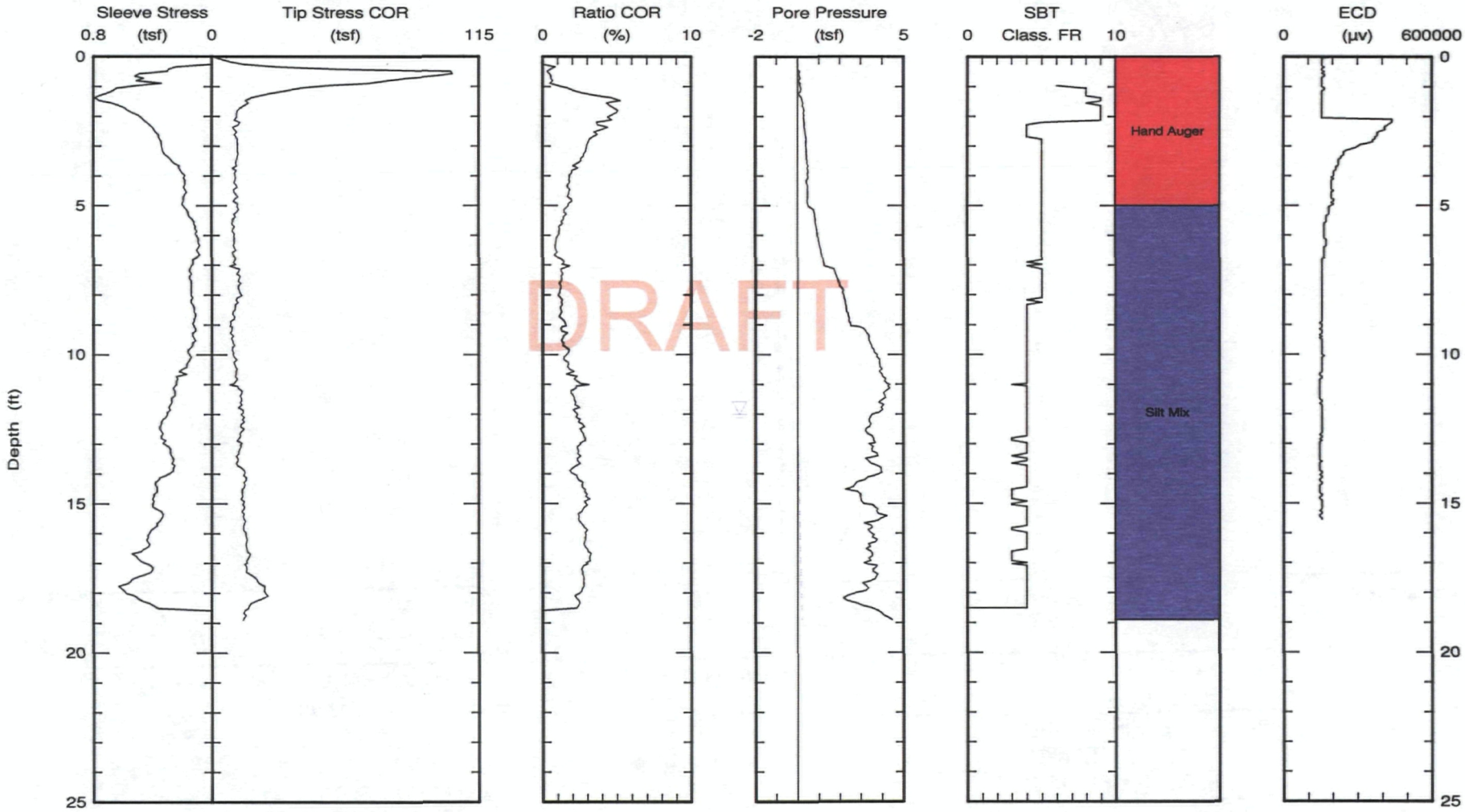



Maximum depth: 25.98 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

▽ Estimated Phreatic Surface

| | | | |
|---|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation: | Date: 19/May/2008<br>Test ID: MIP-22<br>Project: SLOP |
| | | Client: CH2M<br>Job Site: SLOP | |



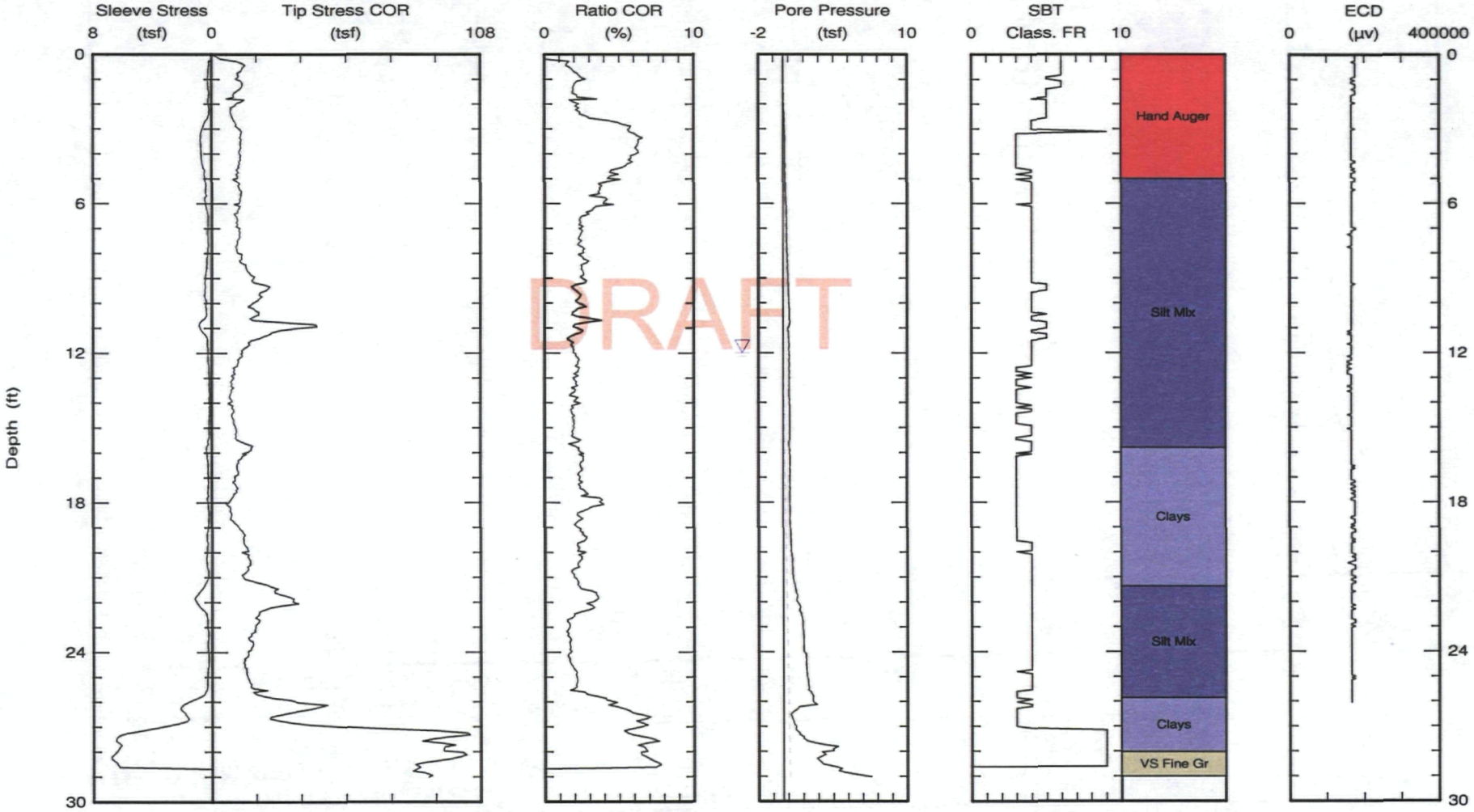

Maximum depth: 18.91 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Estimated Phreatic Surface

Test ID: MIP-22
File: MIP-22~1.CSV

| | | |
|---|---|---|
| DIRECT SENSING PATC<br>FLORIDA 407-426-7885<br>CALIFORNIA 510-237-4575<br>...there is a better way... | Direct Sensing Division.<br>2300 Silver Star Rd,Orlando FL,32804<br>407-427-7885<br>clayton.bartholomew@patc-usa.com<br>www.precisiontecha.com | Northing:<br>Easting:<br>Elevation:<br>Client: CH2M<br>Job Site: SLOP |
| | | Date: 19/May/2008<br>Test ID: MIP-23<br>Project: SLOP |




Maximum depth: 29.01 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

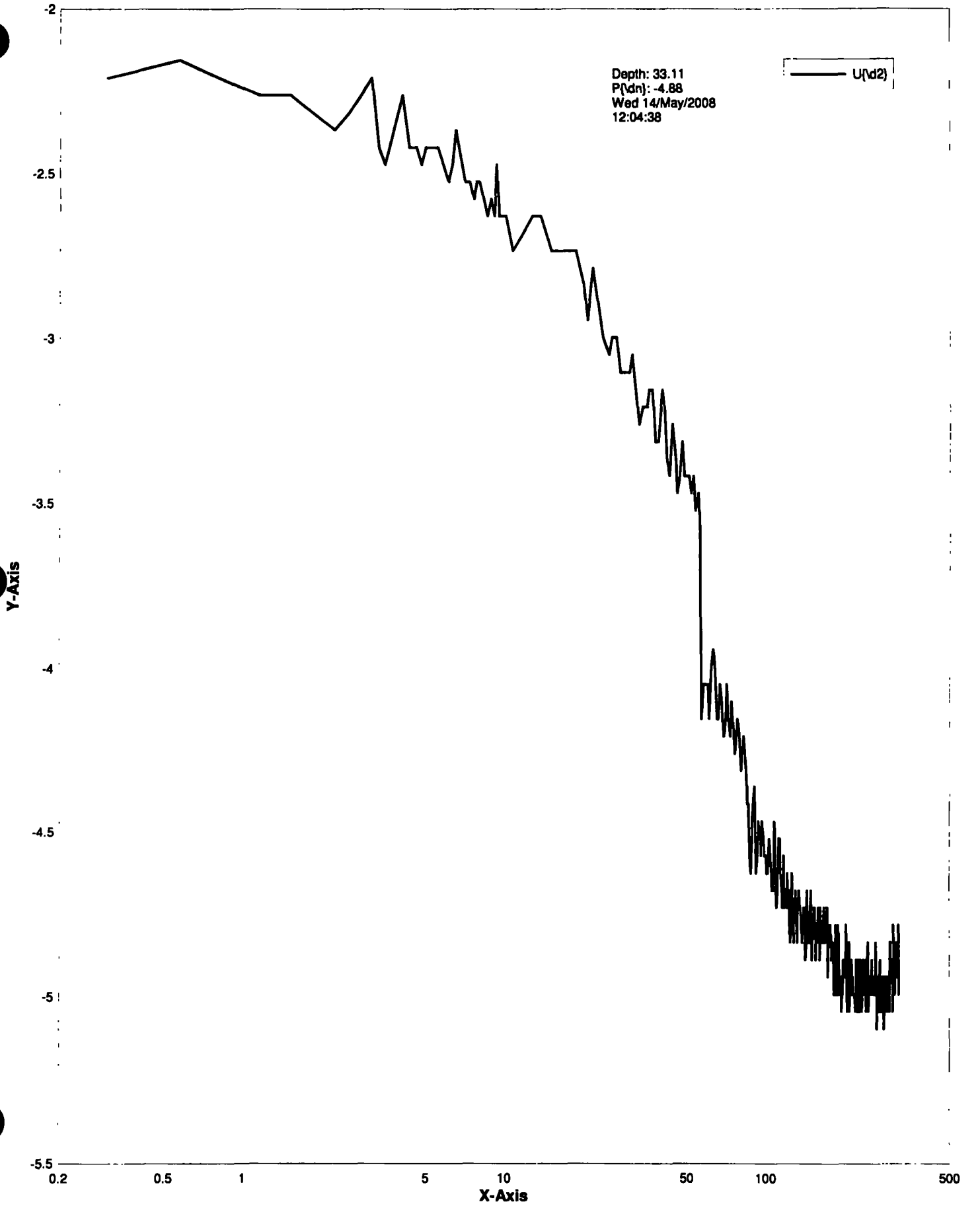
Estimated Phreatic Surface

Test ID: MIP-23
File: MIP-23~1.CSV

# Pore Pressure Dissipation Logs

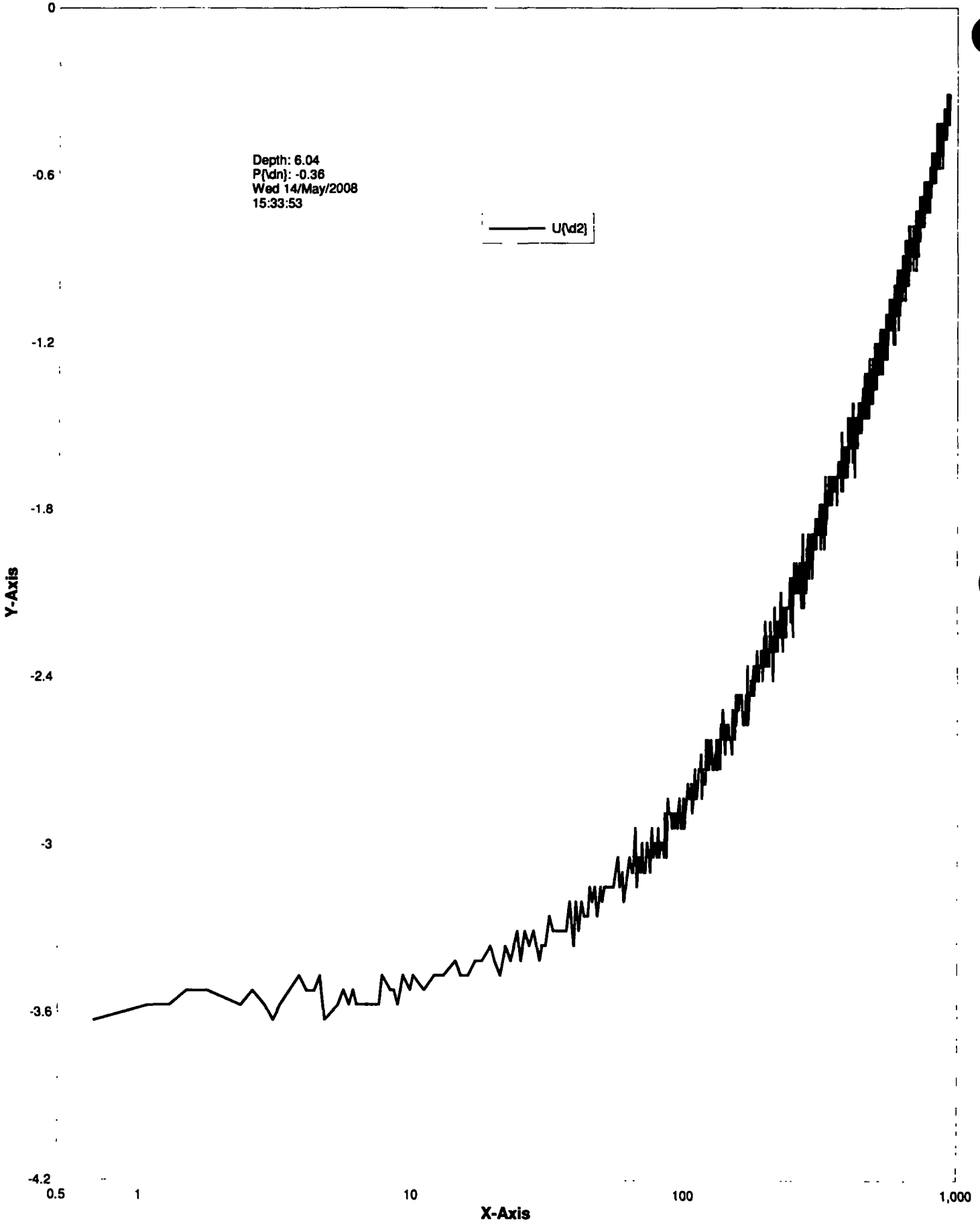
**CH2M** **MIP-01**

**Groundwater Protection** **CP-514Y0801D.33**



# CH2M CPT-02

**Groundwater Protection** **CP-514Y0803D.6**



# Evaluation of Background Concentrations Used in the St. Louis Army Ammunition Plant Environmental Baseline Survey

**PREPARED FOR:** U.S. Army Corps of Engineers - Kansas City District

**PREPARED BY:** CH2M HILL

**DATE:** August 20, 2009

In the remedial investigation (RI) report for the former Hanley Area at the St. Louis Ordnance Plant (CH2M HILL 2009), the U.S. Army used background concentrations for metals and select polycyclic aromatic hydrocarbons (PAHs) as screening levels. The background concentrations were developed during an environmental baseline survey at a nearby industrial site, the St. Louis Army Ammunition Plant (SLAAP). The values were recommended for the former Hanley Area by the Missouri Department of Natural Resources (MDNR) during its review of the draft final RI work plan. The SLAAP background concentrations were a source of the screening levels presented in the final RI work plan (CH2M HILL 2008), which MDNR approved in a letter dated May 19, 2008.

During its review of the draft final RI report for the former Hanley Area, USEPA expressed concern regarding the use of the SLAAP background values as screening levels. In its most recent correspondence, dated August 5, 2009, USEPA offered the following recommendations regarding the use of the SLAAP background values:

1. Remove the outliers from the population, then recalculate the background statistics.
2. Eliminate the 95 percent upper tolerance limit (UTL), and calculate the 95 percent upper confidence limit (UCL) to be used as the representative background population for each constituent.

This memorandum was prepared in response to USEPA's correspondence. It demonstrates that outliers were removed from the SLAAP background sample population before calculating background statistics, and it explains why the 95/95 UTL is an appropriate statistical metric for calculating background concentrations.

## Source Data and Removal of Outliers

The background concentrations used in the RI originally were presented in the May 2004 *Site-specific Environmental Baseline Survey, St. Louis Army Ammunition Plant, St. Louis, Missouri* (URS 2004). Ten surface soil samples were collected from local municipal parks to calculate regional background levels of metals and PAHs. The regional background concentration was defined as the 95 percent upper confidence limit for 95 percent of observations (95/95 UTL).

Before calculating the 95/95 UTLs, outliers within the sample population were identified and removed using Dixon's Extreme Value Test (URS 2004). Outliers are represented in

italics in Table 4-1 of the environmental baseline survey report. The remaining data were confirmed to be normally distributed by the Studentized Range Test (URS 2004).

In response to USEPA's concerns cited above, no additional adjustment to the sample population is warranted.

## Upper Confidence Limits and Upper Tolerance Limits

The following subsections define and contrast two statistical estimators, designated "UCL of the mean" and "UTL," as they relate to evaluations of background, and specifically the SLAAP background values used in the former Hanley Area RI. It is important to note that the utilities of these two statistics do not overlap one another. Instead, they each serve different purposes, and attempts to use either as a replacement for the other signals an errant approach.

### Differences between UCL of the Mean and UTL

The primary difference between a UCL of the mean and a UTL is the statistical parameter being estimated. The UCL of the mean is an important statistic in risk assessments, because it serves as the conservative estimate of the mean to be compared to a risk-based value. Being such a common environmental statistic, it has become routine simply to refer to this statistic as the UCL. However, since virtually any statistical parameter can have a UCL as a conservative estimate, casually referring to the "UCL of the mean" as simply the "UCL" can reduce clarity and introduce confusion.

Indeed the UTL, or upper tolerance limit, is itself an upper confidence limit. The UTL is an upper confidence limit of an elevated percentile (such as the 95th percentile). The use of the word "tolerance" in this context should not be confused or combined with other uses of the word, such as engineering "tolerances." The UTL in environmental circles refers to an upper confidence limit of an elevated percentile.

The two statistics describe different parameters and thus answer different questions about a population. The UCL provides information about the center of the distribution while the UTL deals with the upper tail of the distribution. Thus the UCL is useful for a conservative test of whether the mean exceeds some constant threshold, such as a risk screening threshold. The UTL is appropriate for comparing to individual values (e.g., site sample results) to see if they are likely members of a population equivalent to the one which produced the UTL. An example of this is a UTL calculated from a background dataset used to compare to individual site values. If a site value exceeds the background UTL, then it represents an elevated result with respect to the background data.

Thus, with regard to the SLAAP background population, one can summarize use of the UCL and UTL as follows:

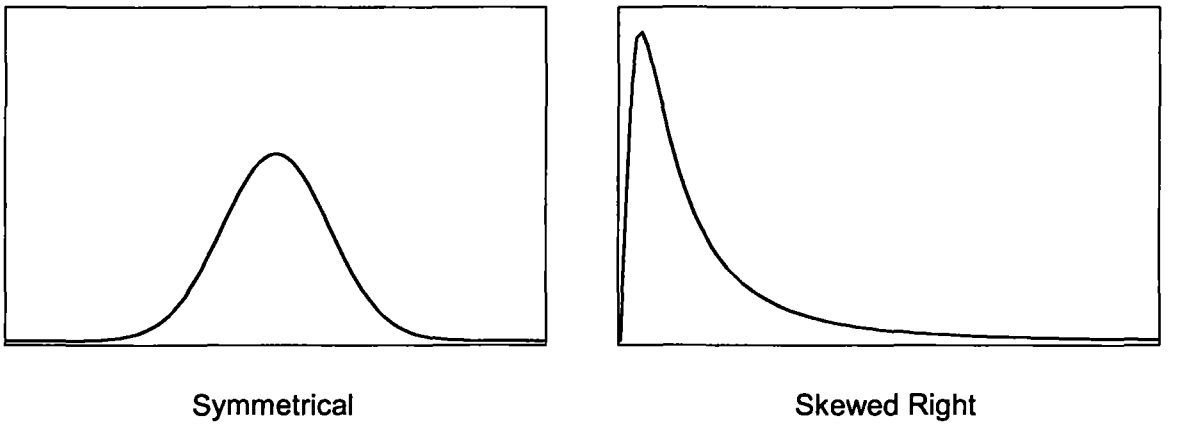
- The UCL can be used in determining whether the mean of a population exceeds a risk-based threshold.
- The background UTL is used in determining whether individual values appear unusually elevated relative to the background population.

These different limits have long caused confusion, but their distinct statistical identities have always been consistent. For instance, older guidance (USEPA 1992) stated that "[t]hough often confused, the interpretations and uses of these intervals are quite distinct." More recently, the technical guide for ProUCL software, written under contract for USEPA (2009), states, "It is important to understand and note the differences between the uses and numerical values of these statistical limits so that they can be properly used. Specifically, the differences between . . . UCLs and UTLs should be clearly understood and acknowledged."

## Graphical Interpretation of UCL of the Mean and UTL

A graphical presentation of the UCL and UTL can help reinforce their differences. First, it is appropriate to introduce the concept of skewed data. Some data, such as those adhering to a normal distribution, are symmetrically distributed. Many times, data tend to be skewed, and with environmental applications this skewness tends to be to the right (toward more elevated concentrations). Types of distributions are depicted in Figure 1.

**FIGURE 1**
Comparison of Symmetrical and Skewed Distributions

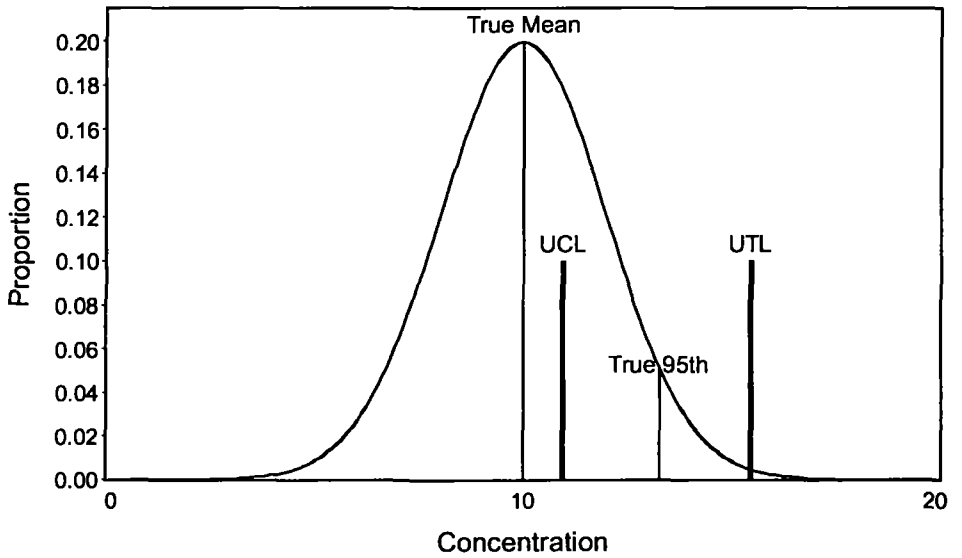



If one considers a normal distribution (which is symmetrical), a relatively simple depiction of a UCL of the mean and a UTL can be provided. The curve in Figure 2 represents the distribution of a normally distributed population with a true mean of 10 and a true standard deviation of 2. The true mean and true 95th percentile are marked on the plots. Also shown on the plot are a potential 95 percent (confidence) UCL and a potential 95 percent (confidence) UTL (of the 95th percentile).

Both the UCL and UTL drawn on Figure 2 represent larger values than the true mean or true 95th percentile, respectively. (For graphical convenience, this example with relatively low variability is used. If the variability is larger, the UCL and UTL typically exceed the true mean and true 95th percentiles, respectively, by larger amounts.) This is the condition one typically would expect since these statistical estimates are upper confidence limits of the true parameters. Since the confidence of both estimators is 95 percent, one would expect that the UCL, or UTL, (which is calculated based on a collection of sample sets from the overall population) would be larger than the true mean, or true 95th percentile, 19 of 20 times (95 percent). One out of 20 times, however, one would expect that the UCL, or UTL, would fall below the true mean, or true 95th percentile. Whether this occurred or not, the UTL for a

given sample set would still be expected to be a larger value than the UCL of the mean, since the 95th percentile is greater than the mean.

**FIGURE 2**
A Normal Distribution with Mean = 10 and Standard Deviation = 2, Showing Typical Positions of UCL and UTL




With Figure 2 in mind, one has a visual reminder of how it is inappropriate to compare the mean to the UTL (since the UTL estimates a value notably higher than the mean) or individual values to the UCL (since a substantial portion of the population exceeds the UCL).

### Impact of Skewness

Many environmental populations are not as symmetrical as the normal distribution but instead are skewed to the right (the longer tail of the distribution appears to the right). With right-skewed populations, the problem of misapplying UCLs and UTLs can become even more dramatic than with the symmetrical presentation in Figure 2. With such distributions, the difference between correctly calculated UCLs and UTLs can become even greater.

The skewness of the data, along with the number of background samples and the variability in the results, also affects whether the maximum result in the background sample set exceeds the calculated UTL. These various factors will alter the odds of having the UTL be higher than the maximum detected result used in calculating the UTL. There are many datasets in which a correctly calculated UTL will exceed the maximum detected value. The skewness will also affect the mathematical assignment of outliers to be considered for exclusion.

### Use of 95/95 UTLs for Calculating Background Concentrations

Based on the information above, 95/95 UTLs are an appropriate statistical metric, following the removal of outliers, for calculating background concentrations from the SLAAP background sample population.

## Modification to Arsenic Background Concentration

Recent review of the SLAAP background values revealed a transcription error for arsenic. The reported background concentration of 13.2 milligrams per kilogram (mg/kg) should actually

be 12.3 (mg/kg). This was determined by calculating the 95/95 UTL for arsenic. The sample population for arsenic, as presented in the 2004 environmental baseline survey report, is as follows: 3.4 mg/kg, 5.1 mg/kg, 5.3 mg/kg, 5.7 mg/kg, 6.3 mg/kg, 6.8 mg/kg, 7.4 mg/kg, 8.1 mg/kg, 10 mg/kg, and 18 mg/kg. As noted in Table 4-1 of the 2004 environmental baseline survey report, the concentration of 18 mg/kg was identified as an outlier and removed from the sample population. With removal of the outlier, the remaining sample population has a mean of 6.46 mg/kg and a standard deviation of 1.92 mg/kg. With n = 9 samples, k = 3.031, and the 95/95 UTL should be 6.46 + 1.92 x 3.031 = 12.3 mg/kg.

To address this transcription error, the screening level for arsenic will be revised to 12.3 mg/kg in the RI report.

## Conclusions

Outliers were removed from the SLAAP background sample population before background statistics were calculated. Given the considerations presented in this memorandum, the Army made an appropriate choice in selecting the 95/95 UTL as the statistical metric for the calculation of background concentrations. A transcription error was discovered for the arsenic background concentration, so the screening level for arsenic will be revised to 12.3 mg/kg in the RI report for the former Hanley Area. Otherwise, the background dataset, resulting 95/95 UTLs, and their use in developing screening levels have received approval from MDNR and will remain unchanged in the RI report.

## References

CH2M HILL. 2008. *Work Plan, Remedial Investigation Report, St. Louis Ordnance Plant, Former Hanley Area, St. Louis.* Missouri. May.

CH2M HILL. 2009. *Remedial Investigation, St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri.* Draft Final. March.

URS Group, Inc. 2004. *Site-specific Environmental Baseline Survey, St. Louis Army Ammunition Plant, St. Louis, Missouri.* May.

USEPA. 1992. *Statistical Analysis of Ground-water Monitoring Data at RCRA Facilities,* addendum to Interim Final Guidance.

USEPA. 2006. *Data Quality Assessment: Statistical Methods for Practitioners.* Office of Environmental Information, Washington, D.C. 2006.

USEPA. 2009. *ProUCL Version 4.00.04 Technical Guide (Draft).* Office of Research and Development.

**TABLE P-1**
Summary of Model Input
Remedial Investigation Report
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Input Parameter | Units | Value | Reference |
|---|---|---|---|
| Initial Source Concentration (PCE) | g/L | 0.034 | Calibrated using 2008 groundwater concentrations |
| Source Mass (PCE) | kg | 500 | Mass derived for rough conceptual design and cost estimate for site |
| Gamma | --- | 1.5 | Power function exponent; Assume value for older release |
| Source Width | m | 12 | Based on width of elevated ECD readings near MW-111 |
| Source Depth | m | 4.6 | Relative thickness of shallow source zone in cost estimate |
| Darcy Velocity | m/yr | 0.15 | =Ki; Based on hydraulic conductivity of $10^{-3}$ cm/sec (slug tests), hydraulic gradient of 0.054 ft/ft (Water levels, 2008) |
| Effective Porosity (ne) | $ft^3/ft^3$ | 0.085 | Assume mobile porosity for alluvial formation |
| Source Fraction Removed | --- | 0 | Assume no source remediation |
| Remediation Time | yr | Arbitrary | Not applicable; no source remediation |
| Source Decay | 1/yr | 0.03 | SourceDK model estimate with minimal biodegradation |
| Retardation Factor (PCE) | --- | 2.1 | Calculated; R = 1 + (Koc*foc* pb)/n |
| Partition Coefficient for PCE (Koc) | L/kg | 238 | Soil Screening Guidance (EPA 1996) |
| Fraction Organic Carbon (foc) | --- | 0.0008 | Site-specific range is 531 to 1020 mg/kg; lower value selected to simulate a "faster" plume |
| Soil Bulk Density (pb) | kg/L | 1.7 | Site-specific (108.9 pcf) |
| Total Porosity (n) | $ft^3/ft^3$ | 0.3 | Site-specific |
| Sigma v | --- | 0.14142 | Assume $\alpha x = x/100$; low dispersion based on current plume front location |
| vMin | --- | 0 | Default value; REMChlor User's Guide |
| vMax | --- | 1.57 | 1+4*Sigmav |
| # streamtubes | --- | 1,000 | Arbitrary Value |
| Alpha y | m | 0.050 | Assume $\alpha y = \alpha x/10$ and plume length of x = 165 ft (TCE plume, most extensive) |
| Alpha z | m | 0.005 | |
| Maximum X Direction | m | 61 | Approximate distance between former Building 220 and residential units along an easterly groundwater flow pattern |
| Maximum Y Direction | m | 21 | Approximately half of TCE plume width |
| Maximum Z Direction | m | 0 | Assume centerline flow |
| Maximum Time - Calibration1 | yr | 29 | Time between most recent sampling event in 2008 and year that plant shut down in 1979 |
| Maximum Time - Calibration2 | yr | 49 | Time between most recent sampling event in 2008 and year that plant began operation under Hanley in 1959 |
| Maximum Time - Calibration3 | yr | 67 | Time between most recent sampling event in 2008 and year that small arms operations began in 1941 |
| Maximum Time - Future Estimate | yr | 79 | Assume 50 years in future |
| First Order Decay Rate | | | |
| PCE | /yr | 0.20 | Estimated using 2008 groundwater concentrations |
| TCE | /yr | 0.15 | Estimated using 2008 groundwater concentrations |
| cis12DCE | /yr | 0.10 | Estimated using 2008 groundwater concentrations |
| VC | /yr | 2.56 | Suarez and Rifai (1999); Geometric mean; field and laboratory reductive dechlorination studies |
| Product Generation | | | MW = molecular weight |
| Yield 1 (PCE-TCE) | --- | 0.79 | MW of TCE/MW of PCE |
| Yield 2 (PCE-DCE) | --- | 0.74 | MW of DCE/MW of TCE |
| Yield 3 (DCE-VC) | --- | 0.64 | MW of VC/MW of DCE |
| Current Field data | | | June 2008 |
| PCE | µg/L | 34,900 | MW-111; Distance = 0 |
| | µg/L | 9,440 | MW-110; Distance = 20 m |
| | µg/L | <1 | MW-08; Distance = 37 m |
| TCE | µg/L | 1,620 | MW-111; Distance = 0 |
| | µg/L | 129 | MW-110; Distance = 20 m |
| | µg/L | 16.8 | MW-08; Distance = 37 m |
| DCE | µg/L | 281 | MW-111; Distance = 0 |
| | µg/L | 82.2 | MW-110; Distance = 20 m |
| | µg/L | 9.4 | MW-08; Distance = 37 m |
| VC | µg/L | <50 | MW-111; Distance = 0 |
| | µg/L | <20 | MW-110; Distance = 20 m |
| | µg/L | <1 | MW-08; Distance = 37 m |

REMChlor - [REMChlor Model Parameters]

File Model Help

REMChlor Project

- Project: SLOP_1959
  - Model Parameters
  - View Model Results
    - View File Output
    - View Graphical Output
      - Output vs. Distance
      - 2D Contour

## Source Zone Parameters

**Source Parameters**

Initial Source

| | |
|---|---|
| Concentration (g/L) | 0.47 |
| Mass (Kg) | 500 |
| Gamma | 1.5 |

**Source Dimensions**

| | |
|---|---|
| Source Width (m) | 12 |
| Source Depth (m) | 4.6 |
| Darcy Velocity (m/yr) | 0.15 |
| Porosity | 0.09 |

**Source Remediation**

| | |
|---|---|
| Fraction Removed | 0 |

Remediation Time (Years): Start Time (T1) 0; End Time (T2) 0

| | |
|---|---|
| Source Decay (1/yr) | 0.03 |

**Transport Parameters**

| | |
|---|---|
| Retardation Factor | 2 |

Velocity: Sigmav 0.14142; vMin 0; vMax 1.57

| | |
|---|---|
| Number of Stream Tube | 500 |

alphay (m) 0.05; alphaz (m) 0.005

| | Yield 2 From 1 | Yield 3 From 2 | Yield 4 From 3 |
|---|---|---|---|
| | 0.1 | 0.79 | 0 |

Component 1 | Component 2 | Component 3 | Component 4

Component Name: PCE

Time, Years

| | Zone 1 | Zone 2 | Zone 3 |
|---|---|---|---|
| Period 3 (100 Time ---> Period 2) | Decay Rate (1,3) 0.64 | Decay Rate (2,3) 0.64 | Decay Rate (3,3) 0.64 |
| Period 2 (50 Time ---> Period 1) | Decay Rate (1,2) 0.64 | Decay Rate (2,2) 0.64 | Decay Rate (3,2) 0.64 |
| Period 1 | Decay Rate (1,1) 0.64 | Decay Rate (2,1) 0.64 | Decay Rate (3,1) 0.64 |

X1 90 X2 100

Distance From Source, Meters

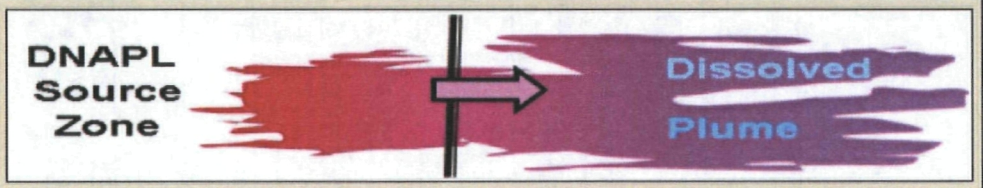
**Cancer Risk**

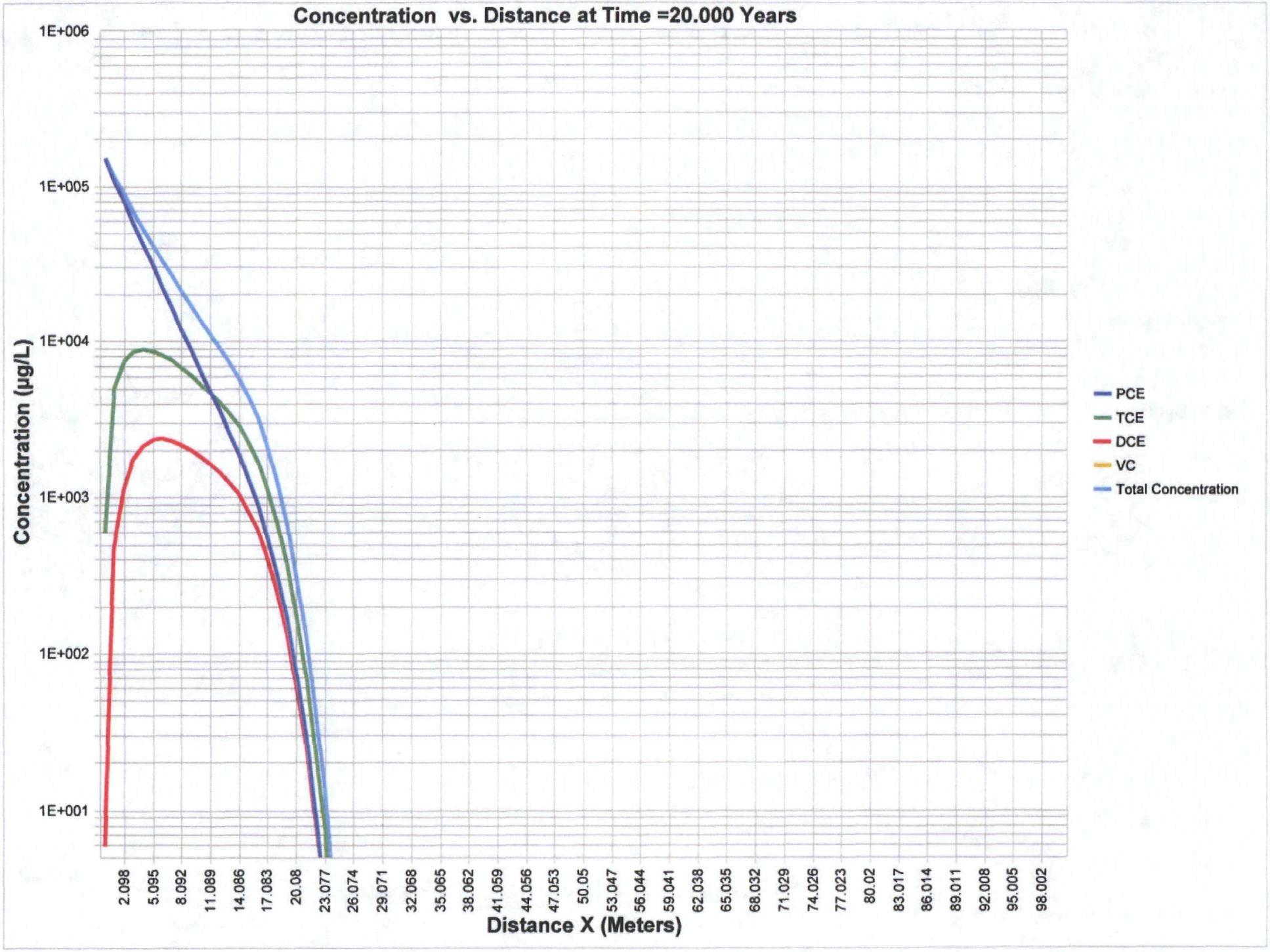
Lifetime Oral Cancer Risk | Lifetime Inhalation Cancer Risk

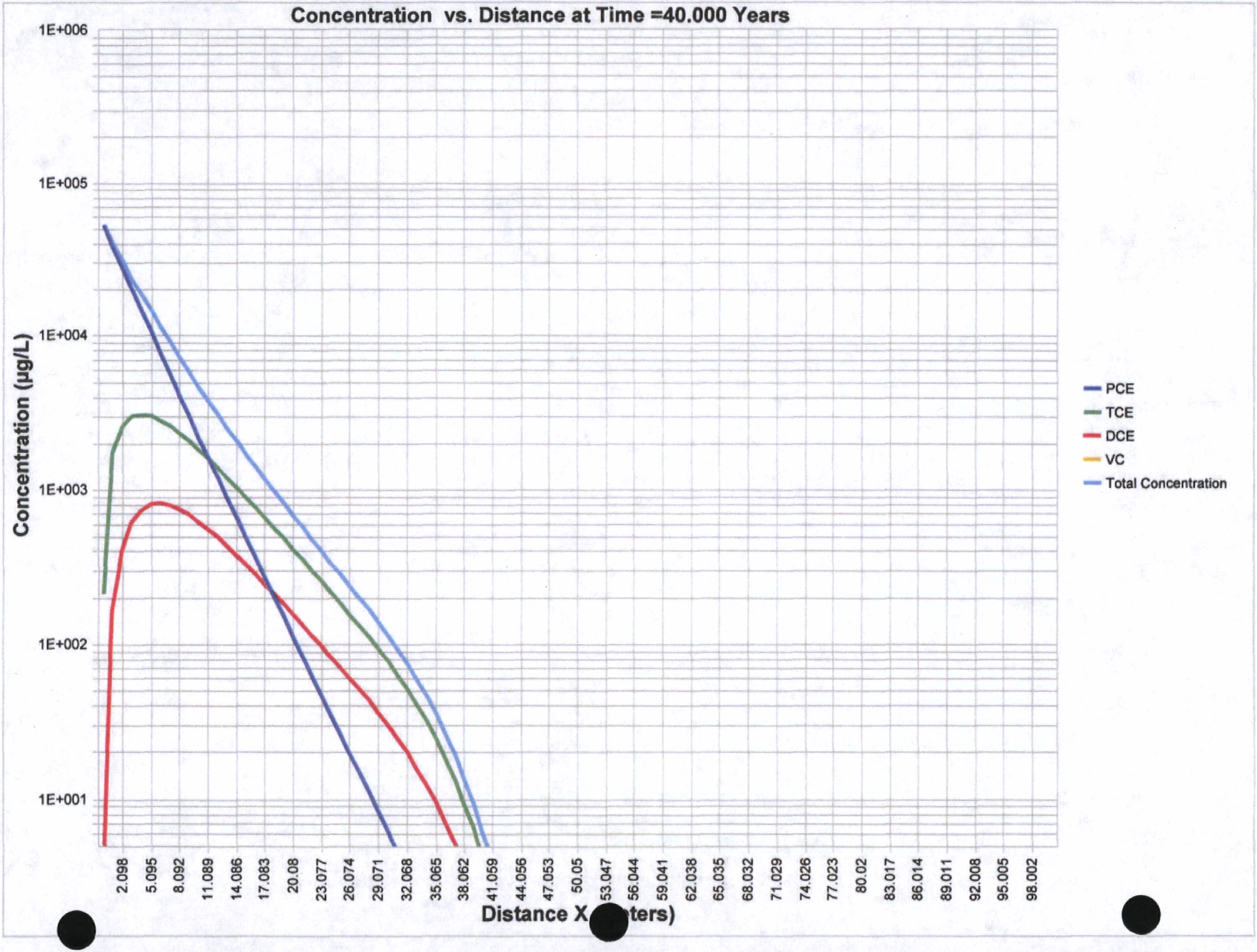
| Component 1 | Component 2 | Component 3 | Component 4 |
|---|---|---|---|
| 0 | 0 | 0 | 0 |

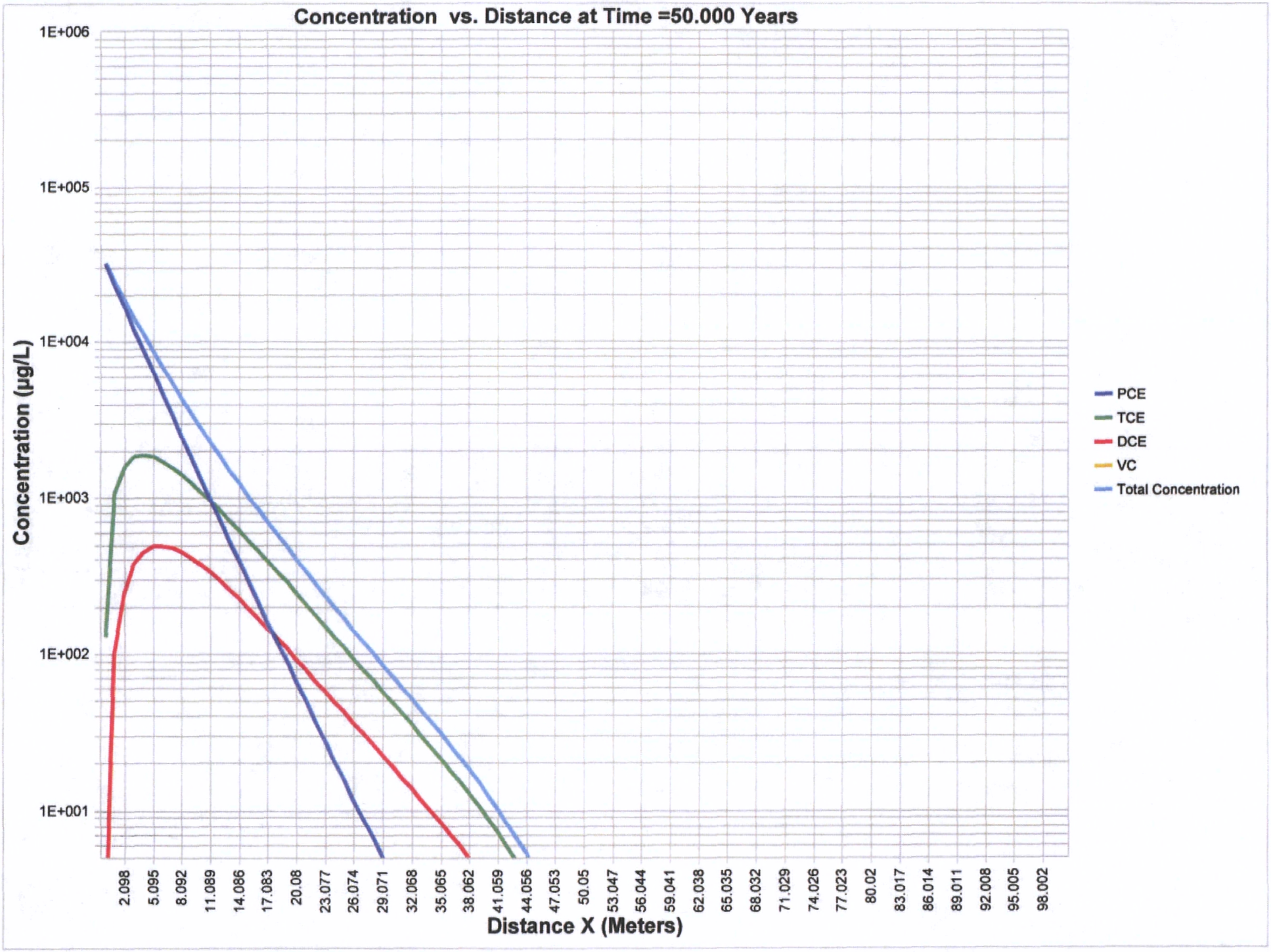
## Simulation Parameters

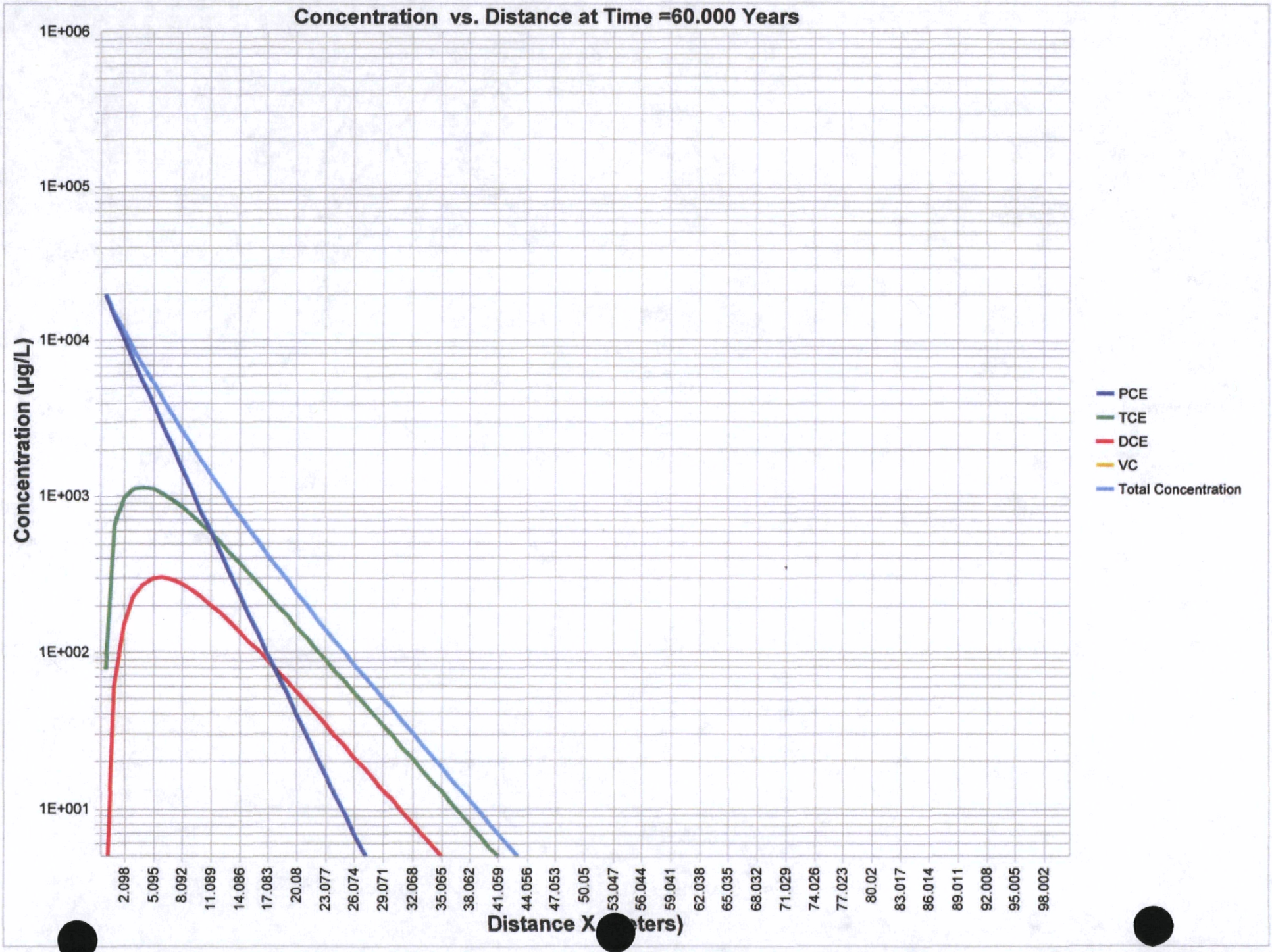
| | Intervals | Min Value | Max Value | Units |
|---|---|---|---|---|
| X - Direction | 101 | 0.1 | 100 | Meter |
| Y - Direction | 11 | -20 | 20 | Meter |
| Z - Direction | 1 | 0 | 0 | Meter |
| Time | 100 | 0 | 100 | Year |

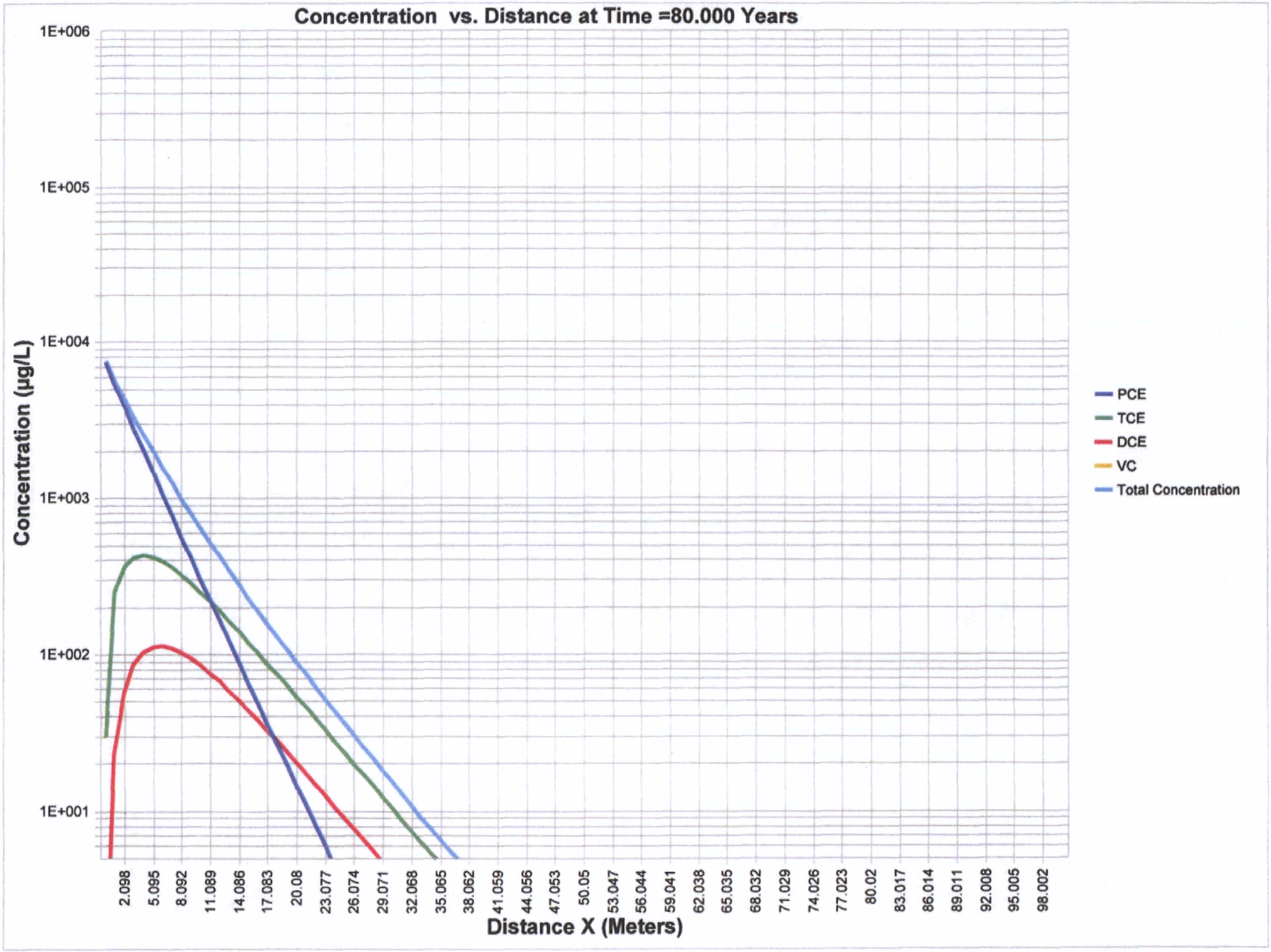



Concentration vs. Distance at Time =20.000 Years
Concentration (µg/L)
1E+006
1E+005
1E+004
1E+003
1E+002
1E+001
2.098
5.095
8.092
11.089
14.086
17.083
20.08
23.077
26.074
29.071
32.068
35.065
38.062
41.059
44.056
47.053
50.05
53.047
56.044
59.041
62.038
65.035
68.032
71.029
74.026
77.023
80.02
83.017
86.014
89.011
92.008
95.005
98.002
Distance X (Meters)
PCE
TCE
DCE
VC
Total Concentration


Concentration vs. Distance at Time =40.000 Years
Concentration (µg/L)
1E+006
1E+005
1E+004
1E+003
1E+002
1E+001
2.098
5.095
8.092
11.089
14.086
17.083
20.08
23.077
26.074
29.071
32.068
35.065
38.062
41.059
44.056
47.053
50.05
53.047
56.044
59.041
62.038
65.035
68.032
71.029
74.026
77.023
80.02
83.017
86.014
89.011
92.008
95.005
98.002
Distance X
ters)
PCE
TCE
DCE
VC
Total Concentration


Concentration vs. Distance at Time =50.000 Years
1E+006
1E+005
1E+004
1E+003
1E+002
1E+001
Concentration (µg/L)
2.098
5.095
8.092
11.089
14.086
17.083
20.08
23.077
26.074
29.071
32.068
35.065
38.062
41.059
44.056
47.053
50.05
53.047
56.044
59.041
62.038
65.035
68.032
71.029
74.026
77.023
80.02
83.017
86.014
89.011
92.008
95.005
98.002
Distance X (Meters)
PCE
TCE
DCE
VC
Total Concentration


Concentration vs. Distance at Time =60.000 Years
Concentration (µg/L)
1E+006
1E+005
1E+004
1E+003
1E+002
1E+001
2.098
5.095
8.092
11.089
14.086
17.083
20.08
23.077
26.074
29.071
32.068
35.065
38.062
41.059
44.056
47.053
50.05
53.047
56.044
59.041
62.038
65.035
68.032
71.029
74.026
77.023
80.02
83.017
86.014
89.011
92.008
95.005
98.002
Distance X
ters)
PCE
TCE
DCE
VC
Total Concentration


Concentration vs. Distance at Time =80.000 Years
1E+006
1E+005
1E+004
1E+003
1E+002
1E+001
Concentration (µg/L)
2.098
5.095
8.092
11.089
14.086
17.083
20.08
23.077
26.074
29.071
32.068
35.065
38.062
41.059
44.056
47.053
50.05
53.047
56.044
59.041
62.038
65.035
68.032
71.029
74.026
77.023
80.02
83.017
86.014
89.011
92.008
95.005
98.002
Distance X (Meters)
PCE
TCE
DCE
VC
Total Concentration

# Risk Assessment Guidance for Superfund: Tables 1–7

**APPENDIX Q**
**TABLE 1**
Selection of Potentially Complete Exposure Pathways
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|---|---|---|---|---|---|---|---|---|
| Current/Future | Surface Soil (0-2 feet bgs) | On-Site Surface Soil [1] (0-2 feet bgs) | On-Site Surface Soil (0-2 ft bgs) | Industrial Worker | Adult | Dermal Absorption/ Ingestion<br>Inhalation | Quant | |
| | | Off-Site Surface Soil (0-2 feet bgs) | Off-Site Surface Soil (Job Corps) (0-2 ft bgs) | Resident | Adult/Child | Dermal Absorption/ Ingestion<br>Inhalation | None | No samples were collected from areas outside the site fencing adjacent to the Job Corps property; future on-site residential exposures can be used to conservatively represent off-site exposures since off-site receptors are expected to be exposed to lower soil concentrations. |
| | Groundwater | Off-Site Groundwater | Off-Site Residential Indoor Air | Resident | Adult/Child | Inhalation | Qual | Indoor air samples were collected from the residence immediately downgradient of the site groundwater plume; indoor air concentrations were not of concern. |
| | | On-Site Groundwater at Bldg 219G | Indoor Air at Bldg 219G | Industrial Worker | Adult | Inhalation | None | No VOCs were detected in groundwater within 100 ft of Bldg 219G; the exposure pathway is incomplete. |
| Future | Subsurface Soil (0-10 feet bgs) | On-Site Subsurface Soil [1] (0-10 feet bgs) | On-Site Subsurface Soil (0-10 ft bgs) | Construction Worker | Adult | Dermal Absorption/ Ingestion<br>Inhalation | Quant | |
| | | On-Site Subsurface Soil (0-10 feet bgs) | On-Site Exposure Units A through L[2] Subsurface Soil (0-10 ft bgs) | Resident | Adult/Child | Dermal Absorption/ Ingestion<br>Inhalation | Quant | |

**APPENDIX Q**
**TABLE 1**
Selection of Potentially Complete Exposure Pathways
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|---|---|---|---|---|---|---|---|---|
| Future (cont.) | Groundwater | On-Site Groundwater (Area Downgradient of Former Building 220) | On-site Tap Water | Resident | Adult/Child | Ingestion/ Dermal Absorption/ Inhalation | Quant | |
| | | | On-Site Indoor Air | Resident | Adult/Child | Inhalation | Qual | Site groundwater is too shallow (i.e., somes areas are <1 ft bgs) to evaluate the indoor air vapor intrusion pathway using the Johnson and Ettinger Model. |
| | | | On-Site Groundwater in Excavations | Construction Worker | Adult | Dermal Absorption/ Inhalation | Quant | |
| | | On-Site Groundwater (Sitewide Excluding Area Downgradient of Building 220) | On-site Tap Water | Resident | Adult/Child | Ingestion/ Dermal Absorption/ Inhalation | Quant | |
| | | Off-Site Groundwater | Off-Site Tap Water | Resident | Adult/Child | Ingestion/ Dermal Absorption/ Inhalation | Quant | |
| | | | Off-Site Groundwater in Excavations | Construction Worker | Adult | Dermal Absorption/ Inhalation | Quant | |

Notes:
[1]Exposure evaluated sitewide.
[2]Exposure to subsurface soil evaluated separately for Exposure Units A through L; locations are presented in Figure 7-1.
Qual = Qualitative; Quant = Quantitative

**APPENDIX Q**
**TABLE 2.1**
Soil Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | Station ID | Sample Date | Upper Depth | Lower Depth | Sample Type | Sample ID |
|---|---|---|---|---|---|---|
| SO_Onsite_0_10 | CSS-001 | 2005 | 0 | 1 | N | CSS-001_2005_0_1 |
| SO_Onsite_0_10 | CSS-002 | 2005 | 0 | 1 | N | CSS-002_2005_0_1 |
| SO_Onsite_0_10 | CSS-003 | 2005 | 0 | 1 | N | CSS-003_2005_0_1 |
| SO_Onsite_0_10 | CSS-004 | 2005 | 0 | 1 | N | CSS-004_2005_0_1 |
| SO_Onsite_0_10 | CSS-005 | 2005 | 0 | 1 | N | CSS-005_2005_0_1 |
| SO_Onsite_0_10 | CSS-006 | 2005 | 0 | 1 | N | CSS-006_2005_0_1 |
| SO_Onsite_0_10 | CSS-007 | 2005 | 0 | 1 | N | CSS-007_2005_0_1 |
| SO_Onsite_0_10 | CSS-008 | 2005 | 0 | 1 | N | CSS-008_2005_0_1 |
| SO_Onsite_0_10 | CSS-009 | 2005 | 0 | 1 | N | CSS-009_2005_0_1 |
| SO_Onsite_0_10 | CSS-010 | 2005 | 0 | 1 | N | CSS-010_2005_0_1 |
| SO_Onsite_0_10 | CSS-011 | 2005 | 0 | 1 | N | CSS-011_2005_0_1 |
| SO_Onsite_0_10 | CSS-012 | 2005 | 0 | 1 | N | CSS-012_2005_0_1 |
| SO_Onsite_0_10 | CSS-013 | 2005 | 0 | 1 | N | CSS-013_2005_0_1 |
| SO_Onsite_0_10 | CSS-014 | 2005 | 0 | 1 | N | CSS-014_2005_0_1 |
| SO_Onsite_0_10 | CSS-015 | 2005 | 0 | 1 | N | CSS-015_2005_0_1 |
| SO_Onsite_0_10 | HA-01 | 5/13/2008 | 0 | 2 | N | HA-01-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-02 | 5/13/2008 | 0 | 2 | N | HA-02-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-03 | 5/13/2008 | 0 | 2 | N | HA-03-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-04 | 5/13/2008 | 0 | 2 | N | HA-04-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-05 | 5/13/2008 | 0 | 2 | N | HA-05-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-06 | 5/13/2008 | 0 | 2 | N | HA-06-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-07 | 5/13/2008 | 0 | 2 | N | HA-07-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-08 | 5/13/2008 | 0 | 2 | N | HA-08-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-09 | 5/13/2008 | 0 | 2 | N | HA-09-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-10 | 5/13/2008 | 0 | 0.25 | N | HA-10-S-00_5/13/2008_0_0.25 |
| SO_Onsite_0_10 | HA-11 | 5/13/2008 | 0 | 2 | N | HA-11-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-12 | 5/13/2008 | 0 | 2 | N | HA-12-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-13 | 5/13/2008 | 0 | 2 | N | HA-13-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-14 | 5/13/2008 | 0 | 2 | N | HA-14-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-15 | 5/13/2008 | 0 | 2 | N | HA-15-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-16 | 5/13/2008 | 0 | 2 | N | HA-16-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10 | HA-20 | 5/14/2008 | 0 | 2 | N | HA-20-S-00_5/14/2008_0_2 |
| SO_Onsite_0_10 | HA-21 | 5/14/2008 | 0 | 2 | N | HA-21-S-00_5/14/2008_0_2 |
| SO_Onsite_0_10 | HA-22 | 5/14/2008 | 0 | 2 | N | HA-22-S-00_5/14/2008_0_2 |
| SO_Onsite_0_10 | NS02A | 1998 | 0 | 1 | N | NS02A_1998_0_1 |
| SO_Onsite_0_10 | NS02B | 1998 | 1 | 2 | N | NS02B_1998_1_2 |
| SO_Onsite_0_10 | NS03B | 1998 | 1 | 2 | N | NS03B_1998_1_2 |
| SO_Onsite_0_10 | NS05A | 1998 | 0 | 1 | N | NS05A_1998_0_1 |
| SO_Onsite_0_10 | NS05B | 1998 | 1 | 2 | N | NS05B_1998_1_2 |
| SO_Onsite_0_10 | NS07A | 1998 | 0 | 1 | N | NS07A_1998_0_1 |
| SO_Onsite_0_10 | NS07B | 1998 | 1 | 2 | N | NS07B_1998_1_2 |
| SO_Onsite_0_10 | NS08B | 1998 | 1 | 2 | N | NS08B_1998_1_2 |
| SO_Onsite_0_10 | NS09A | 1998 | 0 | 1 | N | NS09A_1998_0_1 |
| SO_Onsite_0_10 | NS09B | 1998 | 1 | 2 | N | NS09B_1998_1_2 |
| SO_Onsite_0_10 | NS11A | 1998 | 0 | 1 | N | NS11A_1998_0_1 |
| SO_Onsite_0_10 | NS11B | 1998 | 1 | 2 | N | NS11B_1998_1_2 |
| SO_Onsite_0_10 | NS12A | 1998 | 0 | 1 | N | NS12A_1998_0_1 |
| SO_Onsite_0_10 | NS12B | 1998 | 1 | 2 | N | NS12B_1998_1_2 |
| SO_Onsite_0_10 | NS13A | 1998 | 0 | 1 | N | NS13A_1998_0_1 |
| SO_Onsite_0_10 | NS13B | 1998 | 1 | 2 | N | NS13B_1998_1_2 |
| SO_Onsite_0_10 | NS14A | 1998 | 6 | 8 | N | NS14A_1998_6_8 |
| SO_Onsite_0_10 | PW12 | 2001 | 7 | 8 | N | PW12_2001_7_8 |
| SO_Onsite_0_10 | PW13 | 2001 | 7 | 8 | N | PW13_2001_7_8 |

**APPENDIX Q**
**TABLE 2.1**
Soil Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | Station ID | Sample Date | Upper Depth | Lower Depth | Sample Type | Sample ID |
|---|---|---|---|---|---|---|
| SO_Onsite_0_10 | SB-001 | 2005 | NA1 | NA1 | N | SB-001_2005_NA_NA |
| SO_Onsite_0_10 | SB-002 | 2005 | 3 | 4 | N | SB-002_2005_3_4 |
| SO_Onsite_0_10 | SB-002 | 2005 | NA1 | NA1 | N | SB-002_2005_NA_NA |
| SO_Onsite_0_10 | SB-003 | 2005 | 0 | 1 | N | SB-003_2005_0_1 |
| SO_Onsite_0_10 | SB-003 | 2005 | NA1 | NA1 | N | SB-003_2005_NA_NA |
| SO_Onsite_0_10 | SB-005 | 2005 | NA1 | NA1 | N | SB-005_2005_NA_NA |
| SO_Onsite_0_10 | SB-006 | 2005 | 0 | 1 | N | SB-006_2005_0_1 |
| SO_Onsite_0_10 | SB-006 | 2005 | NA1 | NA1 | N | SB-006_2005_NA_NA |
| SO_Onsite_0_10 | SB-008 | 2005 | NA1 | NA1 | N | SB-008_2005_NA_NA |
| SO_Onsite_0_10 | SB-009 | 2005 | NA1 | NA1 | N | SB-009_2005_NA_NA |
| SO_Onsite_0_10 | SB-010 | 2005 | 0 | 1 | N | SB-010_2005_0_1 |
| SO_Onsite_0_10 | SB-010 | 2005 | NA1 | NA1 | N | SB-010_2005_NA_NA |
| SO_Onsite_0_10 | SB-011 | 2005 | NA1 | NA1 | N | SB-011_2005_NA_NA |
| SO_Onsite_0_10 | SB-012 | 2005 | NA1 | NA1 | N | SB-012_2005_NA_NA |
| SO_Onsite_0_10 | SB-013 | 2005 | NA1 | NA1 | N | SB-013_2005_NA_NA |
| SO_Onsite_0_10 | SB-014 | 2005 | NA1 | NA1 | N | SB-014_2005_NA_NA |
| SO_Onsite_0_10 | SB-015 | 2005 | NA1 | NA1 | N | SB-015_2005_NA_NA |
| SO_Onsite_0_10 | SB-016 | 2005 | NA1 | NA1 | N | SB-016_2005_NA_NA |
| SO_Onsite_0_10 | SB-017 | 2005 | 3 | 4 | N | SB-017_2005_3_4 |
| SO_Onsite_0_10 | SB-017 | 2005 | NA1 | NA1 | N | SB-017_2005_NA_NA |
| SO_Onsite_0_10 | SB-018 | 2005 | NA1 | NA1 | N | SB-018_2005_NA_NA |
| SO_Onsite_0_10 | SB-019 | 2005 | 3 | 4 | N | SB-019_2005_3_4 |
| SO_Onsite_0_10 | SB-019 | 2005 | NA1 | NA1 | N | SB-019_2005_NA_NA |
| SO_Onsite_0_10 | SB-020 | 2005 | 8 | 9 | N | SB-020_2005_8_9 |
| SO_Onsite_0_10 | SB-021 | 2005 | NA1 | NA1 | N | SB-021_2005_NA_NA |
| SO_Onsite_0_10 | SB-022 | 2005 | NA1 | NA1 | N | SB-022_2005_NA_NA |
| SO_Onsite_0_10 | SB-023 | 2007 | 1.7 | 2.2 | N | SB-023_2007_1.7_2.2 |
| SO_Onsite_0_10 | SB-023 | 2007 | 5 | 6 | N | SB-023_2007_5_6 |
| SO_Onsite_0_10 | SB-024 | 2007 | 0.5 | 1 | N | SB-024_2007_0.5_1 |
| SO_Onsite_0_10 | SB-024 | 2007 | 5 | 6 | N | SB-024_2007_5_6 |
| SO_Onsite_0_10 | SB-025 | 2007 | 0.5 | 1 | N | SB-025_2007_0.5_1 |
| SO_Onsite_0_10 | SB-025 | 2007 | 5 | 6 | N | SB-025_2007_5_6 |
| SO_Onsite_0_10 | SB-026 | 2007 | 0.5 | 1 | N | SB-026_2007_0.5_1 |
| SO_Onsite_0_10 | SB-026 | 2007 | 5 | 6 | N | SB-026_2007_5_6 |
| SO_Onsite_0_10 | SB-027 | 2007 | 0.5 | 1 | N | SB-027_2007_0.5_1 |
| SO_Onsite_0_10 | SB-027 | 2007 | 5 | 6 | N | SB-027_2007_5_6 |
| SO_Onsite_0_10 | SB-028 | 2007 | 0.5 | 1 | N | SB-028_2007_0.5_1 |
| SO_Onsite_0_10 | SB-028 | 2007 | 5 | 6 | N | SB-028_2007_5_6 |
| SO_Onsite_0_10 | SB-029 | 2007 | 0.5 | 1 | N | SB-029_2007_0.5_1 |
| SO_Onsite_0_10 | SB-029 | 2007 | 5 | 6 | N | SB-029_2007_5_6 |
| SO_Onsite_0_10 | SB-033 | 2007 | 0.5 | 1 | N | SB-033_2007_0.5_1 |
| SO_Onsite_0_10 | SB-033 | 2007 | 5 | 6 | N | SB-033_2007_5_6 |
| SO_Onsite_0_10 | SB-034 | 2007 | 0.5 | 1 | N | SB-034_2007_0.5_1 |
| SO_Onsite_0_10 | SB-034 | 2007 | 5 | 6 | N | SB-034_2007_5_6 |
| SO_Onsite_0_10 | SS-218A-1 | 2001 | 0 | 1 | N | SS-218A-1_2001_0_1 |
| SO_Onsite_0_10 | SS-218A-3 | 2001 | 0 | 1 | N | SS-218A-3_2001_0_1 |
| SO_Onsite_0_10 | SS-218B-1 | 2001 | 0 | 1 | N | SS-218B-1_2001_0_1 |
| SO_Onsite_0_10 | SS-218B-2 | 2001 | 0 | 1 | N | SS-218B-2_2001_0_1 |
| SO_Onsite_0_10 | SS-218C-1 | 2001 | 0 | 1 | N | SS-218C-1_2001_0_1 |
| SO_Onsite_0_10 | SS-218C-2 | 2001 | 0 | 1 | N | SS-218C-2_2001_0_1 |
| SO_Onsite_0_10 | SS-218C-3 | 2001 | 0 | 1 | N | SS-218C-3_2001_0_1 |
| SO_Onsite_0_10 | SS-219A-1 | 2001 | 0 | 1 | N | SS-219A-1_2001_0_1 |
| SO_Onsite_0_10 | SS-219A-2 | 2001 | 0 | 1 | N | SS-219A-2_2001_0_1 |

**APPENDIX Q**
**TABLE 2.1**
Soil Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | Station ID | Sample Date | Upper Depth | Lower Depth | Sample Type | Sample ID |
|---|---|---|---|---|---|---|
| SO_Onsite_0_10 | SS-219A-3 | 2001 | 0 | 1 | N | SS-219A-3_2001_0_1 |
| SO_Onsite_0_10 | SS-219D-1 | 2001 | 0 | 1 | N | SS-219D-1_2001_0_1 |
| SO_Onsite_0_10 | SS-219D-2 | 2001 | 0 | 1 | N | SS-219D-2_2001_0_1 |
| SO_Onsite_0_10 | SS-219D-3 | 2001 | 0 | 1 | N | SS-219D-3_2001_0_1 |
| SO_Onsite_0_10 | SS-219E | 2001 | 0 | 1 | N | SS-219E_2001_0_1 |
| SO_Onsite_0_10 | SS-219G-1 | 2001 | 0 | 1 | N | SS-219G-1_2001_0_1 |
| SO_Onsite_0_10 | SS-219G-2 | 2001 | 0 | 1 | N | SS-219G-2_2001_0_1 |
| SO_Onsite_0_10 | SS-219G-3 | 2001 | 0 | 1 | N | SS-219G-3_2001_0_1 |
| SO_Onsite_0_10 | SS-219H | 2001 | 0 | 1 | N | SS-219H_2001_0_1 |
| SO_Onsite_0_10 | SS-219J-1 | 2001 | 0 | 1 | N | SS-219J-1_2001_0_1 |
| SO_Onsite_0_10 | SS-220-1 | 2001 | 0 | 1 | N | SS-220-1_2001_0_1 |
| SO_Onsite_0_10 | SS-220-2 | 2001 | 0 | 1 | N | SS-220-2_2001_0_1 |
| SO_Onsite_0_10 | SS-220-3 | 2001 | 0 | 1 | N | SS-220-3_2001_0_1 |
| SO_Onsite_0_10 | SS-220-4 | 2001 | 0 | 1 | N | SS-220-4_2001_0_1 |
| SO_Onsite_0_10 | SS-227A-1 | 2001 | 0 | 1 | N | SS-227A-1_2001_0_1 |
| SO_Onsite_0_10 | SS-227B-1 | 2001 | 0 | 1 | N | SS-227B-1_2001_0_1 |
| SO_Onsite_0_10 | SS-227J-1 | 2001 | 0 | 1 | N | SS-227J-1_2001_0_1 |
| SO_Onsite_0_10 | SS-227M-1 | 2001 | 0 | 1 | N | SS-227M-1_2001_0_1 |
| SO_Onsite_0_10 | SS-227O-1 | 2001 | 0 | 1 | N | SS-227O-1_2001_0_1 |
| SO_Onsite_0_10 | SS-228A-1 | 2001 | 0 | 1 | N | SS-228A-1_2001_0_1 |
| SO_Onsite_0_10 | SS-228B-1 | 2001 | 0 | 1 | N | SS-228B-1_2001_0_1 |
| SO_Onsite_0_10 | SS-228C-1 | 2001 | 0 | 1 | N | SS-228C-1_2001_0_1 |
| SO_Onsite_0_10 | SS-228D-1 | 2001 | 0 | 1 | N | SS-228D-1_2001_0_1 |
| SO_Onsite_0_10 | SS-228E-1 | 2001 | 0 | 1 | N | SS-228E-1_2001_0_1 |
| SO_Onsite_0_10 | SS-228F-1 | 2001 | 0 | 1 | N | SS-228F-1_2001_0_1 |
| SO_Onsite_0_10 | SS-228G-1 | 2001 | 0 | 1 | N | SS-228G-1_2001_0_1 |
| SO_Onsite_0_10 | SS-228M-1 | 2001 | 0 | 1 | N | SS-228M-1_2001_0_1 |
| SO_Onsite_0_10 | SS-228WX-1 | 2001 | 0 | 1 | N | SS-228WX-1_2001_0_1 |
| SO_Onsite_0_10 | SS-228YZ-1 | 2001 | 0 | 1 | N | SS-228YZ-1_2001_0_1 |
| SO_Onsite_0_10 | SS-236-1 | 2001 | 0 | 1 | N | SS-236-1_2001_0_1 |
| SO_Onsite_0_10 | SS41A | 1991 | 0 | 1 | N | SS41A_1991_0_1 |
| SO_Onsite_0_10 | SS42A | 1991 | 0 | 1 | N | SS42A_1991_0_1 |
| SO_Onsite_0_10 | SS43A | 1991 | 0 | 1 | N | SS43A_1991_0_1 |
| SO_Onsite_0_10 | SS43B | 1991 | 1 | 2 | N | SS43B_1991_1_2 |
| SO_Onsite_0_10 | SS44A | 1991 | 0 | 1 | N | SS44A_1991_0_1 |
| SO_Onsite_0_10 | SS44B | 1991 | 1 | 2 | N | SS44B_1991_1_2 |
| SO_Onsite_0_10 | SS45A | 1991 | 0 | 1 | N | SS45A_1991_0_1 |
| SO_Onsite_0_10 | SS45B | 1991 | 1 | 2 | N | SS45B_1991_1_2 |
| SO_Onsite_0_10 | SS46A | 1991 | 0 | 1 | N | SS46A_1991_0_1 |
| SO_Onsite_0_10 | SS46B | 1991 | 1 | 2 | N | SS46B_1991_1_2 |
| SO_Onsite_0_10 | SS47A | 1991 | 0 | 1 | N | SS47A_1991_0_1 |
| SO_Onsite_0_10 | SS47B | 1991 | 1 | 2 | N | SS47B_1991_1_2 |
| SO_Onsite_0_10 | SS48A | 1991 | 0 | 1 | N | SS48A_1991_0_1 |
| SO_Onsite_0_10 | SS48B | 1991 | 1 | 2 | N | SS48B_1991_1_2 |
| SO_Onsite_0_10 | SS49A | 1991 | 0 | 1 | N | SS49A_1991_0_1 |
| SO_Onsite_0_10 | SS49B | 1991 | 1 | 2 | N | SS49B_1991_1_2 |
| SO_Onsite_0_10 | SS50A | 1991 | 0 | 1 | N | SS50A_1991_0_1 |
| SO_Onsite_0_10 | SS50B | 1991 | 1 | 2 | N | SS50B_1991_1_2 |
| SO_Onsite_0_10 | SS51A | 1991 | 0 | 1 | N | SS51A_1991_0_1 |
| SO_Onsite_0_10 | SS51B | 1991 | 1 | 2 | N | SS51B_1991_1_2 |
| SO_Onsite_0_10 | SS52A | 1991 | 0 | 1 | N | SS52A_1991_0_1 |
| SO_Onsite_0_10 | SS52B | 1991 | 1 | 2 | N | SS52B_1991_1_2 |
| SO_Onsite_0_10 | SS-DPILE-1 | 2001 | NA1 | NA1 | N | SS-DPILE-1_2001_NA_NA |

**APPENDIX Q**
**TABLE 2.1**
Soil Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | Station ID | Sample Date | Upper Depth | Lower Depth | Sample Type | Sample ID |
|---|---|---|---|---|---|---|
| SO_Onsite_0_10_A | CSS-001 | 2005 | 0 | 1 | N | CSS-001_2005_0_1 |
| SO_Onsite_0_10_A | CSS-002 | 2005 | 0 | 1 | N | CSS-002_2005_0_1 |
| SO_Onsite_0_10_A | HA-20 | 5/14/2008 | 0 | 2 | N | HA-20-S-00_5/14/2008_0_2 |
| SO_Onsite_0_10_A | SB-001 | 2005 | NA1 | NA1 | N | SB-001_2005_NA_NA |
| SO_Onsite_0_10_A | SB-003 | 2005 | 0 | 1 | N | SB-003_2005_0_1 |
| SO_Onsite_0_10_A | SB-003 | 2005 | NA1 | NA1 | N | SB-003_2005_NA_NA |
| SO_Onsite_0_10_A | SS-228G-1 | 2001 | 0 | 1 | N | SS-228G-1_2001_0_1 |
| SO_Onsite_0_10_A | SS-228M-1 | 2001 | 0 | 1 | N | SS-228M-1_2001_0_1 |
| SO_Onsite_0_10_A | SS-228WX-1 | 2001 | 0 | 1 | N | SS-228WX-1_2001_0_1 |
| SO_Onsite_0_10_A | SS-228YZ-1 | 2001 | 0 | 1 | N | SS-228YZ-1_2001_0_1 |
| SO_Onsite_0_10_A | SS41A | 1991 | 0 | 1 | N | SS41A_1991_0_1 |
| SO_Onsite_0_10_B | HA-21 | 5/14/2008 | 0 | 2 | N | HA-21-S-00_5/14/2008_0_2 |
| SO_Onsite_0_10_B | SB-002 | 2005 | 3 | 4 | N | SB-002_2005_3_4 |
| SO_Onsite_0_10_B | SB-002 | 2005 | NA1 | NA1 | N | SB-002_2005_NA_NA |
| SO_Onsite_0_10_B | SS-228A-1 | 2001 | 0 | 1 | N | SS-228A-1_2001_0_1 |
| SO_Onsite_0_10_B | SS-228B-1 | 2001 | 0 | 1 | N | SS-228B-1_2001_0_1 |
| SO_Onsite_0_10_B | SS-228C-1 | 2001 | 0 | 1 | N | SS-228C-1_2001_0_1 |
| SO_Onsite_0_10_B | SS-228D-1 | 2001 | 0 | 1 | N | SS-228D-1_2001_0_1 |
| SO_Onsite_0_10_B | SS-228E-1 | 2001 | 0 | 1 | N | SS-228E-1_2001_0_1 |
| SO_Onsite_0_10_B | SS-228F-1 | 2001 | 0 | 1 | N | SS-228F-1_2001_0_1 |
| SO_Onsite_0_10_B | SS42A | 1991 | 0 | 1 | N | SS42A_1991_0_1 |
| SO_Onsite_0_10_C | CSS-003 | 2005 | 0 | 1 | N | CSS-003_2005_0_1 |
| SO_Onsite_0_10_C | SB-005 | 2005 | NA1 | NA1 | N | SB-005_2005_NA_NA |
| SO_Onsite_0_10_C | SS-227A-1 | 2001 | 0 | 1 | N | SS-227A-1_2001_0_1 |
| SO_Onsite_0_10_C | SS-227B-1 | 2001 | 0 | 1 | N | SS-227B-1_2001_0_1 |
| SO_Onsite_0_10_D | CSS-004 | 2005 | 0 | 1 | N | CSS-004_2005_0_1 |
| SO_Onsite_0_10_D | PW12 | 2001 | 7 | 8 | N | PW12_2001_7_8 |
| SO_Onsite_0_10_D | SS-218C-1 | 2001 | 0 | 1 | N | SS-218C-1_2001_0_1 |
| SO_Onsite_0_10_D | SS-227J-1 | 2001 | 0 | 1 | N | SS-227J-1_2001_0_1 |
| SO_Onsite_0_10_D | SS43A | 1991 | 0 | 1 | N | SS43A_1991_0_1 |
| SO_Onsite_0_10_D | SS43B | 1991 | 1 | 2 | N | SS43B_1991_1_2 |
| SO_Onsite_0_10_E | NS09A | 1998 | 0 | 1 | N | NS09A_1998_0_1 |
| SO_Onsite_0_10_E | NS09B | 1998 | 1 | 2 | N | NS09B_1998_1_2 |
| SO_Onsite_0_10_E | SB-006 | 2005 | 0 | 1 | N | SB-006_2005_0_1 |
| SO_Onsite_0_10_E | SB-006 | 2005 | NA1 | NA1 | N | SB-006_2005_NA_NA |
| SO_Onsite_0_10_E | SS-227M-1 | 2001 | 0 | 1 | N | SS-227M-1_2001_0_1 |
| SO_Onsite_0_10_E | SS-227O-1 | 2001 | 0 | 1 | N | SS-227O-1_2001_0_1 |
| SO_Onsite_0_10_E | SS-236-1 | 2001 | 0 | 1 | N | SS-236-1_2001_0_1 |
| SO_Onsite_0_10_E | SS44A | 1991 | 0 | 1 | N | SS44A_1991_0_1 |
| SO_Onsite_0_10_E | SS44B | 1991 | 1 | 2 | N | SS44B_1991_1_2 |
| SO_Onsite_0_10_E | SS-DPILE-1 | 2001 | NA1 | NA1 | N | SS-DPILE-1_2001_NA_NA |
| SO_Onsite_0_10_F | CSS-005 | 2005 | 0 | 1 | N | CSS-005_2005_0_1 |
| SO_Onsite_0_10_F | CSS-006 | 2005 | 0 | 1 | N | CSS-006_2005_0_1 |
| SO_Onsite_0_10_F | NS02A | 1998 | 0 | 1 | N | NS02A_1998_0_1 |
| SO_Onsite_0_10_F | NS02B | 1998 | 1 | 2 | N | NS02B_1998_1_2 |
| SO_Onsite_0_10_F | NS12A | 1998 | 0 | 1 | N | NS12A_1998_0_1 |
| SO_Onsite_0_10_F | NS12B | 1998 | 1 | 2 | N | NS12B_1998_1_2 |
| SO_Onsite_0_10_F | NS14A | 1998 | 6 | 8 | N | NS14A_1998_6_8 |
| SO_Onsite_0_10_F | SB-008 | 2005 | NA1 | NA1 | N | SB-008_2005_NA_NA |
| SO_Onsite_0_10_F | SB-021 | 2005 | NA1 | NA1 | N | SB-021_2005_NA_NA |
| SO_Onsite_0_10_F | SS-218C-2 | 2001 | 0 | 1 | N | SS-218C-2_2001_0_1 |
| SO_Onsite_0_10_F | SS-219H | 2001 | 0 | 1 | N | SS-219H_2001_0_1 |
| SO_Onsite_0_10_F | SS-219J-1 | 2001 | 0 | 1 | N | SS-219J-1_2001_0_1 |

**APPENDIX Q**
**TABLE 2.1**
Soil Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | Station ID | Sample Date | Upper Depth | Lower Depth | Sample Type | Sample ID |
|---|---|---|---|---|---|---|
| SO_Onsite_0_10_F | SS45A | 1991 | 0 | 1 | N | SS45A_1991_0_1 |
| SO_Onsite_0_10_F | SS45B | 1991 | 1 | 2 | N | SS45B_1991_1_2 |
| SO_Onsite_0_10_F | SS48A | 1991 | 0 | 1 | N | SS48A_1991_0_1 |
| SO_Onsite_0_10_F | SS48B | 1991 | 1 | 2 | N | SS48B_1991_1_2 |
| SO_Onsite_0_10_G | PW13 | 2001 | 7 | 8 | N | PW13_2001_7_8 |
| SO_Onsite_0_10_G | SB-009 | 2005 | NA1 | NA1 | N | SB-009_2005_NA_NA |
| SO_Onsite_0_10_G | SB-010 | 2005 | 0 | 1 | N | SB-010_2005_0_1 |
| SO_Onsite_0_10_G | SB-010 | 2005 | NA1 | NA1 | N | SB-010_2005_NA_NA |
| SO_Onsite_0_10_G | SS-218C-3 | 2001 | 0 | 1 | N | SS-218C-3_2001_0_1 |
| SO_Onsite_0_10_G | SS-219G-1 | 2001 | 0 | 1 | N | SS-219G-1_2001_0_1 |
| SO_Onsite_0_10_G | SS-219G-2 | 2001 | 0 | 1 | N | SS-219G-2_2001_0_1 |
| SO_Onsite_0_10_G | SS-219G-3 | 2001 | 0 | 1 | N | SS-219G-3_2001_0_1 |
| SO_Onsite_0_10_G | SS46A | 1991 | 0 | 1 | N | SS46A_1991_0_1 |
| SO_Onsite_0_10_G | SS46B | 1991 | 1 | 2 | N | SS46B_1991_1_2 |
| SO_Onsite_0_10_G | SS47A | 1991 | 0 | 1 | N | SS47A_1991_0_1 |
| SO_Onsite_0_10_G | SS47B | 1991 | 1 | 2 | N | SS47B_1991_1_2 |
| SO_Onsite_0_10_H | CSS-007 | 2005 | 0 | 1 | N | CSS-007_2005_0_1 |
| SO_Onsite_0_10_H | CSS-008 | 2005 | 0 | 1 | N | CSS-008_2005_0_1 |
| SO_Onsite_0_10_H | CSS-015 | 2005 | 0 | 1 | N | CSS-015_2005_0_1 |
| SO_Onsite_0_10_H | HA-10 | 5/13/2008 | 0 | 0.25 | N | HA-10-S-00_5/13/2008_0_0.25 |
| SO_Onsite_0_10_H | HA-11 | 5/13/2008 | 0 | 2 | N | HA-11-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_H | HA-12 | 5/13/2008 | 0 | 2 | N | HA-12-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_H | HA-13 | 5/13/2008 | 0 | 2 | N | HA-13-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_H | HA-14 | 5/13/2008 | 0 | 2 | N | HA-14-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_H | HA-15 | 5/13/2008 | 0 | 2 | N | HA-15-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_H | HA-16 | 5/13/2008 | 0 | 2 | N | HA-16-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_H | NS03B | 1998 | 1 | 2 | N | NS03B_1998_1_2 |
| SO_Onsite_0_10_H | NS05A | 1998 | 0 | 1 | N | NS05A_1998_0_1 |
| SO_Onsite_0_10_H | NS05B | 1998 | 1 | 2 | N | NS05B_1998_1_2 |
| SO_Onsite_0_10_H | NS11A | 1998 | 0 | 1 | N | NS11A_1998_0_1 |
| SO_Onsite_0_10_H | NS11B | 1998 | 1 | 2 | N | NS11B_1998_1_2 |
| SO_Onsite_0_10_H | SB-011 | 2005 | NA1 | NA1 | N | SB-011_2005_NA_NA |
| SO_Onsite_0_10_H | SB-022 | 2005 | NA1 | NA1 | N | SB-022_2005_NA_NA |
| SO_Onsite_0_10_H | SS-218B-1 | 2001 | 0 | 1 | N | SS-218B-1_2001_0_1 |
| SO_Onsite_0_10_H | SS-219E | 2001 | 0 | 1 | N | SS-219E_2001_0_1 |
| SO_Onsite_0_10_I | SB-012 | 2005 | NA1 | NA1 | N | SB-012_2005_NA_NA |
| SO_Onsite_0_10_I | SB-013 | 2005 | NA1 | NA1 | N | SB-013_2005_NA_NA |
| SO_Onsite_0_10_I | SS-218B-2 | 2001 | 0 | 1 | N | SS-218B-2_2001_0_1 |
| SO_Onsite_0_10_I | SS-219D-1 | 2001 | 0 | 1 | N | SS-219D-1_2001_0_1 |
| SO_Onsite_0_10_I | SS-219D-2 | 2001 | 0 | 1 | N | SS-219D-2_2001_0_1 |
| SO_Onsite_0_10_I | SS-219D-3 | 2001 | 0 | 1 | N | SS-219D-3_2001_0_1 |
| SO_Onsite_0_10_I | SS49A | 1991 | 0 | 1 | N | SS49A_1991_0_1 |
| SO_Onsite_0_10_I | SS49B | 1991 | 1 | 2 | N | SS49B_1991_1_2 |
| SO_Onsite_0_10_J | CSS-009 | 2005 | 0 | 1 | N | CSS-009_2005_0_1 |
| SO_Onsite_0_10_J | CSS-010 | 2005 | 0 | 1 | N | CSS-010_2005_0_1 |
| SO_Onsite_0_10_J | CSS-011 | 2005 | 0 | 1 | N | CSS-011_2005_0_1 |
| SO_Onsite_0_10_J | CSS-012 | 2005 | 0 | 1 | N | CSS-012_2005_0_1 |
| SO_Onsite_0_10_J | CSS-013 | 2005 | 0 | 1 | N | CSS-013_2005_0_1 |
| SO_Onsite_0_10_J | HA-01 | 5/13/2008 | 0 | 2 | N | HA-01-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_J | HA-02 | 5/13/2008 | 0 | 2 | N | HA-02-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_J | HA-03 | 5/13/2008 | 0 | 2 | N | HA-03-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_J | HA-04 | 5/13/2008 | 0 | 2 | N | HA-04-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_J | HA-05 | 5/13/2008 | 0 | 2 | N | HA-05-S-00_5/13/2008_0_2 |

**APPENDIX Q**
**TABLE 2.1**
Soil Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | Station ID | Sample Date | Upper Depth | Lower Depth | Sample Type | Sample ID |
|---|---|---|---|---|---|---|
| SO_Onsite_0_10_J | HA-06 | 5/13/2008 | 0 | 2 | N | HA-06-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_J | HA-07 | 5/13/2008 | 0 | 2 | N | HA-07-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_J | HA-08 | 5/13/2008 | 0 | 2 | N | HA-08-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_J | HA-09 | 5/13/2008 | 0 | 2 | N | HA-09-S-00_5/13/2008_0_2 |
| SO_Onsite_0_10_J | NS07A | 1998 | 0 | 1 | N | NS07A_1998_0_1 |
| SO_Onsite_0_10_J | NS07B | 1998 | 1 | 2 | N | NS07B_1998_1_2 |
| SO_Onsite_0_10_J | NS08B | 1998 | 1 | 2 | N | NS08B_1998_1_2 |
| SO_Onsite_0_10_J | NS13A | 1998 | 0 | 1 | N | NS13A_1998_0_1 |
| SO_Onsite_0_10_J | NS13B | 1998 | 1 | 2 | N | NS13B_1998_1_2 |
| SO_Onsite_0_10_J | SB-014 | 2005 | NA1 | NA1 | N | SB-014_2005_NA_NA |
| SO_Onsite_0_10_J | SB-017 | 2005 | 3 | 4 | N | SB-017_2005_3_4 |
| SO_Onsite_0_10_J | SB-017 | 2005 | NA1 | NA1 | N | SB-017_2005_NA_NA |
| SO_Onsite_0_10_J | SS-218A-1 | 2001 | 0 | 1 | N | SS-218A-1_2001_0_1 |
| SO_Onsite_0_10_K | SB-015 | 2005 | NA1 | NA1 | N | SB-015_2005_NA_NA |
| SO_Onsite_0_10_K | SB-016 | 2005 | NA1 | NA1 | N | SB-016_2005_NA_NA |
| SO_Onsite_0_10_K | SB-018 | 2005 | NA1 | NA1 | N | SB-018_2005_NA_NA |
| SO_Onsite_0_10_K | SB-019 | 2005 | 3 | 4 | N | SB-019_2005_3_4 |
| SO_Onsite_0_10_K | SB-019 | 2005 | NA1 | NA1 | N | SB-019_2005_NA_NA |
| SO_Onsite_0_10_K | SS-218A-3 | 2001 | 0 | 1 | N | SS-218A-3_2001_0_1 |
| SO_Onsite_0_10_K | SS-219A-1 | 2001 | 0 | 1 | N | SS-219A-1_2001_0_1 |
| SO_Onsite_0_10_K | SS-219A-2 | 2001 | 0 | 1 | N | SS-219A-2_2001_0_1 |
| SO_Onsite_0_10_K | SS-219A-3 | 2001 | 0 | 1 | N | SS-219A-3_2001_0_1 |
| SO_Onsite_0_10_K | SS50A | 1991 | 0 | 1 | N | SS50A_1991_0_1 |
| SO_Onsite_0_10_K | SS50B | 1991 | 1 | 2 | N | SS50B_1991_1_2 |
| SO_Onsite_0_10_K | SS51A | 1991 | 0 | 1 | N | SS51A_1991_0_1 |
| SO_Onsite_0_10_K | SS51B | 1991 | 1 | 2 | N | SS51B_1991_1_2 |
| SO_Onsite_0_10_L | CSS-014 | 2005 | 0 | 1 | N | CSS-014_2005_0_1 |
| SO_Onsite_0_10_L | HA-22 | 5/14/2008 | 0 | 2 | N | HA-22-S-00_5/14/2008_0_2 |
| SO_Onsite_0_10_L | SB-020 | 2005 | 8 | 9 | N | SB-020_2005_8_9 |
| SO_Onsite_0_10_L | SB-023 | 2007 | 1.7 | 2.2 | N | SB-023_2007_1.7_2.2 |
| SO_Onsite_0_10_L | SB-023 | 2007 | 5 | 6 | N | SB-023_2007_5_6 |
| SO_Onsite_0_10_L | SB-024 | 2007 | 0.5 | 1 | N | SB-024_2007_0.5_1 |
| SO_Onsite_0_10_L | SB-024 | 2007 | 5 | 6 | N | SB-024_2007_5_6 |
| SO_Onsite_0_10_L | SB-025 | 2007 | 0.5 | 1 | N | SB-025_2007_0.5_1 |
| SO_Onsite_0_10_L | SB-025 | 2007 | 5 | 6 | N | SB-025_2007_5_6 |
| SO_Onsite_0_10_L | SB-026 | 2007 | 0.5 | 1 | N | SB-026_2007_0.5_1 |
| SO_Onsite_0_10_L | SB-026 | 2007 | 5 | 6 | N | SB-026_2007_5_6 |
| SO_Onsite_0_10_L | SB-027 | 2007 | 0.5 | 1 | N | SB-027_2007_0.5_1 |
| SO_Onsite_0_10_L | SB-027 | 2007 | 5 | 6 | N | SB-027_2007_5_6 |
| SO_Onsite_0_10_L | SB-028 | 2007 | 0.5 | 1 | N | SB-028_2007_0.5_1 |
| SO_Onsite_0_10_L | SB-028 | 2007 | 5 | 6 | N | SB-028_2007_5_6 |
| SO_Onsite_0_10_L | SB-029 | 2007 | 0.5 | 1 | N | SB-029_2007_0.5_1 |
| SO_Onsite_0_10_L | SB-029 | 2007 | 5 | 6 | N | SB-029_2007_5_6 |
| SO_Onsite_0_10_L | SB-033 | 2007 | 0.5 | 1 | N | SB-033_2007_0.5_1 |
| SO_Onsite_0_10_L | SB-033 | 2007 | 5 | 6 | N | SB-033_2007_5_6 |
| SO_Onsite_0_10_L | SB-034 | 2007 | 0.5 | 1 | N | SB-034_2007_0.5_1 |
| SO_Onsite_0_10_L | SB-034 | 2007 | 5 | 6 | N | SB-034_2007_5_6 |
| SO_Onsite_0_10_L | SS-220-1 | 2001 | 0 | 1 | N | SS-220-1_2001_0_1 |
| SO_Onsite_0_10_L | SS-220-2 | 2001 | 0 | 1 | N | SS-220-2_2001_0_1 |
| SO_Onsite_0_10_L | SS-220-3 | 2001 | 0 | 1 | N | SS-220-3_2001_0_1 |
| SO_Onsite_0_10_L | SS-220-4 | 2001 | 0 | 1 | N | SS-220-4_2001_0_1 |
| SO_Onsite_0_10_L | SS52A | 1991 | 0 | 1 | N | SS52A_1991_0_1 |
| SO_Onsite_0_10_L | SS52B | 1991 | 1 | 2 | N | SS52B_1991_1_2 |

**APPENDIX Q**
**TABLE 2.1**
Soil Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | Station ID | Sample Date | Upper Depth | Lower Depth | Sample Type | Sample ID |
|---|---|---|---|---|---|---|
| SO_Onsite_0_2 | CSS-001 | 2005 | 0 | 1 | N | CSS-001_2005_0_1 |
| SO_Onsite_0_2 | CSS-002 | 2005 | 0 | 1 | N | CSS-002_2005_0_1 |
| SO_Onsite_0_2 | CSS-003 | 2005 | 0 | 1 | N | CSS-003_2005_0_1 |
| SO_Onsite_0_2 | CSS-004 | 2005 | 0 | 1 | N | CSS-004_2005_0_1 |
| SO_Onsite_0_2 | CSS-005 | 2005 | 0 | 1 | N | CSS-005_2005_0_1 |
| SO_Onsite_0_2 | CSS-006 | 2005 | 0 | 1 | N | CSS-006_2005_0_1 |
| SO_Onsite_0_2 | CSS-007 | 2005 | 0 | 1 | N | CSS-007_2005_0_1 |
| SO_Onsite_0_2 | CSS-008 | 2005 | 0 | 1 | N | CSS-008_2005_0_1 |
| SO_Onsite_0_2 | CSS-009 | 2005 | 0 | 1 | N | CSS-009_2005_0_1 |
| SO_Onsite_0_2 | CSS-010 | 2005 | 0 | 1 | N | CSS-010_2005_0_1 |
| SO_Onsite_0_2 | CSS-011 | 2005 | 0 | 1 | N | CSS-011_2005_0_1 |
| SO_Onsite_0_2 | CSS-012 | 2005 | 0 | 1 | N | CSS-012_2005_0_1 |
| SO_Onsite_0_2 | CSS-013 | 2005 | 0 | 1 | N | CSS-013_2005_0_1 |
| SO_Onsite_0_2 | CSS-014 | 2005 | 0 | 1 | N | CSS-014_2005_0_1 |
| SO_Onsite_0_2 | CSS-015 | 2005 | 0 | 1 | N | CSS-015_2005_0_1 |
| SO_Onsite_0_2 | HA-01 | 5/13/2008 | 0 | 2 | N | HA-01-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-02 | 5/13/2008 | 0 | 2 | N | HA-02-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-03 | 5/13/2008 | 0 | 2 | N | HA-03-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-04 | 5/13/2008 | 0 | 2 | N | HA-04-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-05 | 5/13/2008 | 0 | 2 | N | HA-05-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-06 | 5/13/2008 | 0 | 2 | N | HA-06-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-07 | 5/13/2008 | 0 | 2 | N | HA-07-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-08 | 5/13/2008 | 0 | 2 | N | HA-08-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-09 | 5/13/2008 | 0 | 2 | N | HA-09-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-10 | 5/13/2008 | 0 | 0.25 | N | HA-10-S-00_5/13/2008_0_0.25 |
| SO_Onsite_0_2 | HA-11 | 5/13/2008 | 0 | 2 | N | HA-11-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-12 | 5/13/2008 | 0 | 2 | N | HA-12-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-13 | 5/13/2008 | 0 | 2 | N | HA-13-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-14 | 5/13/2008 | 0 | 2 | N | HA-14-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-15 | 5/13/2008 | 0 | 2 | N | HA-15-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-16 | 5/13/2008 | 0 | 2 | N | HA-16-S-00_5/13/2008_0_2 |
| SO_Onsite_0_2 | HA-20 | 5/14/2008 | 0 | 2 | N | HA-20-S-00_5/14/2008_0_2 |
| SO_Onsite_0_2 | HA-21 | 5/14/2008 | 0 | 2 | N | HA-21-S-00_5/14/2008_0_2 |
| SO_Onsite_0_2 | HA-22 | 5/14/2008 | 0 | 2 | N | HA-22-S-00_5/14/2008_0_2 |
| SO_Onsite_0_2 | NS02A | 1998 | 0 | 1 | N | NS02A_1998_0_1 |
| SO_Onsite_0_2 | NS02B | 1998 | 1 | 2 | N | NS02B_1998_1_2 |
| SO_Onsite_0_2 | NS03B | 1998 | 1 | 2 | N | NS03B_1998_1_2 |
| SO_Onsite_0_2 | NS05A | 1998 | 0 | 1 | N | NS05A_1998_0_1 |
| SO_Onsite_0_2 | NS05B | 1998 | 1 | 2 | N | NS05B_1998_1_2 |
| SO_Onsite_0_2 | NS07A | 1998 | 0 | 1 | N | NS07A_1998_0_1 |
| SO_Onsite_0_2 | NS07B | 1998 | 1 | 2 | N | NS07B_1998_1_2 |
| SO_Onsite_0_2 | NS08B | 1998 | 1 | 2 | N | NS08B_1998_1_2 |
| SO_Onsite_0_2 | NS09A | 1998 | 0 | 1 | N | NS09A_1998_0_1 |
| SO_Onsite_0_2 | NS09B | 1998 | 1 | 2 | N | NS09B_1998_1_2 |
| SO_Onsite_0_2 | NS11A | 1998 | 0 | 1 | N | NS11A_1998_0_1 |
| SO_Onsite_0_2 | NS11B | 1998 | 1 | 2 | N | NS11B_1998_1_2 |
| SO_Onsite_0_2 | NS12A | 1998 | 0 | 1 | N | NS12A_1998_0_1 |
| SO_Onsite_0_2 | NS12B | 1998 | 1 | 2 | N | NS12B_1998_1_2 |
| SO_Onsite_0_2 | NS13A | 1998 | 0 | 1 | N | NS13A_1998_0_1 |
| SO_Onsite_0_2 | NS13B | 1998 | 1 | 2 | N | NS13B_1998_1_2 |
| SO_Onsite_0_2 | SB-003 | 2005 | 0 | 1 | N | SB-003_2005_0_1 |
| SO_Onsite_0_2 | SB-006 | 2005 | 0 | 1 | N | SB-006_2005_0_1 |
| SO_Onsite_0_2 | SB-010 | 2005 | 0 | 1 | N | SB-010_2005_0_1 |

**APPENDIX Q**
**TABLE 2.1**
Soil Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | Station ID | Sample Date | Upper Depth | Lower Depth | Sample Type | Sample ID |
|---|---|---|---|---|---|---|
| SO_Onsite_0_2 | SB-023 | 2007 | 1.7 | 2.2 | N | SB-023_2007_1.7_2.2 |
| SO_Onsite_0_2 | SB-024 | 2007 | 0.5 | 1 | N | SB-024_2007_0.5_1 |
| SO_Onsite_0_2 | SB-025 | 2007 | 0.5 | 1 | N | SB-025_2007_0.5_1 |
| SO_Onsite_0_2 | SB-026 | 2007 | 0.5 | 1 | N | SB-026_2007_0.5_1 |
| SO_Onsite_0_2 | SB-027 | 2007 | 0.5 | 1 | N | SB-027_2007_0.5_1 |
| SO_Onsite_0_2 | SB-028 | 2007 | 0.5 | 1 | N | SB-028_2007_0.5_1 |
| SO_Onsite_0_2 | SB-029 | 2007 | 0.5 | 1 | N | SB-029_2007_0.5_1 |
| SO_Onsite_0_2 | SB-033 | 2007 | 0.5 | 1 | N | SB-033_2007_0.5_1 |
| SO_Onsite_0_2 | SB-034 | 2007 | 0.5 | 1 | N | SB-034_2007_0.5_1 |
| SO_Onsite_0_2 | SS-218A-1 | 2001 | 0 | 1 | N | SS-218A-1_2001_0_1 |
| SO_Onsite_0_2 | SS-218A-3 | 2001 | 0 | 1 | N | SS-218A-3_2001_0_1 |
| SO_Onsite_0_2 | SS-218B-1 | 2001 | 0 | 1 | N | SS-218B-1_2001_0_1 |
| SO_Onsite_0_2 | SS-218B-2 | 2001 | 0 | 1 | N | SS-218B-2_2001_0_1 |
| SO_Onsite_0_2 | SS-218C-1 | 2001 | 0 | 1 | N | SS-218C-1_2001_0_1 |
| SO_Onsite_0_2 | SS-218C-2 | 2001 | 0 | 1 | N | SS-218C-2_2001_0_1 |
| SO_Onsite_0_2 | SS-218C-3 | 2001 | 0 | 1 | N | SS-218C-3_2001_0_1 |
| SO_Onsite_0_2 | SS-219A-1 | 2001 | 0 | 1 | N | SS-219A-1_2001_0_1 |
| SO_Onsite_0_2 | SS-219A-2 | 2001 | 0 | 1 | N | SS-219A-2_2001_0_1 |
| SO_Onsite_0_2 | SS-219A-3 | 2001 | 0 | 1 | N | SS-219A-3_2001_0_1 |
| SO_Onsite_0_2 | SS-219D-1 | 2001 | 0 | 1 | N | SS-219D-1_2001_0_1 |
| SO_Onsite_0_2 | SS-219D-2 | 2001 | 0 | 1 | N | SS-219D-2_2001_0_1 |
| SO_Onsite_0_2 | SS-219D-3 | 2001 | 0 | 1 | N | SS-219D-3_2001_0_1 |
| SO_Onsite_0_2 | SS-219E | 2001 | 0 | 1 | N | SS-219E_2001_0_1 |
| SO_Onsite_0_2 | SS-219G-1 | 2001 | 0 | 1 | N | SS-219G-1_2001_0_1 |
| SO_Onsite_0_2 | SS-219G-2 | 2001 | 0 | 1 | N | SS-219G-2_2001_0_1 |
| SO_Onsite_0_2 | SS-219G-3 | 2001 | 0 | 1 | N | SS-219G-3_2001_0_1 |
| SO_Onsite_0_2 | SS-219H | 2001 | 0 | 1 | N | SS-219H_2001_0_1 |
| SO_Onsite_0_2 | SS-219J-1 | 2001 | 0 | 1 | N | SS-219J-1_2001_0_1 |
| SO_Onsite_0_2 | SS-220-1 | 2001 | 0 | 1 | N | SS-220-1_2001_0_1 |
| SO_Onsite_0_2 | SS-220-2 | 2001 | 0 | 1 | N | SS-220-2_2001_0_1 |
| SO_Onsite_0_2 | SS-220-3 | 2001 | 0 | 1 | N | SS-220-3_2001_0_1 |
| SO_Onsite_0_2 | SS-220-4 | 2001 | 0 | 1 | N | SS-220-4_2001_0_1 |
| SO_Onsite_0_2 | SS-227A-1 | 2001 | 0 | 1 | N | SS-227A-1_2001_0_1 |
| SO_Onsite_0_2 | SS-227B-1 | 2001 | 0 | 1 | N | SS-227B-1_2001_0_1 |
| SO_Onsite_0_2 | SS-227J-1 | 2001 | 0 | 1 | N | SS-227J-1_2001_0_1 |
| SO_Onsite_0_2 | SS-227M-1 | 2001 | 0 | 1 | N | SS-227M-1_2001_0_1 |
| SO_Onsite_0_2 | SS-227O-1 | 2001 | 0 | 1 | N | SS-227O-1_2001_0_1 |
| SO_Onsite_0_2 | SS-228A-1 | 2001 | 0 | 1 | N | SS-228A-1_2001_0_1 |
| SO_Onsite_0_2 | SS-228B-1 | 2001 | 0 | 1 | N | SS-228B-1_2001_0_1 |
| SO_Onsite_0_2 | SS-228C-1 | 2001 | 0 | 1 | N | SS-228C-1_2001_0_1 |
| SO_Onsite_0_2 | SS-228D-1 | 2001 | 0 | 1 | N | SS-228D-1_2001_0_1 |
| SO_Onsite_0_2 | SS-228E-1 | 2001 | 0 | 1 | N | SS-228E-1_2001_0_1 |
| SO_Onsite_0_2 | SS-228F-1 | 2001 | 0 | 1 | N | SS-228F-1_2001_0_1 |
| SO_Onsite_0_2 | SS-228G-1 | 2001 | 0 | 1 | N | SS-228G-1_2001_0_1 |
| SO_Onsite_0_2 | SS-228M-1 | 2001 | 0 | 1 | N | SS-228M-1_2001_0_1 |
| SO_Onsite_0_2 | SS-228WX-1 | 2001 | 0 | 1 | N | SS-228WX-1_2001_0_1 |
| SO_Onsite_0_2 | SS-228YZ-1 | 2001 | 0 | 1 | N | SS-228YZ-1_2001_0_1 |
| SO_Onsite_0_2 | SS-236-1 | 2001 | 0 | 1 | N | SS-236-1_2001_0_1 |
| SO_Onsite_0_2 | SS41A | 1991 | 0 | 1 | N | SS41A_1991_0_1 |
| SO_Onsite_0_2 | SS42A | 1991 | 0 | 1 | N | SS42A_1991_0_1 |
| SO_Onsite_0_2 | SS43A | 1991 | 0 | 1 | N | SS43A_1991_0_1 |
| SO_Onsite_0_2 | SS43B | 1991 | 1 | 2 | N | SS43B_1991_1_2 |
| SO_Onsite_0_2 | SS44A | 1991 | 0 | 1 | N | SS44A_1991_0_1 |

**APPENDIX Q**
**TABLE 2.1**
Soil Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | Station ID | Sample Date | Upper Depth | Lower Depth | Sample Type | Sample ID |
|---|---|---|---|---|---|---|
| SO_Onsite_0_2 | SS44B | 1991 | 1 | 2 | N | SS44B_1991_1_2 |
| SO_Onsite_0_2 | SS45A | 1991 | 0 | 1 | N | SS45A_1991_0_1 |
| SO_Onsite_0_2 | SS45B | 1991 | 1 | 2 | N | SS45B_1991_1_2 |
| SO_Onsite_0_2 | SS46A | 1991 | 0 | 1 | N | SS46A_1991_0_1 |
| SO_Onsite_0_2 | SS46B | 1991 | 1 | 2 | N | SS46B_1991_1_2 |
| SO_Onsite_0_2 | SS47A | 1991 | 0 | 1 | N | SS47A_1991_0_1 |
| SO_Onsite_0_2 | SS47B | 1991 | 1 | 2 | N | SS47B_1991_1_2 |
| SO_Onsite_0_2 | SS48A | 1991 | 0 | 1 | N | SS48A_1991_0_1 |
| SO_Onsite_0_2 | SS48B | 1991 | 1 | 2 | N | SS48B_1991_1_2 |
| SO_Onsite_0_2 | SS49A | 1991 | 0 | 1 | N | SS49A_1991_0_1 |
| SO_Onsite_0_2 | SS49B | 1991 | 1 | 2 | N | SS49B_1991_1_2 |
| SO_Onsite_0_2 | SS50A | 1991 | 0 | 1 | N | SS50A_1991_0_1 |
| SO_Onsite_0_2 | SS50B | 1991 | 1 | 2 | N | SS50B_1991_1_2 |
| SO_Onsite_0_2 | SS51A | 1991 | 0 | 1 | N | SS51A_1991_0_1 |
| SO_Onsite_0_2 | SS51B | 1991 | 1 | 2 | N | SS51B_1991_1_2 |
| SO_Onsite_0_2 | SS52A | 1991 | 0 | 1 | N | SS52A_1991_0_1 |
| SO_Onsite_0_2 | SS52B | 1991 | 1 | 2 | N | SS52B_1991_1_2 |
| SO_Onsite_0_2 | SS-DPILE-1 | 2001 | NA2 | NA2 | N | SS-DPILE-1_2001_NA_NA |

**Note:**
N = Normal
NA = Not Available
1) Assumed to be collected from 2-10 feet bgs.
2) Assumed to be collected from 0-2 feet bgs.
Sample group designations are as follows:
SO_Onsite_0_2 = Sitewide Analysis, Soil (0-2 feet)
SO_Onsite_0_10 = Sitewide Analysis, Soil (0-10 feet)
SO_Onsite_0_10_A = Exposure Unit A, Soil (0-10 feet)
SO_Onsite_0_10_B = Exposure Unit B, Soil (0-10 feet)
SO_Onsite_0_10_C = Exposure Unit C, Soil (0-10 feet)
SO_Onsite_0_10_D = Exposure Unit D, Soil (0-10 feet)
SO_Onsite_0_10_E = Exposure Unit E, Soil (0-10 feet)
SO_Onsite_0_10_F = Exposure Unit F, Soil (0-10 feet)
SO_Onsite_0_10_G = Exposure Unit G, Soil (0-10 feet)
SO_Onsite_0_10_H = Exposure Unit H, Soil (0-10 feet)
SO_Onsite_0_10_I = Exposure Unit I, Soil (0-10 feet)
SO_Onsite_0_10_J = Exposure Unit J, Soil (0-10 feet)
SO_Onsite_0_10_K = Exposure Unit K, Soil (0-10 feet)
SO_Onsite_0_10_L = Exposure Unit L, Soil (0-10 feet)

**APPENDIX Q**
**TABLE 2.2**
Groundwater Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample_Group | Station ID | Sample Date | Sample ID | Sample Type |
|---|---|---|---|---|
| GW_220_Down_Residential | CB-01 | 5/22/2008 | CB-01-W-30 | N |
| GW_220_Down_Residential | CB-04 | 5/23/2008 | CB-04-W-27.5 | N |
| GW_220_Down_Residential | CB-06 | 5/23/2008 | CB-06-W-20.5 | N |
| GW_220_Down_Residential | MW-108 | 2007 | MW-108 | N |
| GW_220_Down_Residential | MW-108 | 6/4/2008 | MW-108-W-00 | N |
| GW_220_Down_Residential | MW-109 | 2007 | MW-109 | N |
| GW_220_Down_Residential | MW-109 | 6/4/2008 | MW-109-W-00 | N |
| GW_220_Down_Residential | MW-110 | 2007 | MW-110 | N |
| GW_220_Down_Residential | MW-110 | 6/5/2008 | MW-110-W-00 | N |
| GW_220_Down_Residential | MW-111 | 2007 | MW-111 | N |
| GW_220_Down_Residential | MW-111 | 6/6/2008 | MW-111-W-00 | N |
| GW_220_Down_Residential | MW-112 | 2007 | MW-112 | N |
| GW_220_Down_Residential | MW-112 | 6/5/2008 | MW-112-W-00 | N |
| GW_220_Down_Residential | MW-113 | 2007 | MW-113 | N |
| GW_220_Down_Residential | MW-113 | 6/4/2008 | MW-113-W-00 | N |
| GW_220_Down_Residential | MW-114 | 2007 | MW-114 | N |
| GW_220_Down_Residential | MW-114 | 6/3/2008 | MW-114-W | N |
| GW_220_Down_Residential | MW-116 | 6/4/2008 | MW-116-W-00 | N |
| GW_220_Down_Residential | MW-117 | 6/12/2008 | MW-117-W-00 | N |
| GW_220_Down_Residential | SLOP-6317 | 3/31/2008 | SLOP-6317-5-25 | N |
| GW_220_Down_Residential | SLOP-6321 | 3/31/2008 | SLOP-6321-5-24 | N |
| GW_Offsite | MW-107 | 2007 | MW-107 | N |
| GW_Offsite | MW-107 | 6/5/2008 | MW-107-W-00 | N |
| GW_Offsite | MW-108 | 2007 | MW-108 | N |
| GW_Offsite | MW-108 | 6/4/2008 | MW-108-W-00 | N |
| GW_Offsite | MW-109 | 2007 | MW-109 | N |
| GW_Offsite | MW-109 | 6/4/2008 | MW-109-W-00 | N |
| GW_Offsite | MW-110 | 2007 | MW-110 | N |
| GW_Offsite | MW-110 | 6/5/2008 | MW-110-W-00 | N |
| GW_Offsite | MW-116 | 6/4/2008 | MW-116-W-00 | N |
| GW_Offsite | SLOP-4701 | 3/31/2008 | SLOP-4701-5-22 | N |
| GW_Offsite | SLOP-6317 | 3/31/2008 | SLOP-6317-5-25 | N |
| GW_Offsite | SLOP-6321 | 3/31/2008 | SLOP-6321-5-24 | N |
| GW_Onsite | CB-02 | 5/22/2008 | CB-02-W-30 | N |
| GW_Onsite | MW-106 | 2007 | MW-106 | N |
| GW_Onsite | MW-106 | 6/3/2008 | MW-106-W-00 | N |
| GW_Onsite | MW-115 | 6/5/2008 | MW-115-W-00 | N |
| GW_Res4701 | SLOP-4701 | 3/31/2008 | SLOP-4701-5-22 | N |
| GW_Res6317 | SLOP-6317 | 3/31/2008 | SLOP-6317-5-25 | N |
| GW_Res6321 | SLOP-6321 | 3/31/2008 | SLOP-6321-5-24 | N |
| GW_220_Down_On-site Excavations | CB-01 | 5/22/2008 | CB-01-W-30 | N |
| GW_220_Down_On-site Excavations | CB-04 | 5/23/2008 | CB-04-W-27.5 | N |
| GW_220_Down_On-site Excavations | CB-06 | 5/23/2008 | CB-06-W-20.5 | N |
| GW_220_Down_On-site Excavations | MW-111 | 2007 | MW-111 | N |
| GW_220_Down_On-site Excavations | MW-111 | 6/6/2008 | MW-111-W-00 | N |
| GW_220_Down_On-site Excavations | MW-112 | 2007 | MW-112 | N |

**APPENDIX Q**
**TABLE 2.2**
Groundwater Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample_Group | Station ID | Sample Date | Sample ID | Sample Type |
|---|---|---|---|---|
| GW_220_Down_On-site Excavations | MW-112 | 6/5/2008 | MW-112-W-00 | N |
| GW_220_Down_On-site Excavations | MW-113 | 2007 | MW-113 | N |
| GW_220_Down_On-site Excavations | MW-113 | 6/4/2008 | MW-113-W-00 | N |
| GW_220_Down_On-site Excavations | MW-114 | 2007 | MW-114 | N |
| GW_220_Down_On-site Excavations | MW-114 | 6/3/2008 | MW-114-W | N |
| GW_220_Down_On-site Excavations | MW-117 | 6/12/2008 | MW-117-W-00 | N |

**Note:**
N = Normal
Sample group designations are as follows:
GW_Offsite = Groundwater Off-site
GW_Onsite = Groundwater On-site
GW_220_Down_Residential = Groundwater downgradient of former Building 220 for future residential use
GW_220_Down_On-site Excavations = Groundwater downgradient of former Building 220 for future on-site excavations
GW_Res4701 = Groundwater at 4701 Stratford Ave. residence
GW_Res6317 = Groundwater at 6317 Stratford Ave. residence
GW_Res6321 = Groundwater at 6321 Stratford Ave. residence

**APPENDIX Q**
**TABLE 2.3**
Indoor Air Samples Used in the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Station ID | Sample Date | Sample ID | Sample Type |
|---|---|---|---|
| SLOP-6317-IA-NE | 3/18/2008 | SLOP-6317-IA-NE | N |
| SLOP-6317-IA-NE | 5/29/2008 | SLOP-6317-IA-NE_20080529 | N |
| SLOP-6317-IA-SW | 3/18/2008 | SLOP-6317-IA-SW | N |
| SLOP-6317-IA-SW | 5/29/2008 | SLOP-6317-IA-SW_20080529 | N |

**Note:**
N = Normal

**APPENDIX Q**
**TABLE 3.1**
Summary of On-Site Soil Data Collected from 0-2 feet Depth Interval - Sitewide Analysis
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | MaxDet Exceeds SL |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 4,192.70 | 12,900 | 8219.684615 | 78 | 78 | 100% | 100,000 | |
| Metals | 7440-36-0 | Antimony | 1.2 | 14.1 | 3.955264917 | 12 | 49 | 24% | 45 | |
| Metals | 7440-38-2 | Arsenic | 4 | 36.3 | 9.498305267 | 75 | 96 | 78% | 12.3 | Yes |
| Metals | 7440-39-3 | Barium | 0 | 723 | 167.8195957 | 94 | 94 | 100% | 100,000 | |
| Metals | 7440-41-7 | Beryllium | 0.3 | 0.632 | 0.483622642 | 53 | 75 | 71% | 220 | |
| Metals | 7440-43-9 | Cadmium | 0.3 | 3.17 | 0.949392857 | 56 | 94 | 60% | 56 | |
| Metals | 7440-70-2 | Calcium | 2,544 | 80,321 | 18512.66962 | 79 | 79 | 100% | - | |
| Metals | 7440-47-3 | Chromium | 3.8462 | 57.7 | 15.124 | 75 | 95 | 79% | 500 | |
| Metals | 7440-48-4 | Cobalt | 5.0503 | 12.4 | 8.523963158 | 57 | 64 | 89% | 2,100 | |
| Metals | 7440-50-8 | Copper | 11.975 | 410.2 | 45.43415789 | 57 | 79 | 72% | 4,200 | |
| Metals | 7439-89-6 | Iron | 4,600 | 21,855 | 14670.96456 | 79 | 79 | 100% | 100,000 | |
| Metals | 7439-92-1 | Lead | 11.9 | 1,416 | 137.7945657 | 99 | 99 | 100% | 800 | Yes |
| Metals | 7439-95-4 | Magnesium | 1,398.7 | 20,570 | 5260.082278 | 79 | 79 | 100% | - | |
| Metals | 7439-96-5 | Manganese | 336.26 | 1,120 | 680.1411392 | 79 | 79 | 100% | 3,500 | |
| Metals | 7439-97-6 | Mercury | 0.05 | 0.57 | 0.096 | 15 | 78 | 19% | 34 | |
| Metals | 7440-02-0 | Nickel | 9.8616 | 32.2 | 19.72867895 | 76 | 79 | 96% | 2,300 | |
| Metals | 7440-09-7 | Potassium | 382.9 | 10,923 | 1206.538861 | 79 | 79 | 100% | - | |
| Metals | 7782-49-2 | Selenium | 0.5 | 12.4 | 2.212142857 | 14 | 74 | 19% | 570 | |
| Metals | 7440-22-4 | Silver | 0.65 | 82.6 | 11.473 | 10 | 78 | 13% | 570 | |
| Metals | 7440-23-5 | Sodium | 17.5 | 678 | 161.9452278 | 79 | 79 | 100% | - | |
| Metals | 7440-28-0 | Thallium | 0.2 | 8.64 | 3.999166667 | 12 | 48 | 25% | 79 | |
| Metals | 7440-62-2 | Vanadium | 13.856 | 51.2 | 25.77101563 | 64 | 64 | 100% | 570 | |
| Metals | 7440-66-6 | Zinc | 48.918 | 1,305 | 162.9671266 | 79 | 79 | 100% | 100,000 | |
| PAHs | 83-32-9 | Acenaphthene | 0.0035 | 0.1152 | 0.02687 | 10 | 11 | 91% | 3,300 | |
| PAHs | 208-96-8 | Acenaphthylene | 0.00579 | 0.00579 | 0.00579 | 1 | 2 | 50% | 0.0305 | |
| PAHs | 120-12-7 | Anthracene | 0.0109 | 35.53 | 3.042758333 | 12 | 17 | 71% | 100,000 | |
| PAHs | 56-55-3 | Benzo(a)anthracene | 0.059 | 0.7295 | 0.254518182 | 12 | 17 | 69% | 2.3 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.0472 | 0.5053 | 0.188129412 | 17 | 17 | 100% | 0.23 | Yes |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.0172 | 0.8186 | 0.314152941 | 17 | 22 | 77% | 2.3 | |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.044 | 0.3555 | 0.156346154 | 13 | 13 | 100% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.0191 | 0.3967 | 0.1404375 | 16 | 21 | 76% | 23 | |
| PAHs | 218-01-9 | Chrysene | 0.0516 | 0.5776 | 0.264664286 | 14 | 17 | 82% | 230 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.0109 | 0.0811 | 0.040481818 | 11 | 11 | 100% | 0.23 | |

**APPENDIX Q**
**TABLE 3.1**
Summary of On-Site Soil Data Collected from 0-2 feet Depth Interval - Sitewide Analysis
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | MaxDet Exceeds SL |
|---|---|---|---|---|---|---|---|---|---|---|
| PAHs | 206-44-0 | Fluoranthene | 0.11 | 1.5901 | 0.55569375 | 16 | 18 | 89% | 2,400 | |
| PAHs | 86-73-7 | Fluorene | 0.0034 | 0.0602 | 0.01992 | 10 | 11 | 91% | 2,600 | |
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.0483 | 0.3387 | 0.151584615 | 13 | 13 | 100% | 2.3 | |
| PAHs | 91-20-3 | Naphthalene | 0.0031 | 0.0145 | 0.007966667 | 6 | 13 | 46% | 21 | |
| PAHs | 85-01-8 | Phenanthrene | 0.0538 | 0.9221 | 0.313842857 | 14 | 17 | 82% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.0889 | 1.2396 | 0.39650625 | 16 | 18 | 89% | 3,200 | |
| VOCs | 75-35-4 | 1,1-Dichloroethene | 0.00086 | 0.00086 | 0.00086 | 1 | 7 | 14% | 47 | |
| VOCs | 120-82-1 | 1,2,4-Trichlorobenzene | 0.0021 | 0.0021 | 0.0021 | 1 | 7 | 14% | 26 | |
| VOCs | 95-63-6 | 1,2,4-Trimethylbenzene | 0.011 | 0.011 | 0.011 | 1 | 7 | 14% | 19 | |
| VOCs | 95-50-1 | 1,2-Dichlorobenzene | 0.0055 | 0.0055 | 0.0055 | 1 | 7 | 14% | 370 | |
| VOCs | 108-67-8 | 1,3,5-Trimethylbenzene | 0.0051 | 0.0051 | 0.0051 | 1 | 7 | 14% | 7.8 | |
| VOCs | 541-73-1 | 1,3-Dichlorobenzene | 0.00078 | 0.00078 | 0.00078 | 1 | 7 | 14% | 14 | |
| VOCs | 99-87-6 | 4-Isopropyltoluene | 0.0015 | 0.0015 | 0.0015 | 1 | 7 | 14% | - | |
| VOCs | 156-59-2 | cis-1,2-Dichloroethene | 0.00067 | 0.7 | 0.138011667 | 6 | 9 | 67% | 16 | |
| VOCs | 104-51-8 | n-Butylbenzene | 0.0025 | 0.0025 | 0.0025 | 1 | 7 | 14% | 240 | |
| VOCs | 127-18-4 | Tetrachloroethene | 0.0012 | 6.4 | 0.776933333 | 9 | 9 | 100% | 1.7 | Yes |
| VOCs | 108-88-3 | Toluene | 0.00066 | 0.001 | 0.00078 | 3 | 7 | 43% | 520 | |
| VOCs | 156-60-5 | trans-1,2-Dichloroethene | 0.0016 | 0.036 | 0.013166667 | 3 | 9 | 33% | 20 | |
| VOCs | 79-01-6 | Trichloroethene | 0.0011 | 0.81 | 0.237716667 | 6 | 9 | 67% | 0.1 | Yes |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for industrial outdoor worker.
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.2**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Sitewide Analysis
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| CAS | Chemical Group | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | MaxDet Exceeds SL |
|---|---|---|---|---|---|---|---|---|---|---|
| 7429-90-5 | Metals | Aluminum | 4,192.70 | 14,655 | 8034.881443 | 97 | 97 | 100% | 100,000 | |
| 7440-36-0 | Metals | Antimony | 1.2 | 14.1 | 3.437545267 | 15 | 54 | 28% | 45 | |
| 7440-38-2 | Metals | Arsenic | 4 | 36.3 | 8.955898319 | 94 | 116 | 81% | 12.3 | Yes |
| 7440-39-3 | Metals | Barium | 0 | 723 | 162.6290965 | 114 | 114 | 100% | 100,000 | |
| 7440-41-7 | Metals | Beryllium | 0.3 | 0.986 | 0.468362083 | 72 | 94 | 77% | 220 | |
| 7440-43-9 | Metals | Cadmium | 0.3 | 3.17 | 0.887267123 | 73 | 112 | 65% | 56 | |
| 7440-70-2 | Metals | Calcium | 2,364 | 80,321 | 17468.33265 | 98 | 98 | 100% | - | |
| 7440-47-3 | Metals | Chromium | 3.8462 | 57.7 | 14.69642526 | 95 | 115 | 83% | 500 | |
| 7440-48-4 | Metals | Cobalt | 5.0503 | 12.6 | 8.443097368 | 76 | 83 | 92% | 2,100 | |
| 7440-50-8 | Metals | Copper | 9.03 | 410.2 | 40.44119737 | 76 | 98 | 78% | 4,200 | |
| 7439-89-6 | Metals | Iron | 4,600 | 23,197 | 14860.04242 | 99 | 99 | 100% | 100,000 | |
| 7439-92-1 | Metals | Lead | 7.37 | 1,416 | 123.4835126 | 119 | 119 | 100% | 800 | Yes |
| 7439-95-4 | Metals | Magnesium | 1,398.70 | 20,570 | 4889.407143 | 98 | 98 | 100% | - | |
| 7439-96-5 | Metals | Manganese | 306 | 1,120 | 668.9858163 | 98 | 98 | 100% | 3,500 | |
| 7439-97-6 | Metals | Mercury | 0.05 | 0.57 | 0.096 | 15 | 81 | 19% | 34 | |
| 7440-02-0 | Metals | Nickel | 9.8616 | 32.2 | 19.04361684 | 95 | 98 | 97% | 2,300 | |
| 7440-09-7 | Metals | Potassium | 265.2 | 10,923 | 1101.070714 | 98 | 98 | 100% | - | |
| 7782-49-2 | Metals | Selenium | 0.5 | 12.4 | 2.212142857 | 14 | 77 | 18% | 570 | |
| 7440-22-4 | Metals | Silver | 0.5 | 82.6 | 8.359285714 | 14 | 85 | 16% | 570 | |
| 7440-23-5 | Metals | Sodium | 16.379 | 678 | 138.2686224 | 98 | 98 | 100% | - | |
| 7440-28-0 | Metals | Thallium | 0.2 | 8.64 | 3.394117647 | 17 | 53 | 32% | 79 | |
| 7440-62-2 | Metals | Vanadium | 13.856 | 51.2 | 25.371 | 83 | 83 | 100% | 570 | |
| 7440-66-6 | Metals | Zinc | 29.2 | 1,305 | 148.8498265 | 98 | 98 | 100% | 100,000 | |
| 83-32-9 | PAHs | Acenaphthene | 0.0023 | 0.1152 | 0.0236 | 23 | 24 | 96% | 3,300 | |
| 208-96-8 | PAHs | Acenaphthylene | 0.0022 | 0.009 | 0.004815 | 6 | 7 | 86% | 0.0305 | |
| 120-12-7 | PAHs | Anthracene | 0.0024 | 35.53 | 1.392144444 | 27 | 33 | 82% | 100,000 | |
| 56-55-3 | PAHs | Benzo(a)anthracene | 0.0058 | 0.7295 | 0.182318519 | 28 | 33 | 84% | 2.3 | |
| 50-32-8 | PAHs | Benzo(a)pyrene | 0.0039 | 0.5053 | 0.144583333 | 36 | 36 | 100% | 0.23 | Yes |
| 205-99-2 | PAHs | Benzo(b)fluoranthene | 0.0079 | 0.8186 | 0.248315152 | 33 | 38 | 87% | 2.3 | |
| 191-24-2 | PAHs | Benzo(g,h,i)perylene | 0.0039 | 0.3555 | 0.112013793 | 29 | 29 | 100% | 0.478 | |
| 207-08-9 | PAHs | Benzo(k)fluoranthene | 0.0021 | 0.3967 | 0.097309688 | 32 | 37 | 86% | 23 | |
| 218-01-9 | PAHs | Chrysene | 0.0053 | 0.5776 | 0.19159 | 30 | 33 | 91% | 230 | |
| 53-70-3 | PAHs | Dibenz(a,h)anthracene | 0.003 | 0.0811 | 0.02695 | 26 | 26 | 100% | 0.23 | |
| 206-44-0 | PAHs | Fluoranthene | 0.0101 | 1.5901 | 0.43109375 | 32 | 34 | 94% | 2,400 | |

**APPENDIX Q**
**TABLE 3.2**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Sitewide Analysis
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| CAS | Chemical Group | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | MaxDet Exceeds SL |
|---|---|---|---|---|---|---|---|---|---|---|
| 86-73-7 | PAHs | Fluorene | 0.002 | 0.0613 | 0.018438095 | 21 | 24 | 88% | 2,600 | |
| 193-39-5 | PAHs | Indeno(1,2,3-cd)pyrene | 0.0034 | 0.3387 | 0.105955172 | 29 | 29 | 100% | 2.3 | |
| 91-20-3 | PAHs | Naphthalene | 0.00209 | 0.0145 | 0.005569375 | 16 | 30 | 53% | 21 | |
| 85-01-8 | PAHs | Phenanthrene | 0.0049 | 0.9221 | 0.231216667 | 30 | 33 | 91% | 1.04 | |
| 129-00-0 | PAHs | Pyrene | 0.0085 | 1.2396 | 0.3150875 | 32 | 34 | 94% | 3,200 | |
| 75-35-4 | VOCs | 1,1-Dichloroethene | 0.00086 | 0.00086 | 0.00086 | 1 | 14 | 7% | 47 | |
| 120-82-1 | VOCs | 1,2,4-Trichlorobenzene | 0.0021 | 0.0021 | 0.0021 | 1 | 14 | 7% | 26 | |
| 95-63-6 | VOCs | 1,2,4-Trimethylbenzene | 0.011 | 0.011 | 0.011 | 1 | 14 | 7% | 19 | |
| 95-50-1 | VOCs | 1,2-Dichlorobenzene | 0.0055 | 0.0055 | 0.0055 | 1 | 14 | 7% | 370 | |
| 108-67-8 | VOCs | 1,3,5-Trimethylbenzene | 0.00089 | 0.0051 | 0.002995 | 2 | 14 | 14% | 7.8 | |
| 541-73-1 | VOCs | 1,3-Dichlorobenzene | 0.00078 | 0.00078 | 0.00078 | 1 | 14 | 7% | 14 | |
| 99-87-6 | VOCs | 4-Isopropyltoluene | 0.0015 | 0.0015 | 0.0015 | 1 | 14 | 7% | - | |
| 56-23-5 | VOCs | Carbon tetrachloride | 0.003 | 0.0043 | 0.00365 | 2 | 16 | 13% | 0.58 | |
| 156-59-2 | VOCs | cis-1,2-Dichloroethene | 0.00067 | 0.7 | 0.12149 | 13 | 18 | 72% | 16 | |
| 104-51-8 | VOCs | n-Butylbenzene | 0.0025 | 0.0025 | 0.0025 | 1 | 14 | 7% | 240 | |
| 127-18-4 | VOCs | Tetrachloroethene | 0.00046 | 6.4 | 0.770521176 | 17 | 18 | 94% | 1.7 | Yes |
| 108-88-3 | VOCs | Toluene | 0.00066 | 0.001 | 0.00078 | 3 | 14 | 21% | 520 | |
| 156-60-5 | VOCs | trans-1,2-Dichloroethene | 0.00062 | 0.036 | 0.0084525 | 8 | 18 | 44% | 20 | |
| 79-01-6 | VOCs | Trichloroethene | 0.0011 | 0.81 | 0.172369231 | 13 | 18 | 72% | 0.1 | Yes |
| 108-38-3/1 | VOCs | Xylene, m-, p- | 0.0026 | 0.0026 | 0.0026 | 1 | 15 | 7% | 210 | |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for industrial outdoor worker.
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.3**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit A
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 5748.2 | 7,845 | 6,708 | 9 | 9 | 100.00% | 7,700 | Yes |
| Metals | 7440-36-0 | Antimony | 1.2 | 5.293179 | 2.6 | 3 | 8 | 37.50% | 3.1 | Yes |
| Metals | 7440-38-2 | Arsenic | 5.646396 | 8.92 | 6.7 | 5 | 9 | 55.56% | 12.3 | |
| Metals | 7440-39-3 | Barium | 101.74 | 127 | 113 | 9 | 9 | 100.00% | 1,600 | |
| Metals | 7440-41-7 | Beryllium | 0.3 | 0.64007 | 0.46 | 7 | 8 | 87.50% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.53 | 3.17 | 1.4 | 6 | 8 | 75.00% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 21,400 | 63,774 | 45,921 | 9 | 9 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 8.2 | 19.7 | 14 | 8 | 9 | 88.89% | 38 | |
| Metals | 7440-48-4 | Cobalt | 6.9277 | 9.8 | 8.1 | 8 | 9 | 88.89% | 900 | |
| Metals | 7440-50-8 | Copper | 16.083 | 150 | 44 | 8 | 9 | 88.89% | 290 | |
| Metals | 7439-89-6 | Iron | 10,700 | 21,855 | 13,971 | 9 | 9 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 28.345 | 1,022.90 | 236 | 10 | 10 | 100.00% | 400 | Yes |
| Metals | 7439-95-4 | Magnesium | 5,266.40 | 15,724 | 10,530 | 9 | 9 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 440 | 601 | 526 | 9 | 9 | 100.00% | 350 | Yes |
| Metals | 7439-97-6 | Mercury | 0.058 | 0.08 | 0.069 | 2 | 5 | 40.00% | 2.3 | |
| Metals | 7440-02-0 | Nickel | 13.7 | 19.7 | 16 | 8 | 9 | 88.89% | 130 | |
| Metals | 7440-09-7 | Potassium | 616.7 | 1,679 | 1,004 | 9 | 9 | 100.00% | - | |
| Metals | 7782-49-2 | Selenium | 12.4 | 12.4 | 12 | 1 | 5 | 20.00% | 5 | Yes |
| Metals | 7440-23-5 | Sodium | 39.31 | 508 | 114 | 9 | 9 | 100.00% | - | |
| Metals | 7440-62-2 | Vanadium | 20 | 33.3 | 23 | 9 | 9 | 100.00% | 39 | |
| Metals | 7440-66-6 | Zinc | 48.918 | 1,001 | 290 | 9 | 9 | 100.00% | 2,300 | |
| PAHs | 83-32-9 | Acenaphthene | 0.0033 | 0.0033 | 0.0033 | 1 | 1 | 100.00% | 370 | |
| PAHs | 208-96-8 | Acenaphthylene | 0.0022 | 0.0022 | 0.0022 | 1 | 1 | 100.00% | 0.0305 | |
| PAHs | 120-12-7 | Anthracene | 0.0042 | 0.0114 | 0.0078 | 2 | 3 | 66.67% | 2,200 | |
| PAHs | 56-55-3 | Benzo(a)anthracene | 0.0307 | 0.0801 | 0.055 | 2 | 3 | 66.67% | 0.887 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.0295 | 0.0757 | 0.053 | 2 | 2 | 100.00% | 0.735 | |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.0467 | 0.1228 | 0.085 | 2 | 3 | 66.67% | 0.626 | |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.0258 | 0.0658 | 0.046 | 2 | 2 | 100.00% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.0143 | 0.0375 | 0.026 | 2 | 3 | 66.67% | 1.5 | |
| PAHs | 218-01-9 | Chrysene | 0.0342 | 0.09 | 0.062 | 2 | 3 | 66.67% | 15 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.0048 | 0.0121 | 0.0085 | 2 | 2 | 100.00% | 0.303 | |
| PAHs | 206-44-0 | Fluoranthene | 0.0632 | 0.1724 | 0.12 | 3 | 3 | 100.00% | 230 | |
| PAHs | 86-73-7 | Fluorene | 0.0038 | 0.0038 | 0.0038 | 1 | 1 | 100.00% | 260 | |

**APPENDIX Q**
**TABLE 3.3**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit A
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.0223 | 0.0581 | 0.040 | 2 | 2 | 100.00% | 0.415 | |
| PAHs | 91-20-3 | Naphthalene | 0.00209 | 0.00209 | 0.0021 | 1 | 1 | 100.00% | 12 | |
| PAHs | 85-01-8 | Phenanthrene | 0.0213 | 0.0652 | 0.043 | 2 | 3 | 66.67% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.0542 | 0.1435 | 0.099 | 3 | 3 | 100.00% | 230 | |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.4**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit B
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 5,500 | 11,600 | 7,243 | 8 | 8 | 100.00% | 7,700 | Yes |
| Metals | 7440-36-0 | Antimony | 2.76 | 3.15 | 2.9 | 3 | 6 | 50.00% | 3.1 | Yes |
| Metals | 7440-38-2 | Arsenic | 7.280546 | 18.9 | 14 | 5 | 7 | 71.43% | 12.3 | Yes |
| Metals | 7440-39-3 | Barium | 80 | 194 | 115 | 8 | 8 | 100.00% | 1,600 | |
| Metals | 7440-41-7 | Beryllium | 0.416 | 0.509 | 0.46 | 7 | 8 | 87.50% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.916 | 1.09 | 1.0 | 4 | 7 | 57.14% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 18,073 | 80,321 | 41,616 | 8 | 8 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 10.6 | 14.5 | 13 | 7 | 8 | 87.50% | 38 | |
| Metals | 7440-48-4 | Cobalt | 6.61 | 7.49 | 7.1 | 7 | 7 | 100.00% | 900 | |
| Metals | 7440-50-8 | Copper | 17.528 | 30.8 | 24 | 7 | 8 | 87.50% | 290 | |
| Metals | 7439-89-6 | Iron | 10,659 | 17,630 | 12,833 | 8 | 8 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 31 | 1416 | 268 | 9 | 9 | 100.00% | 400 | Yes |
| Metals | 7439-95-4 | Magnesium | 4,531 | 20,570 | 9,301 | 8 | 8 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 435.2 | 708 | 524 | 8 | 8 | 100.00% | 350 | Yes |
| Metals | 7439-97-6 | Mercury | 0.05 | 0.055 | 0.053 | 2 | 7 | 28.57% | 2.3 | |
| Metals | 7440-02-0 | Nickel | 14 | 27.1 | 17 | 8 | 8 | 100.00% | 130 | |
| Metals | 7440-09-7 | Potassium | 502.1 | 1,410 | 1,045 | 8 | 8 | 100.00% | - | |
| Metals | 7440-22-4 | Silver | 0.6 | 0.6 | 0.60 | 1 | 8 | 12.50% | 34 | |
| Metals | 7440-23-5 | Sodium | 53.2 | 475 | 133 | 8 | 8 | 100.00% | - | |
| Metals | 7440-62-2 | Vanadium | 15.9 | 22.7 | 19 | 7 | 7 | 100.00% | 39 | |
| Metals | 7440-66-6 | Zinc | 64.936 | 337 | 188 | 8 | 8 | 100.00% | 2,300 | |
| PAHs | 83-32-9 | Acenaphthene | 0.0132 | 0.0132 | 0.013 | 1 | 1 | 100.00% | 370 | |
| PAHs | 208-96-8 | Acenaphthylene | 0.0037 | 0.0037 | 0.0037 | 1 | 1 | 100.00% | 0.0305 | |
| PAHs | 120-12-7 | Anthracene | 0.0024 | 0.0024 | 0.0024 | 1 | 1 | 100.00% | 2,200 | |
| PAHs | 56-55-3 | Benzo(a)anthracene | 0.024 | 0.024 | 0.024 | 1 | 1 | 100.00% | 0.887 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.0198 | 0.121 | 0.070 | 2 | 2 | 100.00% | 0.735 | |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.0284 | 0.0284 | 0.028 | 1 | 1 | 100.00% | 0.626 | |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.0155 | 0.0155 | 0.016 | 1 | 1 | 100.00% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.00961 | 0.00961 | 0.0096 | 1 | 1 | 100.00% | 1.5 | |
| PAHs | 218-01-9 | Chrysene | 0.018 | 0.018 | 0.018 | 1 | 1 | 100.00% | 15 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.003 | 0.003 | 0.0030 | 1 | 1 | 100.00% | 0.303 | |
| PAHs | 206-44-0 | Fluoranthene | 0.037 | 0.037 | 0.037 | 1 | 1 | 100.00% | 230 | |
| PAHs | 86-73-7 | Fluorene | 0.0107 | 0.0107 | 0.011 | 1 | 1 | 100.00% | 260 | |

**APPENDIX Q**
**TABLE 3.4**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit B
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.0148 | 0.0148 | 0.015 | 1 | 1 | 100.00% | 0.415 | |
| PAHs | 91-20-3 | Naphthalene | 0.00712 | 0.00712 | 0.0071 | 1 | 1 | 100.00% | 12 | |
| PAHs | 85-01-8 | Phenanthrene | 0.0132 | 0.0132 | 0.013 | 1 | 1 | 100.00% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.0355 | 0.0355 | 0.036 | 1 | 1 | 100.00% | 230 | |
| VOCs | 108-38-3/1 | Xylene, m-, p- | 0.0026 | 0.0026 | 0.0026 | 1 | 1 | 100.00% | 210 | |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.5**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit C
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 6,382.40 | 8,259 | 7,322 | 4 | 4 | 100.00% | 7,700 | Yes |
| Metals | 7440-36-0 | Antimony | 4.24 | 4.24 | 4.2 | 1 | 2 | 50.00% | 3.1 | Yes |
| Metals | 7440-38-2 | Arsenic | 4 | 11.7 | 7.0 | 3 | 4 | 75.00% | 12.3 | |
| Metals | 7440-39-3 | Barium | 87.9 | 129.42 | 103 | 4 | 4 | 100.00% | 1,600 | |
| Metals | 7440-41-7 | Beryllium | 0.5 | 0.615 | 0.55 | 3 | 3 | 100.00% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.5 | 0.898 | 0.70 | 2 | 3 | 66.67% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 5,234.30 | 49,170 | 36,037 | 4 | 4 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 13.814 | 16.8 | 15 | 4 | 4 | 100.00% | 38 | |
| Metals | 7440-48-4 | Cobalt | 7.08 | 9.68 | 8.7 | 4 | 4 | 100.00% | 900 | |
| Metals | 7440-50-8 | Copper | 17.094 | 30.2 | 21 | 4 | 4 | 100.00% | 290 | |
| Metals | 7439-89-6 | Iron | 13,258 | 17,675 | 15,185 | 4 | 4 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 44.7 | 143.3 | 89 | 4 | 4 | 100.00% | 400 | |
| Metals | 7439-95-4 | Magnesium | 1987.2 | 8,637 | 6,424 | 4 | 4 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 423.08 | 611 | 511 | 4 | 4 | 100.00% | 350 | Yes |
| Metals | 7440-02-0 | Nickel | 15.5 | 19.9 | 18 | 4 | 4 | 100.00% | 130 | |
| Metals | 7440-09-7 | Potassium | 481.8 | 1,080 | 763 | 4 | 4 | 100.00% | - | |
| Metals | 7440-22-4 | Silver | 0.6 | 0.6 | 0.60 | 1 | 3 | 33.33% | 34 | |
| Metals | 7440-23-5 | Sodium | 32.636 | 66.6 | 51 | 4 | 4 | 100.00% | - | |
| Metals | 7440-62-2 | Vanadium | 21.9 | 26.992 | 24 | 4 | 4 | 100.00% | 39 | |
| Metals | 7440-66-6 | Zinc | 42.791 | 1305 | 375 | 4 | 4 | 100.00% | 2,300 | |
| PAHs | 83-32-9 | Acenaphthene | 0.0091 | 0.0091 | 0.0091 | 1 | 1 | 100.00% | 370 | |
| PAHs | 120-12-7 | Anthracene | 0.0041 | 0.0041 | 0.0041 | 1 | 1 | 100.00% | 2,200 | |
| PAHs | 56-55-3 | Benzo(a)anthracene | 0.0214 | 0.0214 | 0.021 | 1 | 1 | 100.00% | 0.887 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.0197 | 0.0197 | 0.020 | 1 | 1 | 100.00% | 0.735 | |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.0278 | 0.0278 | 0.028 | 1 | 1 | 100.00% | 0.626 | |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.0143 | 0.0143 | 0.014 | 1 | 1 | 100.00% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.0885 | 0.0885 | 0.089 | 1 | 1 | 100.00% | 1.5 | |
| PAHs | 218-01-9 | Chrysene | 0.022 | 0.022 | 0.022 | 1 | 1 | 100.00% | 15 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.003 | 0.003 | 0.0030 | 1 | 1 | 100.00% | 0.303 | |
| PAHs | 206-44-0 | Fluoranthene | 0.0421 | 0.0421 | 0.042 | 1 | 1 | 100.00% | 230 | |
| PAHs | 86-73-7 | Fluorene | 0.0096 | 0.0096 | 0.0096 | 1 | 1 | 100.00% | 260 | |
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.0131 | 0.0131 | 0.013 | 1 | 1 | 100.00% | 0.415 | |

**APPENDIX Q**
**TABLE 3.5**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit C
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| PAHs | 85-01-8 | Phenanthrene | 0.0182 | 0.0182 | 0.018 | 1 | 1 | 100.00% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.0409 | 0.0409 | 0.041 | 1 | 1 | 100.00% | 230 | |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.6**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit D
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 6,987 | 12,900 | 9,170 | 6 | 6 | 100.00% | 7,700 | Yes |
| Metals | 7440-38-2 | Arsenic | 6.65 | 8.59 | 7.2 | 4 | 4 | 100.00% | 12.3 | |
| Metals | 7440-39-3 | Barium | 93.6 | 394 | 180 | 6 | 6 | 100.00% | 1,600 | |
| Metals | 7440-41-7 | Beryllium | 0.3 | 0.476 | 0.39 | 4 | 6 | 66.67% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.3 | 0.976 | 0.66 | 4 | 6 | 66.67% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 2,364 | 53,900 | 18,921 | 6 | 6 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 5.7 | 24.6 | 14 | 5 | 6 | 83.33% | 38 | |
| Metals | 7440-48-4 | Cobalt | 5.13 | 8.7 | 7.1 | 4 | 4 | 100.00% | 900 | |
| Metals | 7440-50-8 | Copper | 9.03 | 29.1 | 21 | 4 | 6 | 66.67% | 290 | |
| Metals | 7439-89-6 | Iron | 11,678 | 19,100 | 15,879 | 6 | 6 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 7.37 | 126 | 61 | 6 | 6 | 100.00% | 400 | |
| Metals | 7439-95-4 | Magnesium | 1,927 | 12,698 | 5,479 | 6 | 6 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 306 | 1,040 | 629 | 6 | 6 | 100.00% | 350 | Yes |
| Metals | 7440-02-0 | Nickel | 11.1 | 28.5 | 19 | 6 | 6 | 100.00% | 130 | |
| Metals | 7440-09-7 | Potassium | 482 | 1,540 | 1,121 | 6 | 6 | 100.00% | - | |
| Metals | 7782-49-2 | Selenium | 0.5 | 0.5 | 0.50 | 1 | 4 | 25.00% | 5 | |
| Metals | 7440-23-5 | Sodium | 28.3 | 484 | 172 | 6 | 6 | 100.00% | - | |
| Metals | 7440-28-0 | Thallium | 2.74 | 4.66 | 3.7 | 3 | 3 | 100.00% | 0.7 | Yes |
| Metals | 7440-62-2 | Vanadium | 19.6 | 24.1 | 22 | 4 | 4 | 100.00% | 39 | |
| Metals | 7440-66-6 | Zinc | 29.2 | 197 | 113 | 6 | 6 | 100.00% | 2,300 | |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.7**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit E
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 6,292 | 10,600 | 8,026 | 7 | 7 | 100.00% | 7,700 | Yes |
| Metals | 7440-36-0 | Antimony | 14.1 | 14.1 | 14 | 1 | 5 | 20.00% | 3.1 | Yes |
| Metals | 7440-38-2 | Arsenic | 5.12 | 16.5 | 10 | 7 | 7 | 100.00% | 12.3 | Yes |
| Metals | 7440-39-3 | Barium | 110.12 | 249 | 165 | 9 | 9 | 100.00% | 1,600 | |
| Metals | 7440-41-7 | Beryllium | 0.4 | 0.581 | 0.50 | 5 | 7 | 71.43% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.693 | 1.63 | 0.97 | 5 | 9 | 55.56% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 4,757 | 40,449 | 16,606 | 7 | 7 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 13 | 57.7 | 22 | 8 | 9 | 88.89% | 38 | Yes |
| Metals | 7440-48-4 | Cobalt | 7.95 | 11.6 | 9.4 | 5 | 6 | 83.33% | 900 | |
| Metals | 7440-50-8 | Copper | 22 | 77.2 | 38 | 5 | 7 | 71.43% | 290 | |
| Metals | 7439-89-6 | Iron | 5,800 | 17,300 | 13,810 | 7 | 7 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 17.4 | 304.2 | 94 | 9 | 9 | 100.00% | 400 | |
| Metals | 7439-95-4 | Magnesium | 2,177 | 7,786 | 4,980 | 7 | 7 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 509 | 1,060 | 689 | 7 | 7 | 100.00% | 350 | Yes |
| Metals | 7439-97-6 | Mercury | 0.054 | 0.075 | 0.062 | 3 | 8 | 37.50% | 2.3 | |
| Metals | 7440-02-0 | Nickel | 15.4 | 32.2 | 21 | 7 | 7 | 100.00% | 130 | |
| Metals | 7440-09-7 | Potassium | 552.07 | 10,923 | 2,331 | 7 | 7 | 100.00% | - | |
| Metals | 7440-22-4 | Silver | 0.65 | 0.67 | 1 | 2 | 8 | 25.00% | 34 | |
| Metals | 7440-23-5 | Sodium | 42.6 | 678 | 207 | 7 | 7 | 100.00% | - | |
| Metals | 7440-28-0 | Thallium | 5.07 | 5.07 | 5.1 | 1 | 5 | 20.00% | 0.7 | Yes |
| Metals | 7440-62-2 | Vanadium | 20.3 | 44.1 | 27 | 6 | 6 | 100.00% | 39 | Yes |
| Metals | 7440-66-6 | Zinc | 98.3 | 323 | 158 | 7 | 7 | 100.00% | 2,300 | |
| PAHs | 83-32-9 | Acenaphthene | 0.0023 | 0.0023 | 0.0023 | 1 | 1 | 100.00% | 370 | |
| PAHs | 120-12-7 | Anthracene | 0.0052 | 0.0052 | 0.0052 | 1 | 2 | 50.00% | 2,200 | |
| PAHs | 56-55-3 | Benzo(a)anthracene | 0.0545 | 0.0545 | 0.055 | 1 | 2 | 50.00% | 1 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.0485 | 0.0485 | 0.049 | 1 | 1 | 100.00% | 0.735 | |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.0802 | 0.0802 | 0.080 | 1 | 2 | 50.00% | 0.626 | |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.0362 | 0.0362 | 0.036 | 1 | 1 | 100.00% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.0197 | 0.0197 | 0.020 | 1 | 2 | 50.00% | 1.5 | |
| PAHs | 218-01-9 | Chrysene | 0.0502 | 0.0502 | 0.050 | 1 | 2 | 50.00% | 15 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.0074 | 0.0074 | 0.0074 | 1 | 1 | 100.00% | 0.303 | |
| PAHs | 206-44-0 | Fluoranthene | 0.096 | 0.11 | 0.10 | 2 | 2 | 100.00% | 230 | |
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.0313 | 0.0313 | 0.031 | 1 | 1 | 100.00% | 0.415 | |

**APPENDIX Q**
**TABLE 3.7**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit E
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| PAHs | 91-20-3 | Naphthalene | 0.0024 | 0.0024 | 0.0024 | 1 | 1 | 100.00% | 12 | |
| PAHs | 85-01-8 | Phenanthrene | 0.0227 | 0.0227 | 0.023 | 1 | 2 | 50.00% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.0791 | 0.09 | 0.085 | 2 | 2 | 100.00% | 230 | |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.8**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit F
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 6,464.20 | 11,100 | 8,486 | 11 | 11 | 100.00% | 7,700 | Yes |
| Metals | 7440-36-0 | Antimony | 2.2 | 5.73 | 4.0 | 2 | 4 | 50.00% | 3.1 | Yes |
| Metals | 7440-38-2 | Arsenic | 4.93 | 14.5 | 7.8 | 11 | 14 | 78.57% | 12.3 | Yes |
| Metals | 7440-39-3 | Barium | 114 | 286 | 178 | 16 | 16 | 100.00% | 1600 | |
| Metals | 7440-41-7 | Beryllium | 0.3 | 0.532 | 0.41 | 7 | 11 | 63.64% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.314 | 1.72 | 0.88 | 8 | 16 | 50.00% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 2,528.90 | 24,800 | 12,858 | 11 | 11 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 6.3593 | 21.2 | 14 | 12 | 16 | 75.00% | 38 | |
| Metals | 7440-48-4 | Cobalt | 7.8498 | 9.48 | 8.7 | 7 | 8 | 87.50% | 900 | |
| Metals | 7440-50-8 | Copper | 14.758 | 129 | 51 | 7 | 11 | 63.64% | 290 | |
| Metals | 7439-89-6 | Iron | 13,429 | 18,600 | 15,736 | 11 | 11 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 11.9 | 1118 | 136 | 16 | 16 | 100.00% | 400 | Yes |
| Metals | 7439-95-4 | Magnesium | 2,057 | 5,870 | 3,918 | 11 | 11 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 516 | 1,025.30 | 694 | 11 | 11 | 100.00% | 350 | Yes |
| Metals | 7439-97-6 | Mercury | 0.06 | 0.068 | 0.064 | 2 | 12 | 16.67% | 2.3 | |
| Metals | 7440-02-0 | Nickel | 15.169 | 28.3 | 21 | 10 | 11 | 90.91% | 130 | |
| Metals | 7440-09-7 | Potassium | 325.8 | 1,530 | 866 | 11 | 11 | 100.00% | - | |
| Metals | 7782-49-2 | Selenium | 0.5 | 0.6 | 0.55 | 2 | 11 | 18.18% | 5 | |
| Metals | 7440-22-4 | Silver | 0.5 | 0.9 | 0.70 | 3 | 13 | 23.08% | 34 | |
| Metals | 7440-23-5 | Sodium | 27.977 | 444 | 170 | 11 | 11 | 100.00% | - | |
| Metals | 7440-28-0 | Thallium | 0.3 | 2.18 | 1.2 | 2 | 5 | 40.00% | 0.7 | Yes |
| Metals | 7440-62-2 | Vanadium | 22.045 | 46.1 | 26 | 8 | 8 | 100.00% | 39 | Yes |
| Metals | 7440-66-6 | Zinc | 45.899 | 379 | 162 | 11 | 11 | 100.00% | 2,300 | |
| PAHs | 83-32-9 | Acenaphthene | 0.0035 | 0.0234 | 0.016 | 3 | 3 | 100.00% | 370 | |
| PAHs | 208-96-8 | Acenaphthylene | 0.00579 | 0.00579 | 0.0058 | 1 | 1 | 100.00% | 0.0305 | |
| PAHs | 120-12-7 | Anthracene | 0.0049 | 0.0694 | 0.028 | 3 | 4 | 75.00% | 2,200 | |
| PAHs | 56-55-3 | Benzo(a)anthracene | 0.0374 | 0.201 | 0.10 | 3 | 4 | 75.00% | 0.887 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.0321 | 0.1428 | 0.086 | 4 | 4 | 100.00% | 0.735 | |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.0557 | 0.2461 | 0.13 | 4 | 5 | 80.00% | 0.626 | |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.0264 | 0.1125 | 0.076 | 3 | 3 | 100.00% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.0172 | 0.3967 | 0.13 | 4 | 5 | 80.00% | 1.5 | |
| PAHs | 218-01-9 | Chrysene | 0.0381 | 0.27 | 0.13 | 4 | 4 | 100.00% | 15 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.0051 | 0.0301 | 0.015 | 3 | 3 | 100.00% | 0.303 | |

**APPENDIX Q**
**TABLE 3.8**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit F
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| PAHs | 206-44-0 | Fluoranthene | 0.0657 | 0.4708 | 0.26 | 4 | 4 | 100.00% | 230 | |
| PAHs | 86-73-7 | Fluorene | 0.0041 | 0.025 | 0.015 | 2 | 2 | 100.00% | 260 | |
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.0233 | 0.1291 | 0.067 | 4 | 4 | 100.00% | 0.415 | |
| PAHs | 91-20-3 | Naphthalene | 0.0063 | 0.0063 | 0.0063 | 1 | 1 | 100.00% | 12 | |
| PAHs | 85-01-8 | Phenanthrene | 0.0223 | 0.2965 | 0.13 | 4 | 4 | 100.00% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.0575 | 0.3208 | 0.19 | 4 | 4 | 100.00% | 230 | |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.9**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit G
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 6,837.10 | 14,655 | 9,528 | 11 | 11 | 100.00% | 7,700 | Yes |
| Metals | 7440-36-0 | Antimony | 1.5 | 1.5 | 1.5 | 1 | 8 | 12.50% | 3.1 | |
| Metals | 7440-38-2 | Arsenic | 5.1 | 8.44 | 7.0 | 6 | 9 | 66.67% | 12.3 | |
| Metals | 7440-39-3 | Barium | 141 | 431 | 213 | 11 | 11 | 100.00% | 1,600 | |
| Metals | 7440-41-7 | Beryllium | 0.4 | 0.986 | 0.57 | 7 | 11 | 63.64% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.618 | 0.9 | 0.74 | 6 | 11 | 54.55% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 2,544 | 15,900 | 6,521 | 11 | 11 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 11.648 | 20.3 | 15 | 7 | 11 | 63.64% | 38 | |
| Metals | 7440-48-4 | Cobalt | 8.52 | 12.6 | 9.6 | 7 | 9 | 77.78% | 900 | |
| Metals | 7440-50-8 | Copper | 17.4 | 192 | 51 | 7 | 11 | 63.64% | 290 | |
| Metals | 7439-89-6 | Iron | 6,000 | 22,519 | 16,224 | 11 | 11 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 11 | 983 | 133 | 12 | 12 | 100.00% | 400 | Yes |
| Metals | 7439-95-4 | Magnesium | 2,137 | 10,200 | 3,850 | 11 | 11 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 601 | 1,070 | 814 | 11 | 11 | 100.00% | 350 | Yes |
| Metals | 7440-02-0 | Nickel | 18.421 | 31.2 | 23 | 11 | 11 | 100.00% | 130 | |
| Metals | 7440-09-7 | Potassium | 686.31 | 1,400 | 1,134 | 11 | 11 | 100.00% | - | |
| Metals | 7440-22-4 | Silver | 0.6 | 0.6 | 0.60 | 1 | 10 | 10.00% | 34 | |
| Metals | 7440-23-5 | Sodium | 27.247 | 609 | 194 | 11 | 11 | 100.00% | - | |
| Metals | 7440-28-0 | Thallium | 1.94 | 5.19 | 3.6 | 2 | 7 | 28.57% | 0.7 | Yes |
| Metals | 7440-62-2 | Vanadium | 22.2 | 50.2 | 31 | 9 | 9 | 100.00% | 39 | Yes |
| Metals | 7440-66-6 | Zinc | 52.1 | 177 | 98 | 11 | 11 | 100.00% | 2,300 | |
| PAHs | 83-32-9 | Acenaphthene | 0.0291 | 0.1152 | 0.072 | 2 | 2 | 100.00% | 370 | |
| PAHs | 208-96-8 | Acenaphthylene | 0.009 | 0.009 | 0.0090 | 1 | 1 | 100.00% | 0.0305 | |
| PAHs | 120-12-7 | Anthracene | 0.0444 | 0.1737 | 0.11 | 2 | 3 | 66.67% | 2,200 | |
| PAHs | 56-55-3 | Benzo(a)anthracene | 0.1113 | 0.7295 | 0.42 | 2 | 3 | 66.67% | 0.887 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.08 | 0.5053 | 0.29 | 2 | 2 | 100.00% | 0.735 | |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.1298 | 0.8186 | 0.47 | 2 | 3 | 66.67% | 0.626 | Yes |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.0523 | 0.3555 | 0.20 | 2 | 2 | 100.00% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.0402 | 0.28 | 0.16 | 2 | 3 | 66.67% | 1.5 | |
| PAHs | 218-01-9 | Chrysene | 0.0906 | 0.562 | 0.33 | 2 | 3 | 66.67% | 15 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.0114 | 0.0811 | 0.046 | 2 | 2 | 100.00% | 0.303 | |
| PAHs | 206-44-0 | Fluoranthene | 0.2517 | 1.4615 | 0.86 | 2 | 4 | 50.00% | 230 | |
| PAHs | 86-73-7 | Fluorene | 0.0155 | 0.0532 | 0.034 | 2 | 2 | 100.00% | 260 | |

**APPENDIX Q**
**TABLE 3.9**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit G
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.0462 | 0.3387 | 0.19 | 2 | 2 | 100.00% | 0.415 | |
| PAHs | 91-20-3 | Naphthalene | 0.0042 | 0.012 | 0.0081 | 2 | 2 | 100.00% | 12 | |
| PAHs | 85-01-8 | Phenanthrene | 0.164 | 0.8081 | 0.49 | 2 | 3 | 66.67% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.199 | 1.2396 | 0.72 | 2 | 4 | 50.00% | 230 | |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.10**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit H
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 5,395.60 | 8,960 | 7,182 | 7 | 7 | 100.00% | 7,700 | Yes |
| Metals | 7440-38-2 | Arsenic | 4.035499 | 23.5 | 9.4 | 18 | 19 | 94.74% | 12.3 | Yes |
| Metals | 7440-39-3 | Barium | 79.3 | 196 | 130 | 12 | 12 | 100.00% | 1,600 | |
| Metals | 7440-41-7 | Beryllium | 0.3 | 0.538 | 0.41 | 6 | 6 | 100.00% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.3 | 2.1 | 0.89 | 10 | 12 | 83.33% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 2,431 | 48,589 | 14,555 | 7 | 7 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 7.2 | 22.5 | 15 | 12 | 12 | 100.00% | 38 | |
| Metals | 7440-48-4 | Cobalt | 7.3251 | 10.462 | 8.5 | 7 | 7 | 100.00% | 900 | |
| Metals | 7440-50-8 | Copper | 11.088 | 143 | 40 | 7 | 7 | 100.00% | 290 | |
| Metals | 7439-89-6 | Iron | 12,114 | 15,913 | 14,146 | 7 | 7 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 13.539 | 335 | 125 | 12 | 12 | 100.00% | 400 | |
| Metals | 7439-95-4 | Magnesium | 2,043.10 | 4,417 | 2,790 | 7 | 7 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 530 | 656.17 | 585 | 7 | 7 | 100.00% | 350 | Yes |
| Metals | 7439-97-6 | Mercury | 0.068 | 0.57 | 0.32 | 2 | 7 | 28.57% | 2.3 | |
| Metals | 7440-02-0 | Nickel | 12.137 | 18 | 15 | 7 | 7 | 100.00% | 130 | |
| Metals | 7440-09-7 | Potassium | 265.2 | 1,403 | 800 | 7 | 7 | 100.00% | - | |
| Metals | 7782-49-2 | Selenium | 0.6 | 0.7 | 0.67 | 3 | 10 | 30.00% | 5 | |
| Metals | 7440-22-4 | Silver | 0.72 | 82.6 | 22 | 5 | 7 | 71.43% | 34 | Yes |
| Metals | 7440-23-5 | Sodium | 17.5 | 54.8 | 30 | 7 | 7 | 100.00% | - | |
| Metals | 7440-28-0 | Thallium | 4.52 | 4.52 | 4.5 | 1 | 2 | 50.00% | 0.7 | Yes |
| Metals | 7440-62-2 | Vanadium | 21.585 | 26.774 | 24 | 7 | 7 | 100.00% | 39 | |
| Metals | 7440-66-6 | Zinc | 33.715 | 277 | 110 | 7 | 7 | 100.00% | 2,300 | |
| PAHs | 83-32-9 | Acenaphthene | 0.0086 | 0.0273 | 0.015 | 3 | 3 | 100.00% | 370 | |
| PAHs | 120-12-7 | Anthracene | 0.0285 | 0.6617 | 0.33 | 3 | 3 | 100.00% | 2,200 | |
| PAHs | 56-55-3 | Benzo(a)anthracene | 0.2152 | 0.3252 | 0.25 | 3 | 3 | 100.00% | 0.887 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.0659 | 0.2641 | 0.15 | 5 | 5 | 100.00% | 0.735 | |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.104 | 0.4697 | 0.31 | 4 | 4 | 100.00% | 0.626 | |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.1523 | 0.2008 | 0.17 | 3 | 3 | 100.00% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.0792 | 0.1259 | 0.094 | 4 | 4 | 100.00% | 1.5 | |
| PAHs | 218-01-9 | Chrysene | 0.1871 | 0.3296 | 0.24 | 3 | 3 | 100.00% | 15 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.0357 | 0.0411 | 0.038 | 3 | 3 | 100.00% | 0.303 | |
| PAHs | 206-44-0 | Fluoranthene | 0.51 | 0.83 | 0.62 | 3 | 3 | 100.00% | 230 | |
| PAHs | 86-73-7 | Fluorene | 0.0076 | 0.0253 | 0.014 | 3 | 3 | 100.00% | 260 | |

**APPENDIX Q**
**TABLE 3.10**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit H
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.1766 | 0.1779 | 0.18 | 3 | 3 | 100.00% | 0.415 | |
| PAHs | 91-20-3 | Naphthalene | 0.0038 | 0.0038 | 0.0038 | 1 | 1 | 100.00% | 12 | |
| PAHs | 85-01-8 | Phenanthrene | 0.1529 | 0.4365 | 0.25 | 3 | 3 | 100.00% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.3053 | 0.6045 | 0.41 | 3 | 3 | 100.00% | 230 | |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**

**TABLE 3.11**

Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit I

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 7161.8 | 9440 | 8,180 | 8 | 8 | 100.00% | 7,700 | Yes |
| Metals | 7440-36-0 | Antimony | 2.14 | 2.14 | 2.1 | 1 | 4 | 25.00% | 3.1 | |
| Metals | 7440-38-2 | Arsenic | 7.009738 | 8.952692 | 8.0 | 2 | 6 | 33.33% | 12.3 | |
| Metals | 7440-39-3 | Barium | 114 | 293 | 186 | 8 | 8 | 100.00% | 1,600 | |
| Metals | 7440-41-7 | Beryllium | 0.3 | 0.629 | 0.46 | 6 | 8 | 75.00% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.43 | 1.16 | 0.69 | 6 | 8 | 75.00% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 2797 | 12800 | 6,423 | 8 | 8 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 9.4574 | 19.2 | 14 | 6 | 8 | 75.00% | 38 | |
| Metals | 7440-48-4 | Cobalt | 7.3 | 9.64 | 8.6 | 6 | 6 | 100.00% | 900 | |
| Metals | 7440-50-8 | Copper | 14.5 | 35.6 | 22 | 6 | 8 | 75.00% | 290 | |
| Metals | 7439-89-6 | Iron | 13876 | 17800 | 15,669 | 8 | 8 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 23.4 | 165 | 66 | 8 | 8 | 100.00% | 400 | |
| Metals | 7439-95-4 | Magnesium | 1852 | 5930 | 3,040 | 8 | 8 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 562 | 1120 | 790 | 8 | 8 | 100.00% | 350 | Yes |
| Metals | 7439-97-6 | Mercury | 0.054 | 0.054 | 0.054 | 1 | 6 | 16.67% | 2.3 | |
| Metals | 7440-02-0 | Nickel | 15.2 | 30.5 | 20 | 8 | 8 | 100.00% | 130 | |
| Metals | 7440-09-7 | Potassium | 921.89 | 2220 | 1,349 | 8 | 8 | 100.00% | - | |
| Metals | 7440-23-5 | Sodium | 20.483 | 461 | 140 | 8 | 8 | 100.00% | - | |
| Metals | 7440-28-0 | Thallium | 5.78 | 5.78 | 5.8 | 1 | 4 | 25.00% | 0.7 | Yes |
| Metals | 7440-62-2 | Vanadium | 21.995 | 28.2 | 24 | 6 | 6 | 100.00% | 39 | |
| Metals | 7440-66-6 | Zinc | 58.526 | 164 | 99 | 8 | 8 | 100.00% | 2,300 | |
| PAHs | 120-12-7 | Anthracene | 0.0044 | 0.0044 | 0.0044 | 1 | 2 | 50.00% | 2,200 | |
| PAHs | 56-55-3 | Benzo(a)anthracene | 0.0058 | 0.0761 | 0.041 | 2 | 2 | 100.00% | 0.887 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.0039 | 0.0507 | 0.027 | 2 | 2 | 100.00% | 0.735 | |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.0079 | 0.1117 | 0.060 | 2 | 2 | 100.00% | 0.626 | |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.0039 | 0 0481 | 0.026 | 2 | 2 | 100.00% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.0021 | 0.0273 | 0.015 | 2 | 2 | 100.00% | 1.5 | |
| PAHs | 218-01-9 | Chrysene | 0.0053 | 0.07 | 0.038 | 2 | 2 | 100.00% | 15 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.0099 | 0.0099 | 0.0099 | 1 | 1 | 100.00% | 0.303 | |
| PAHs | 206-44-0 | Fluoranthene | 0.0101 | 0.1284 | 0.069 | 2 | 2 | 100.00% | 230 | |
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.0034 | 0.0423 | 0.023 | 2 | 2 | 100.00% | 0.415 | |
| PAHs | 85-01-8 | Phenanthrene | 0.0049 | 0.0298 | 0.017 | 2 | 2 | 100.00% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.0085 | 0.1057 | 0.057 | 2 | 2 | 100.00% | 230 | |

**Note:**

Concentrations presented in mg/kg

PAH - Polycyclic Aromatic Hydrocarbon

VOC - Volatile Organic Compound

FOD - Frequency of Detection

**Screening Level (SL)**

SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)

The following Screening Levels were used to develop the final SLs used for this comparison.

MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use

MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20

Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.12**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit J
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 4,192.70 | 9,733.40 | 7,377 | 8 | 8 | 100.00% | 7,700 | Yes |
| Metals | 7440-38-2 | Arsenic | 5.729168 | 36.3 | 10 | 22 | 22 | 100.00% | 12.3 | Yes |
| Metals | 7440-39-3 | Barium | 86.202 | 723 | 196 | 13 | 13 | 100.00% | 1,600 | |
| Metals | 7440-41-7 | Beryllium | 0.4 | 0.592 | 0.47 | 7 | 7 | 100.00% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.4 | 1.8 | 0.81 | 9 | 13 | 69.23% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 3,434.90 | 18,438 | 8,846 | 8 | 8 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 3.8462 | 22.1 | 13 | 13 | 13 | 100.00% | 38 | |
| Metals | 7440-48-4 | Cobalt | 5.0503 | 12.4 | 8.7 | 8 | 8 | 100.00% | 900 | |
| Metals | 7440-50-8 | Copper | 11.975 | 410.2 | 77 | 8 | 8 | 100.00% | 290 | Yes |
| Metals | 7439-89-6 | Iron | 9,094.20 | 18,123 | 15,353 | 8 | 8 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 20.5 | 206 | 58 | 13 | 13 | 100.00% | 400 | |
| Metals | 7439-95-4 | Magnesium | 1,398.70 | 5,925 | 2,627 | 8 | 8 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 336.26 | 938.2 | 623 | 8 | 8 | 100.00% | 350 | Yes |
| Metals | 7440-02-0 | Nickel | 9.8616 | 19.6 | 17 | 8 | 8 | 100.00% | 130 | |
| Metals | 7440-09-7 | Potassium | 382.9 | 1326 | 703 | 8 | 8 | 100.00% | - | |
| Metals | 7782-49-2 | Selenium | 0.5 | 0.6 | 0.58 | 4 | 10 | 40.00% | 5 | |
| Metals | 7440-22-4 | Silver | 0.68 | 0.68 | 0.68 | 1 | 6 | 16.67% | 34 | |
| Metals | 7440-23-5 | Sodium | 21.13 | 79.018 | 37 | 8 | 8 | 100.00% | - | |
| Metals | 7440-28-0 | Thallium | 0.2 | 8.64 | 2.4 | 4 | 4 | 100.00% | 0.7 | Yes |
| Metals | 7440-62-2 | Vanadium | 13.856 | 30.5 | 25 | 8 | 8 | 100.00% | 39 | |
| Metals | 7440-66-6 | Zinc | 51.36 | 127 | 78 | 8 | 8 | 100.00% | 2,300 | |
| PAHs | 83-32-9 | Acenaphthene | 0.0062 | 0.0756 | 0.034 | 7 | 7 | 100.00% | 370 | |
| PAHs | 120-12-7 | Anthracene | 0.011 | 35.53 | 5.1 | 7 | 7 | 100.00% | 2,200 | |
| PAHs | 56-55-3 | Benzo(a)anthracene | 0.059 | 0.5515 | 0.28 | 7 | 7 | 100.00% | 0.887 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.0472 | 0.4343 | 0.20 | 11 | 11 | 100.00% | 0.735 | |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.0172 | 0.7669 | 0.33 | 10 | 10 | 100.00% | 0.626 | Yes |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.044 | 0.3388 | 0.15 | 9 | 9 | 100.00% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.0243 | 0.31 | 0.12 | 9 | 9 | 100.00% | 1.5 | |
| PAHs | 218-01-9 | Chrysene | 0.0516 | 0.5776 | 0.26 | 7 | 7 | 100.00% | 15 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.0229 | 0.0693 | 0.039 | 7 | 7 | 100.00% | 0.303 | |
| PAHs | 206-44-0 | Fluoranthene | 0.1394 | 1.5901 | 0.72 | 7 | 7 | 100.00% | 230 | |

**APPENDIX Q**
**TABLE 3.12**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit J
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| PAHs | 86-73-7 | Fluorene | 0.0034 | 0.0613 | 0.029 | 7 | 7 | 100.00% | 260 | |
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.0483 | 0.3144 | 0.15 | 8 | 8 | 100.00% | 0.415 | |
| PAHs | 91-20-3 | Naphthalene | 0.0031 | 0.0145 | 0.0060 | 5 | 5 | 100.00% | 12 | |
| PAHs | 85-01-8 | Phenanthrene | 0.0538 | 0.9221 | 0.40 | 7 | 7 | 100.00% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.0889 | 1.0396 | 0.49 | 7 | 7 | 100.00% | 230 | |
| VOCs | 56-23-5 | Carbon tetrachloride | 0.0043 | 0.0043 | 0.0043 | 1 | 1 | 100.00% | 0.07 | |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.13**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit K
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 5,136.10 | 10,700 | 8,546 | 12 | 12 | 100.00% | 7,700 | Yes |
| Metals | 7440-36-0 | Antimony | 1.4 | 2.59 | 2.0 | 2 | 6 | 33.33% | 3.1 | |
| Metals | 7440-38-2 | Arsenic | 4.93 | 7.24647 | 6.3 | 7 | 9 | 77.78% | 12.3 | |
| Metals | 7440-39-3 | Barium | 0 | 279 | 163 | 12 | 12 | 100.00% | 1,600 | |
| Metals | 7440-41-7 | Beryllium | 0.4 | 0.538 | 0.46 | 8 | 12 | 66.67% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.409 | 1.52 | 0.81 | 8 | 12 | 66.67% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 3,519 | 52,527 | 9,675 | 12 | 12 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 11.067 | 15.8 | 14 | 8 | 12 | 66.67% | 38 | |
| Metals | 7440-48-4 | Cobalt | 6.6634 | 9.82 | 8.1 | 8 | 9 | 88.89% | 900 | |
| Metals | 7440-50-8 | Copper | 14.542 | 115.32 | 39 | 8 | 12 | 66.67% | 290 | |
| Metals | 7439-89-6 | Iron | 4,600 | 17,500 | 14,698 | 12 | 12 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 17.816 | 154 | 58 | 12 | 12 | 100.00% | 400 | |
| Metals | 7439-95-4 | Magnesium | 1,828.50 | 12,303 | 3,955 | 12 | 12 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 539.37 | 1,050 | 748 | 12 | 12 | 100.00% | 350 | Yes |
| Metals | 7439-97-6 | Mercury | 0.056 | 0.057 | 0.057 | 2 | 8 | 25.00% | 2.3 | |
| Metals | 7440-02-0 | Nickel | 14.419 | 29.5 | 20 | 12 | 12 | 100.00% | 130 | |
| Metals | 7440-09-7 | Potassium | 463.6 | 1,530 | 1,120 | 12 | 12 | 100.00% | - | |
| Metals | 7440-23-5 | Sodium | 16.379 | 495 | 180 | 12 | 12 | 100.00% | - | |
| Metals | 7440-28-0 | Thallium | 7.67 | 7.67 | 7.7 | 1 | 5 | 20.00% | 0.7 | Yes |
| Metals | 7440-62-2 | Vanadium | 18.389 | 48.7 | 27 | 9 | 9 | 100.00% | 39 | Yes |
| Metals | 7440-66-6 | Zinc | 49.103 | 208.24 | 108 | 12 | 12 | 100.00% | 2,300 | |
| PAHs | 83-32-9 | Acenaphthene | 0.0032 | 0.0145 | 0.0096 | 4 | 4 | 100.00% | 370 | |
| PAHs | 208-96-8 | Acenaphthylene | 0.0039 | 0.0043 | 0.0041 | 2 | 2 | 100.00% | 0.0305 | |
| PAHs | 120-12-7 | Anthracene | 0.0072 | 0.1 | 0.034 | 5 | 5 | 100.00% | 2,200 | |
| PAHs | 56-55-3 | Benzo(a)anthracene | 0.0488 | 0.29 | 0.15 | 5 | 5 | 100.00% | 0.887 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.0438 | 0.1878 | 0.10 | 5 | 5 | 100.00% | 0.735 | |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.0773 | 0.48 | 0.24 | 5 | 5 | 100.00% | 0.626 | |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.035 | 0.1538 | 0.081 | 4 | 4 | 100.00% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.0198 | 0.15 | 0.069 | 5 | 5 | 100.00% | 1.5 | |
| PAHs | 218-01-9 | Chrysene | 0.0568 | 0.53 | 0.21 | 5 | 5 | 100.00% | 15 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.0066 | 0.032 | 0.017 | 4 | 4 | 100.00% | 0.303 | |

**APPENDIX Q**
**TABLE 3.13**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit K
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| PAHs | 206-44-0 | Fluoranthene | 0.1058 | 0.91 | 0.39 | 5 | 5 | 100.00% | 230 | |
| PAHs | 86-73-7 | Fluorene | 0.002 | 0.0094 | 0.0059 | 4 | 4 | 100.00% | 260 | |
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.0327 | 0.1488 | 0.074 | 4 | 4 | 100.00% | 0.415 | |
| PAHs | 91-20-3 | Naphthalene | 0.0025 | 0.0072 | 0.0041 | 3 | 3 | 100.00% | 12 | |
| PAHs | 85-01-8 | Phenanthrene | 0.04 | 0.6 | 0.21 | 5 | 5 | 100.00% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.0926 | 0.65 | 0.30 | 5 | 5 | 100.00% | 230 | |
| VOCs | 56-23-5 | Carbon tetrachloride | 0.003 | 0.003 | 0.0030 | 1 | 1 | 100.00% | 0.07 | |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.14**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit L
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7429-90-5 | Aluminum | 5,510.80 | 8,681 | 7,523 | 6 | 6 | 100.00% | 7,700 | Yes |
| Metals | 7440-36-0 | Antimony | 1.2 | 1.2 | 1.2 | 1 | 5 | 20.00% | 3.1 | |
| Metals | 7440-38-2 | Arsenic | 4.38 | 10.3 | 8.2 | 4 | 6 | 66.67% | 12.3 | |
| Metals | 7440-39-3 | Barium | 122 | 216 | 149 | 6 | 6 | 100.00% | 1,600 | |
| Metals | 7440-41-7 | Beryllium | 0.3 | 0.603 | 0.49 | 5 | 7 | 71.43% | 16 | |
| Metals | 7440-43-9 | Cadmium | 0.7 | 1.32 | 0.96 | 5 | 7 | 71.43% | 3.9 | |
| Metals | 7440-70-2 | Calcium | 4,067 | 10,060 | 5,497 | 7 | 7 | 100.00% | - | |
| Metals | 7440-47-3 | Chromium | 9.1 | 20.8 | 15 | 5 | 7 | 71.43% | 38 | |
| Metals | 7440-48-4 | Cobalt | 7.2 | 9.42 | 8.4 | 5 | 6 | 83.33% | 900 | |
| Metals | 7440-50-8 | Copper | 18.8 | 38 | 29 | 5 | 7 | 71.43% | 290 | |
| Metals | 7439-89-6 | Iron | 4,900 | 23,197 | 14,364 | 8 | 8 | 100.00% | 5,500 | Yes |
| Metals | 7439-92-1 | Lead | 14.9 | 510 | 137 | 8 | 8 | 100.00% | 400 | Yes |
| Metals | 7439-95-4 | Magnesium | 1,806 | 4,510 | 2,682 | 7 | 7 | 100.00% | - | |
| Metals | 7439-96-5 | Manganese | 528.3 | 1,050 | 720 | 7 | 7 | 100.00% | 350 | Yes |
| Metals | 7439-97-6 | Mercury | 0.079 | 0.079 | 0.079 | 1 | 6 | 16.67% | 2.3 | |
| Metals | 7440-02-0 | Nickel | 13.5 | 29.2 | 18 | 6 | 7 | 85.71% | 130 | |
| Metals | 7440-09-7 | Potassium | 454.5 | 1,240 | 994 | 7 | 7 | 100.00% | - | |
| Metals | 7782-49-2 | Selenium | 0.6 | 6.42 | 4.2 | 3 | 6 | 50.00% | 5 | Yes |
| Metals | 7440-23-5 | Sodium | 32.3 | 412 | 141 | 7 | 7 | 100.00% | - | |
| Metals | 7440-28-0 | Thallium | 2.23 | 2.36 | 2.3 | 2 | 5 | 40.00% | 0.7 | Yes |
| Metals | 7440-62-2 | Vanadium | 19.7 | 51.2 | 28 | 6 | 6 | 100.00% | 39 | Yes |
| Metals | 7440-66-6 | Zinc | 86.5 | 213 | 120 | 7 | 7 | 100.00% | 2,300 | |
| PAHs | 120-12-7 | Anthracene | 0.103 | 0.103 | 0.10 | 1 | 2 | 50.00% | 2,200 | |
| PAHs | 56-55-3 | Benz(a)anthracene | 0.505 | 0.505 | 0.51 | 1 | 1 | 100.00% | 0.887 | |
| PAHs | 50-32-8 | Benzo(a)pyrene | 0.475 | 0.475 | 0.48 | 1 | 1 | 100.00% | 0.735 | |
| PAHs | 205-99-2 | Benzo(b)fluoranthene | 0.604 | 0.604 | 0.60 | 1 | 2 | 50.00% | 0.626 | |
| PAHs | 191-24-2 | Benzo(g,h,i)perylene | 0.242 | 0.242 | 0.24 | 1 | 1 | 100.00% | 0.478 | |
| PAHs | 207-08-9 | Benzo(k)fluoranthene | 0.238 | 0.238 | 0.24 | 1 | 2 | 50.00% | 1.5 | |
| PAHs | 218-01-9 | Chrysene | 0.22 | 0.512 | 0.37 | 2 | 2 | 100.00% | 15 | |
| PAHs | 53-70-3 | Dibenz(a,h)anthracene | 0.0652 | 0.0652 | 0.065 | 1 | 1 | 100.00% | 0.303 | |
| PAHs | 206-44-0 | Fluoranthene | 0.29 | 1.14 | 0.72 | 2 | 2 | 100.00% | 230 | |

**APPENDIX Q**
**TABLE 3.14**
Summary of On-Site Soil Data Collected from 0-10 feet Depth Interval - Exposure Unit L
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical Group | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | Max Detect Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| PAHs | 193-39-5 | Indeno(1,2,3-cd)pyrene | 0.211 | 0.211 | 0.21 | 1 | 1 | 100.00% | 0.415 | |
| PAHs | 91-20-3 | Naphthalene | 0.0087 | 0.0087 | 0.0087 | 1 | 15 | 6.67% | 12 | |
| PAHs | 85-01-8 | Phenanthrene | 0.13 | 0.527 | 0.33 | 2 | 2 | 100.00% | 1.04 | |
| PAHs | 129-00-0 | Pyrene | 0.22 | 0.901 | 0.56 | 2 | 2 | 100.00% | 230 | |
| VOCs | 75-35-4 | 1,1-Dichloroethene | 0.00086 | 0.00086 | 8.60E-04 | 1 | 14 | 7.14% | 0.06 | |
| VOCs | 120-82-1 | 1,2,4-Trichlorobenzene | 0.0021 | 0.0021 | 0.0021 | 1 | 14 | 7.14% | 5 | |
| VOCs | 95-63-6 | 1,2,4-Trimethylbenzene | 0.011 | 0.011 | 0.011 | 1 | 14 | 7.14% | 5.7 | |
| VOCs | 95-50-1 | 1,2-Dichlorobenzene | 0.0055 | 0.0055 | 0.0055 | 1 | 14 | 7.14% | 17 | |
| VOCs | 108-67-8 | 1,3,5-Trimethylbenzene | 0.00089 | 0.0051 | 0.0030 | 2 | 14 | 14.29% | 2.1 | |
| VOCs | 541-73-1 | 1,3-Dichlorobenzene | 0.00078 | 0.00078 | 7.80E-04 | 1 | 14 | 7.14% | 6.9 | |
| VOCs | 99-87-6 | 4-Isopropyltoluene | 0.0015 | 0.0015 | 0.0015 | 1 | 14 | 7.14% | - | |
| VOCs | 156-59-2 | cis-1,2-Dichloroethene | 0.00067 | 0.7 | 0.12 | 13 | 18 | 72.22% | 0.4 | Yes |
| VOCs | 104-51-8 | n-Butylbenzene | 0.0025 | 0.0025 | 0.0025 | 1 | 14 | 7.14% | 14 | |
| VOCs | 127-18-4 | Tetrachloroethene | 0.00046 | 6.4 | 0.77 | 17 | 18 | 94.44% | 0.06 | Yes |
| VOCs | 108-88-3 | Toluene | 0.00066 | 0.001 | 7.80E-04 | 3 | 14 | 21.43% | 12 | |
| VOCs | 156-60-5 | trans-1,2-Dichloroethene | 0.00062 | 0.036 | 0.0085 | 8 | 18 | 44.44% | 0.7 | |
| VOCs | 79-01-6 | Trichloroethene | 0.0011 | 0.81 | 0.17 | 13 | 18 | 72.22% | 0.043 | Yes |

**Note:**
Concentrations presented in mg/kg
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.15**
Summary of Groundwater Data Collected Downgradient of Former Building 220 - Residential
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| MethodType | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | MaxDet Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7439-89-6 | Iron | 6.62 | 6.62 | 6.6 | 1 | 2 | 50.00% | 2,600 | |
| Metals | 7439-96-5 | Manganese | 14.5 | 283 | 149 | 2 | 2 | 100.00% | 170 | Yes |
| PAHs | 91-20-3 | Naphthalene | 10.1 | 10.1 | 10 | 1 | 14 | 7.14% | 0.62 | Yes |
| VOCs | 630-20-6 | 1,1,1,2-Tetrachloroethane | 16 | 16 | 16 | 1 | 21 | 4.76% | 0.43 | Yes |
| VOCs | 79-34-5 | 1,1,2,2-Tetrachloroethane | 0.58 | 0.58 | 0.58 | 1 | 21 | 4.76% | 0.055 | Yes |
| VOCs | 79-00-5 | 1,1,2-Trichloroethane | 2.3 | 2.3 | 2.3 | 1 | 14 | 7.14% | 0.2 | Yes |
| VOCs | 75-35-4 | 1,1-Dichloroethene | 0.52 | 3.8 | 1.8 | 3 | 21 | 14.29% | 34 | |
| VOCs | 107-06-2 | 1,2-Dichloroethane (EDC) | 3.3 | 189 | 111 | 4 | 21 | 19.05% | 0.12 | Yes |
| VOCs | 67-64-1 | Acetone | 4.6 | 9.3 | 6.6 | 3 | 14 | 21.43% | 550 | |
| VOCs | 71-43-2 | Benzene | 0.22 | 4 | 2.1 | 2 | 21 | 9.52% | 0.35 | Yes |
| VOCs | 75-15-0 | Carbon disulfide | 0.57 | 2.9 | 1.4 | 3 | 14 | 21.43% | 100 | |
| VOCs | 56-23-5 | Carbon tetrachloride | 2.7 | 4,160 | 2,081 | 2 | 21 | 9.52% | 0.17 | Yes |
| VOCs | 67-66-3 | Chloroform | 0.35 | 790 | 209 | 4 | 21 | 19.05% | 0.17 | Yes |
| VOCs | 74-87-3 | Chloromethane | 0.45 | 0.46 | 0.46 | 2 | 21 | 9.52% | 19 | |
| VOCs | 156-59-2 | cis-1,2-Dichloroethene | 1.5 | 281 | 85 | 8 | 21 | 38.10% | 6.1 | Yes |
| VOCs | 100-41-4 | Ethylbenzene | 0.28 | 0.39 | 0.33 | 3 | 21 | 14.29% | 130 | |
| VOCs | 74-88-4 | Iodomethane | 1.2 | 1.2 | 1.2 | 1 | 14 | 7.14% | - | |
| VOCs | 1634-04-4 | Methyl tert-butyl ether (MTBE) | 1.1 | 1.1 | 1.1 | 1 | 14 | 7.14% | 10.6 | |
| VOCs | 127-18-4 | Tetrachloroethene | 0.64 | 34,900 | 9,006 | 9 | 21 | 42.86% | 0.1 | Yes |
| VOCs | 108-88-3 | Toluene | 3.7 | 3.7 | 3.7 | 1 | 14 | 7.14% | 230 | |
| VOCs | 156-60-5 | trans-1,2-Dichloroethene | 0.54 | 12 | 3.5 | 4 | 21 | 19.05% | 11 | Yes |
| VOCs | 79-01-6 | Trichloroethene | 0.41 | 1,620 | 393 | 11 | 21 | 52.38% | 0.028 | Yes |
| VOCs | 75-01-4 | Vinyl chloride | 0.32 | 0.32 | 0.32 | 1 | 21 | 4.76% | 0.015 | Yes |
| VOCs | 108-38-3/1 | Xylene, m-, p- | 0.72 | 10.6 | 4.1 | 3 | 21 | 14.29% | 21 | |
| VOCs | 95-47-6 | Xylene, o- | 0.23 | 13.2 | 6.7 | 2 | 14 | 14.29% | 20 | |

**Note:**
Concentrations presented in µg/L
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.

EPA SL = Environmental Protection Agency Screening Level for protection of indoor air based on a target risk of $1x10^{-6}$
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential water
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

**APPENDIX Q**
**TABLE 3.16**
Summary of Groundwater Data Collected Downgradient of Former Building 220 - On-Site Excavations
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| MethodType | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | MaxDet Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7439-89-6 | Iron | 6.6 | 6.6 | 6.6 | 1 | 1 | 100.00% | 2,600 | |
| Metals | 7439-96-5 | Manganese | 14.5 | 14.5 | 14.5 | 1 | 1 | 100.00% | 170 | |
| PAHs | 91-20-3 | Naphthalene | 10.1 | 10.1 | 10.1 | 1 | 4 | 25.00% | 0.62 | Yes |
| VOCs | 630-20-6 | 1,1,1,2-Tetrachloroethane | 16 | 16 | 16.0 | 1 | 5 | 20.00% | 0.43 | Yes |
| VOCs | 79-34-5 | 1,1,2,2-Tetrachloroethane | 0.58 | 0.58 | 0.6 | 1 | 4 | 25.00% | 0.055 | Yes |
| VOCs | 79-00-5 | 1,1,2-Trichloroethane | 2.3 | 2.3 | 2.3 | 1 | 4 | 25.00% | 0.2 | Yes |
| VOCs | 75-35-4 | 1,1-Dichloroethene | 3.8 | 3.8 | 3.8 | 1 | 4 | 25.00% | 34 | |
| VOCs | 107-06-2 | 1,2-Dichloroethane (EDC) | 3.3 | 189 | 96.2 | 2 | 6 | 33.33% | 0.12 | Yes |
| VOCs | 67-64-1 | Acetone | 6 | 6 | 6.0 | 1 | 5 | 20.00% | 550 | |
| VOCs | 71-43-2 | Benzene | 0.22 | 4 | 2.1 | 2 | 6 | 33.33% | 0.35 | Yes |
| VOCs | 75-15-0 | Carbon disulfide | 0.53 | 2.9 | 1.1 | 4 | 7 | 57.14% | 100 | |
| VOCs | 56-23-5 | Carbon tetrachloride | 2.7 | 4,160 | 2,081.0 | 2 | 6 | 33.33% | 0.17 | Yes |
| VOCs | 67-66-3 | Chloroform | 20 | 790 | 277.9 | 3 | 5 | 60.00% | 0.17 | Yes |
| VOCs | 74-87-3 | Chloromethane | 0.45 | 0.45 | 0.5 | 1 | 5 | 20.00% | 19 | |
| VOCs | 156-59-2 | cis-1,2-Dichloroethene | 250 | 281 | 265.5 | 2 | 5 | 40.00% | 6.1 | Yes |
| VOCs | 100-41-4 | Ethylbenzene | 0.28 | 0.39 | 0.3 | 2 | 5 | 40.00% | 130 | |
| VOCs | 127-18-4 | Tetrachloroethene | 0.64 | 34,900 | 10,651.0 | 6 | 8 | 75.00% | 0.1 | Yes |
| VOCs | 108-88-3 | Toluene | 3.7 | 3.7 | 3.7 | 1 | 3 | 33.33% | 230 | |
| VOCs | 156-60-5 | trans-1,2-Dichloroethene | 12 | 12 | 12.0 | 1 | 5 | 20.00% | 11 | Yes |
| VOCs | 79-01-6 | Trichloroethene | 0.41 | 1620 | 812.2 | 5 | 7 | 71.43% | 0.028 | Yes |
| VOCs | 75-01-4 | Vinyl chloride | 0.32 | 0.32 | 0.3 | 1 | 1 | 100.00% | 0.015 | Yes |
| VOCs | 108-38-3/1 | Xylene, m-, p- | 0.72 | 10.6 | 4.1 | 3 | 7 | 42.86% | 21 | |
| VOCs | 95-47-6 | Xylene, o- | 0.23 | 13.2 | 6.7 | 2 | 5 | 40.00% | 20 | |

**Note:**
Concentrations presented in μg/L
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
EPA SL = Environmental Protection Agency Screening Level for protection of indoor air based on a target risk of $1x10^{-6}$
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential water
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

**APPENDIX Q**
**TABLE 3.17**
Summary of Off-site Groundwater Data
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| MethodType | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | MaxDet Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| Metals | 7439-96-5 | Manganese | 283 | 2,010 | 1,147 | 2 | 2 | 100.00% | 170 | Yes |
| VOCs | 75-35-4 | 1,1-Dichloroethene | 0.52 | 0.96 | 0.74 | 2 | 12 | 16.67% | 34 | |
| VOCs | 107-06-2 | 1,2-Dichloroethane (EDC) | 3 | 150 | 84 | 3 | 12 | 25.00% | 0.12 | Yes |
| VOCs | 67-64-1 | Acetone | 4.6 | 9.3 | 7.0 | 2 | 8 | 25.00% | 550 | |
| VOCs | 67-66-3 | Chloroform | 0.35 | 0.35 | 0.35 | 1 | 12 | 8.33% | 0.17 | Yes |
| VOCs | 74-87-3 | Chloromethane | 0.46 | 0.46 | 0.46 | 1 | 12 | 8.33% | 19 | |
| VOCs | 156-59-2 | cis-1,2-Dichloroethene | 1.5 | 82.2 | 25 | 6 | 12 | 50.00% | 6.1 | Yes |
| VOCs | 100-41-4 | Ethylbenzene | 0.31 | 0.68 | 0.50 | 2 | 12 | 16.67% | 130 | |
| VOCs | 74-88-4 | Iodomethane | 1.2 | 1.2 | 1.2 | 1 | 8 | 12.50% | - | |
| VOCs | 1634-04-4 | Methyl tert-butyl ether (MTBE) | 1.1 | 1.1 | 1.1 | 1 | 8 | 12.50% | 10.6 | |
| VOCs | 127-18-4 | Tetrachloroethene | 2.9 | 9,440 | 4,287 | 4 | 12 | 33.33% | 0.1 | Yes |
| VOCs | 156-60-5 | trans-1,2-Dichloroethene | 0.54 | 0.93 | 0.69 | 3 | 12 | 25.00% | 11 | |
| VOCs | 79-01-6 | Trichloroethene | 5.1 | 129 | 43 | 6 | 12 | 50.00% | 0.028 | Yes |
| VOCs | 108-38-3/1 | Xylene, m-, p- | 1.4 | 1.4 | 1.4 | 1 | 12 | 8.33% | 21 | |

**Note:**
Concentrations presented in µg/L
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
EPA SL = Environmental Protection Agency Screening Level for protection of indoor air based on a target risk of $1x10^{-6}$
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential water
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

**APPENDIX Q**
**TABLE 3.18**
Summary of On-site Groundwater Data (Excluding Samples Collected Downgradient of Former Building 220)
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| MethodType | CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | MaxDet Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|
| VOCs | 107-06-2 | 1,2-Dichloroethane (EDC) | 3.3 | 4.4 | 4 | 2 | 4 | 50.00% | 0.12 | Yes |
| VOCs | 67-64-1 | Acetone | 8.8 | 8.8 | 8.8 | 1 | 3 | 33.33% | 550 | |
| VOCs | 56-23-5 | Carbon tetrachloride | 0.38 | 0.38 | 0.38 | 1 | 4 | 25.00% | 0.17 | Yes |

**Note:**
Concentrations presented in µg/L
PAH - Polycyclic Aromatic Hydrocarbon
VOC - Volatile Organic Compound
FOD - Frequency of Detection

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
EPA SL = Environmental Protection Agency Screening Level for protection of indoor air based on a target risk of $1x10^{-6}$
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential water
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

**APPENDIX Q**
**TABLE 3.19**
Summary of Indoor Air Data Collected from Off-site Residence
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| CAS | Analyte | Minimum Detected Concentration | Maximum Detected Concentration | Average Concentration | No. of Detection | No. of Samples | FOD | SL | MaxDet Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|
| 107-06-2 | 1,2-Dichloroethane (EDC) | 0.062 | 0.088 | 0.071 | 4 | 4 | 100% | 0.074 | Yes |
| 156-59-2 | cis-1,2-Dichloroethene | 0.044 | 0.18 | 0.11 | 4 | 4 | 100% | 37 | |
| 127-18-4 | Tetrachloroethene | 0.1 | 0.91 | 0.38 | 3 | 4 | 75% | 0.33 | Yes |
| 156-60-5 | trans-1,2-Dichloroethene | 0.012 | 0.013 | 0.013 | 2 | 4 | 50% | 63 | |
| 79-01-6 | Trichloroethene | 0.13 | 1.1 | 0.45 | 4 | 4 | 100% | 0.017 | Yes |
| 75-01-4 | Vinyl chloride | 0.0047 | 0.0047 | 0.0047 | 1 | 4 | 25% | 0.16 | |

**Note:**
Concentrations presented in $\mu g/m^3$

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for ambient air

**APPENDIX Q**
**TABLE 3.20**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Sitewide Analysis
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_2 | 630-20-6 | 1,1,1,2-Tetrachloroethane | 7 | 7 | mg/kg | 0% | 0.006 | 0.0065 | 7.6 | No |
| SO_Onsite_0_2 | 71-55-6 | 1,1,1-Trichloroethane | 9 | 9 | mg/kg | 0% | 0.006 | 0.0065 | 1,400 | No |
| SO_Onsite_0_2 | 79-34-5 | 1,1,2,2-Tetrachloroethane | 7 | 7 | mg/kg | 0% | 0.006 | 0.0065 | 0.97 | No |
| SO_Onsite_0_2 | 79-00-5 | 1,1,2-Trichloroethane | 7 | 7 | mg/kg | 0% | 0.006 | 0.0065 | 2.1 | No |
| SO_Onsite_0_2 | 75-35-4 | 1,1-Dichloroethene | 6 | 6 | mg/kg | 0% | 0.006 | 0.0065 | 47 | No |
| SO_Onsite_0_2 | 120-82-1 | 1,2,4-Trichlorobenzene | 6 | 6 | mg/kg | 0% | 0.006 | 0.0065 | 26 | No |
| SO_Onsite_0_2 | 95-63-6 | 1,2,4-Trimethylbenzene | 6 | 6 | mg/kg | 0% | 0.00093 | 0.0064 | 19 | No |
| SO_Onsite_0_2 | 95-50-1 | 1,2-Dichlorobenzene | 6 | 6 | mg/kg | 0% | 0.006 | 0.0065 | 370 | No |
| SO_Onsite_0_2 | 107-06-2 | 1,2-Dichloroethane (EDC) | 2 | 2 | mg/kg | 0% | 0.0063 | 0.0064 | 0.84 | No |
| SO_Onsite_0_2 | 108-67-8 | 1,3,5-Trimethylbenzene | 6 | 6 | mg/kg | 0% | 0.006 | 0.0065 | 7.8 | No |
| SO_Onsite_0_2 | 541-73-1 | 1,3-Dichlorobenzene | 6 | 6 | mg/kg | 0% | 0.006 | 0.0065 | 14 | No |
| SO_Onsite_0_2 | 90-12-0 | 1-Methylnaphthalene | 1 | 1 | mg/kg | 0% | 0.243 | 0.243 | 21 | No |
| SO_Onsite_0_2 | 91-57-6 | 2-Methylnaphthalene | 1 | 1 | mg/kg | 0% | 0.243 | 0.243 | 21 | No |
| SO_Onsite_0_2 | 99-87-6 | 4-Isopropyltoluene | 6 | 6 | mg/kg | 0% | 0.006 | 0.0065 | 58 | No |
| SO_Onsite_0_2 | 83-32-9 | Acenaphthene | 1 | 1 | mg/kg | 0% | 0.243 | 0.243 | 3,300 | No |
| SO_Onsite_0_2 | 208-96-8 | Acenaphthylene | 1 | 1 | mg/kg | 0% | 0.243 | 0.243 | 0.0305 | Yes |
| SO_Onsite_0_2 | 120-12-7 | Anthracene | 5 | 5 | mg/kg | 0% | 0.03 | 0.03 | 100,000 | No |
| SO_Onsite_0_2 | 7440-36-0 | Antimony | 37 | 37 | mg/kg | 0% | 3.8 | 3.8 | 45 | No |
| SO_Onsite_0_2 | 7440-38-2 | Arsenic | 21 | 21 | mg/kg | 0% | 0.25 | 0.25 | 12.3 | No |
| SO_Onsite_0_2 | 56-55-3 | Benzo(a)anthracene | 5 | 5 | mg/kg | 0% | 0.17 | 0.17 | 2.3 | No |
| SO_Onsite_0_2 | 205-99-2 | Benzo(b)fluoranthene | 5 | 5 | mg/kg | 0% | 0.21 | 0.21 | 2.3 | No |
| SO_Onsite_0_2 | 207-08-9 | Benzo(k)fluoranthene | 5 | 5 | mg/kg | 0% | 0.07 | 0.07 | 23 | No |
| SO_Onsite_0_2 | 7440-41-7 | Beryllium | 22 | 22 | mg/kg | 0% | 1.8 | 1.8 | 220 | No |
| SO_Onsite_0_2 | 7440-43-9 | Cadmium | 38 | 38 | mg/kg | 0% | 3.05 | 3.05 | 56 | No |
| SO_Onsite_0_2 | 56-23-5 | Carbon tetrachloride | 7 | 7 | mg/kg | 0% | 0.006 | 0.0065 | 0.58 | No |
| SO_Onsite_0_2 | 67-66-3 | Chloroform | 7 | 7 | mg/kg | 0% | 0.006 | 0.0065 | 0.58 | No |
| SO_Onsite_0_2 | 7440-47-3 | Chromium | 20 | 20 | mg/kg | 0% | 12.7 | 12.7 | 500 | No |
| SO_Onsite_0_2 | 218-01-9 | Chrysene | 3 | 3 | mg/kg | 0% | 0.12 | 0.12 | 230 | No |
| SO_Onsite_0_2 | 156-59-2 | cis-1,2-Dichloroethene | 3 | 3 | mg/kg | 0% | 0.0062 | 0.0065 | 16 | No |
| SO_Onsite_0_2 | 7440-48-4 | Cobalt | 7 | 7 | mg/kg | 0% | 15 | 15 | 2,100 | No |
| SO_Onsite_0_2 | 7440-50-8 | Copper | 22 | 22 | mg/kg | 0% | 58.6 | 58.6 | 4,200 | No |

**APPENDIX Q**
**TABLE 3.20**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Sitewide Analysis
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_2 | 57-12-5 | Cyanide | 7 | 7 | mg/kg | 0% | 0.92 | 0.92 | 1,400 | No |
| SO_Onsite_0_2 | 100-41-4 | Ethylbenzene | 7 | 7 | mg/kg | 0% | 0.006 | 0.0065 | 230 | No |
| SO_Onsite_0_2 | 206-44-0 | Fluoranthene | 2 | 2 | mg/kg | 0% | 0.07 | 0.07 | 2,400 | No |
| SO_Onsite_0_2 | 86-73-7 | Fluorene | 1 | 1 | mg/kg | 0% | 0.243 | 0.243 | 2,600 | No |
| SO_Onsite_0_2 | 87-68-3 | Hexachlorobutadiene | 7 | 7 | mg/kg | 0% | 0.006 | 0.0065 | 2.5 | No |
| SO_Onsite_0_2 | 98-82-8 | Isopropylbenzene | 7 | 7 | mg/kg | 0% | 0.006 | 0.0065 | 58 | No |
| SO_Onsite_0_2 | 7439-97-6 | Mercury | 63 | 63 | mg/kg | 0% | 0.05 | 0.05 | 34 | No |
| SO_Onsite_0_2 | 91-20-3 | Naphthalene | 7 | 7 | mg/kg | 0% | 0.0012 | 0.243 | 21 | No |
| SO_Onsite_0_2 | 104-51-8 | n-Butylbenzene | 6 | 6 | mg/kg | 0% | 0.006 | 0.0065 | 240 | No |
| SO_Onsite_0_2 | 7440-02-0 | Nickel | 3 | 3 | mg/kg | 0% | 12.6 | 12.6 | 2,300 | No |
| SO_Onsite_0_2 | 85-01-8 | Phenanthrene | 3 | 3 | mg/kg | 0% | 0.03 | 0.03 | 1.04 | No |
| SO_Onsite_0_2 | 129-00-0 | Pyrene | 2 | 2 | mg/kg | 0% | 0.03 | 0.03 | 3,200 | No |
| SO_Onsite_0_2 | 135-98-8 | sec-Butylbenzene | 7 | 7 | mg/kg | 0% | 0.006 | 0.0065 | 220 | No |
| SO_Onsite_0_2 | 7782-49-2 | Selenium | 60 | 60 | mg/kg | 0% | 0.25 | 0.25 | 570 | No |
| SO_Onsite_0_2 | 7440-22-4 | Silver | 68 | 68 | mg/kg | 0% | 2.5 | 2.5 | 570 | No |
| SO_Onsite_0_2 | 7440-28-0 | Thallium | 36 | 36 | mg/kg | 0% | 31.3 | 31.3 | 79 | No |
| SO_Onsite_0_2 | 108-88-3 | Toluene | 4 | 4 | mg/kg | 0% | 0.006 | 0.0065 | 520 | No |
| SO_Onsite_0_2 | 156-60-5 | trans-1,2-Dichloroethene | 6 | 6 | mg/kg | 0% | 0.0062 | 0.0065 | 20 | No |
| SO_Onsite_0_2 | 79-01-6 | Trichloroethene | 3 | 3 | mg/kg | 0% | 0.006 | 0.0065 | 0.1 | No |
| SO_Onsite_0_2 | 108-38-3/1 | Xylene, m-, p- | 7 | 7 | mg/kg | 0% | 0.006 | 0.0065 | 210 | No |
| SO_Onsite_0_2 | 95-47-6 | Xylene, o- | 7 | 7 | mg/kg | 0% | 0.006 | 0.0065 | 280 | No |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for industrial outdoor worker.
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

SL for Naphthalene used as a surrogate for 1-Methylnaphthalene and 2-Methylnaphthalene.
SL for Isopropylbenzene used as a surrogate for 4-isopropyltoluene.

**APPENDIX Q**
**TABLE 3.21**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-10 ft) - Sitewide Analysis
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10 | 630-20-6 | 1,1,1,2-Tetrachloroethane | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 7.6 | No |
| SO_Onsite_0_10 | 71-55-6 | 1,1,1-Trichloroethane | 18 | 18 | 0% | mg/kg | 0.006 | 0.0065 | 1,400 | No |
| SO_Onsite_0_10 | 79-34-5 | 1,1,2,2-Tetrachloroethane | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 0.97 | No |
| SO_Onsite_0_10 | 79-00-5 | 1,1,2-Trichloroethane | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 2.1 | No |
| SO_Onsite_0_10 | 75-35-4 | 1,1-Dichloroethene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 47 | No |
| SO_Onsite_0_10 | 120-82-1 | 1,2,4-Trichlorobenzene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 26 | No |
| SO_Onsite_0_10 | 95-63-6 | 1,2,4-Trimethylbenzene | 13 | 13 | 0% | mg/kg | 0.00093 | 0.0065 | 19 | No |
| SO_Onsite_0_10 | 95-50-1 | 1,2-Dichlorobenzene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 370 | No |
| SO_Onsite_0_10 | 107-06-2 | 1,2-Dichloroethane (EDC) | 4 | 4 | 0% | mg/kg | 0.0063 | 0.0065 | 0.84 | No |
| SO_Onsite_0_10 | 108-67-8 | 1,3,5-Trimethylbenzene | 12 | 12 | 0% | mg/kg | 0.00083 | 0.0065 | 7.8 | No |
| SO_Onsite_0_10 | 541-73-1 | 1,3-Dichlorobenzene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 14 | No |
| SO_Onsite_0_10 | 90-12-0 | 1-Methylnaphthalene | 1 | 1 | 0% | mg/kg | 0.243 | 0.243 | 21 | No |
| SO_Onsite_0_10 | 91-57-6 | 2-Methylnaphthalene | 1 | 1 | 0% | mg/kg | 0.243 | 0.243 | 21 | No |
| SO_Onsite_0_10 | 99-87-6 | 4-Isopropyltoluene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 58 | No |
| SO_Onsite_0_10 | 83-32-9 | Acenaphthene | 1 | 1 | 0% | mg/kg | 0.243 | 0.243 | 3,300 | No |
| SO_Onsite_0_10 | 208-96-8 | Acenaphthylene | 1 | 1 | 0% | mg/kg | 0.243 | 0.243 | 0.0305 | Yes |
| SO_Onsite_0_10 | 120-12-7 | Anthracene | 6 | 6 | 0% | mg/kg | 0.03 | 0.03 | 100,000 | No |
| SO_Onsite_0_10 | 7440-36-0 | Antimony | 39 | 39 | 0% | mg/kg | 3.8 | 3.8 | 45 | No |
| SO_Onsite_0_10 | 7440-38-2 | Arsenic | 22 | 22 | 0% | mg/kg | 0.25 | 0.25 | 12.3 | No |
| SO_Onsite_0_10 | 56-55-3 | Benzo(a)anthracene | 5 | 5 | 0% | mg/kg | 0.17 | 0.17 | 2.3 | No |
| SO_Onsite_0_10 | 205-99-2 | Benzo(b)fluoranthene | 5 | 5 | 0% | mg/kg | 0.21 | 0.21 | 2.3 | No |
| SO_Onsite_0_10 | 207-08-9 | Benzo(k)fluoranthene | 5 | 5 | 0% | mg/kg | 0.07 | 0.07 | 23 | No |
| SO_Onsite_0_10 | 7440-41-7 | Beryllium | 22 | 22 | 0% | mg/kg | 1.8 | 1.8 | 220 | No |
| SO_Onsite_0_10 | 7440-43-9 | Cadmium | 39 | 39 | 0% | mg/kg | 3.05 | 3.05 | 56 | No |
| SO_Onsite_0_10 | 56-23-5 | Carbon tetrachloride | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 0.58 | No |
| SO_Onsite_0_10 | 67-66-3 | Chloroform | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 0.58 | No |
| SO_Onsite_0_10 | 7440-47-3 | Chromium | 20 | 20 | 0% | mg/kg | 12.7 | 12.7 | 500 | No |
| SO_Onsite_0_10 | 218-01-9 | Chrysene | 3 | 3 | 0% | mg/kg | 0.12 | 0.12 | 230 | No |
| SO_Onsite_0_10 | 156-59-2 | cis-1,2-Dichloroethene | 5 | 5 | 0% | mg/kg | 0.0062 | 0.0065 | 16 | No |
| SO_Onsite_0_10 | 7440-48-4 | Cobalt | 7 | 7 | 0% | mg/kg | 15 | 15 | 2,100 | No |
| SO_Onsite_0_10 | 7440-50-8 | Copper | 22 | 22 | 0% | mg/kg | 58.6 | 58.6 | 4,200 | No |

**APPENDIX Q**
**TABLE 3.21**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-10 ft) - Sitewide Analysis
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10 | 57-12-5 | Cyanide | 7 | 7 | 0% | mg/kg | 0.92 | 0.92 | 1,400 | No |
| SO_Onsite_0_10 | 100-41-4 | Ethylbenzene | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 230 | No |
| SO_Onsite_0_10 | 206-44-0 | Fluoranthene | 2 | 2 | 0% | mg/kg | 0.07 | 0.07 | 2,400 | No |
| SO_Onsite_0_10 | 86-73-7 | Fluorene | 3 | 3 | 0% | mg/kg | 0.243 | 0.243 | 2,600 | No |
| SO_Onsite_0_10 | 87-68-3 | Hexachlorobutadiene | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 2.5 | No |
| SO_Onsite_0_10 | 98-82-8 | Isopropylbenzene | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 58 | No |
| SO_Onsite_0_10 | 7439-97-6 | Mercury | 66 | 66 | 0% | mg/kg | 0.05 | 0.05 | 34 | No |
| SO_Onsite_0_10 | 91-20-3 | Naphthalene | 14 | 14 | 0% | mg/kg | 0.0012 | 0.243 | 21 | No |
| SO_Onsite_0_10 | 104-51-8 | n-Butylbenzene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 240 | No |
| SO_Onsite_0_10 | 7440-02-0 | Nickel | 3 | 3 | 0% | mg/kg | 12.6 | 12.6 | 2,300 | No |
| SO_Onsite_0_10 | 85-01-8 | Phenanthrene | 3 | 3 | 0% | mg/kg | 0.03 | 0.03 | 1.04 | No |
| SO_Onsite_0_10 | 129-00-0 | Pyrene | 2 | 2 | 0% | mg/kg | 0.03 | 0.03 | 3,200 | No |
| SO_Onsite_0_10 | 135-98-8 | sec-Butylbenzene | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 220 | No |
| SO_Onsite_0_10 | 7782-49-2 | Selenium | 63 | 63 | 0% | mg/kg | 0.25 | 0.25 | 570 | No |
| SO_Onsite_0_10 | 7440-22-4 | Silver | 71 | 71 | 0% | mg/kg | 2.5 | 2.5 | 570 | No |
| SO_Onsite_0_10 | 127-18-4 | Tetrachloroethene | 1 | 1 | 0% | mg/kg | 0.0063 | 0.0063 | 1.7 | No |
| SO_Onsite_0_10 | 7440-28-0 | Thallium | 36 | 36 | 0% | mg/kg | 31.3 | 31.3 | 79 | No |
| SO_Onsite_0_10 | 108-88-3 | Toluene | 11 | 11 | 0% | mg/kg | 0.006 | 0.0065 | 520 | No |
| SO_Onsite_0_10 | 156-60-5 | trans-1,2-Dichloroethene | 10 | 10 | 0% | mg/kg | 0.0062 | 0.0065 | 20 | No |
| SO_Onsite_0_10 | 79-01-6 | Trichloroethene | 5 | 5 | 0% | mg/kg | 0.006 | 0.0065 | 0.1 | No |
| SO_Onsite_0_10 | 108-38-3/1 | Xylene, m-, p- | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 210 | No |
| SO_Onsite_0_10 | 95-47-6 | Xylene, o- | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 280 | No |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for industrial outdoor worker.
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

SL for Naphthalene used as a surrogate for 1-Methylnaphthalene and 2-Methylnaphthalene.
SL for Isopropylbenzene used as a surrogate for 4-isopropyltoluene.

**APPENDIX Q**
**TABLE 3.22**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit A
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_A | 120-12-7 | Anthracene | 1 | 1 | 0% | mg/kg | 0.03 | 0.03 | 2,200 | No |
| SO_Onsite_0_10_A | 7440-36-0 | Antimony | 5 | 5 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_A | 7440-38-2 | Arsenic | 4 | 4 | 0% | mg/kg | 0.25 | 1.376 | 12.3 | No |
| SO_Onsite_0_10_A | 56-55-3 | Benzo(a)anthracene | 1 | 1 | 0% | mg/kg | 0.17 | 0.17 | 0.887 | No |
| SO_Onsite_0_10_A | 205-99-2 | Benzo(b)fluoranthene | 1 | 1 | 0% | mg/kg | 0.21 | 0.21 | 0.626 | No |
| SO_Onsite_0_10_A | 207-08-9 | Benzo(k)fluoranthene | 1 | 1 | 0% | mg/kg | 0.07 | 0.07 | 1.5 | No |
| SO_Onsite_0_10_A | 7440-41-7 | Beryllium | 1 | 1 | 0% | mg/kg | 1.8 | 1.8 | 16 | No |
| SO_Onsite_0_10_A | 7440-43-9 | Cadmium | 2 | 2 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_A | 7440-47-3 | Chromium | 1 | 1 | 0% | mg/kg | 12.7 | 12.7 | 38 | No |
| SO_Onsite_0_10_A | 218-01-9 | Chrysene | 1 | 1 | 0% | mg/kg | 0.12 | 0.12 | 15 | No |
| SO_Onsite_0_10_A | 7440-48-4 | Cobalt | 1 | 1 | 0% | mg/kg | 15 | 15 | 900 | No |
| SO_Onsite_0_10_A | 7440-50-8 | Copper | 1 | 1 | 0% | mg/kg | 58.6 | 58.6 | 290 | No |
| SO_Onsite_0_10_A | 57-12-5 | Cyanide | 1 | 1 | 0% | mg/kg | 0.92 | 0.92 | 120 | No |
| SO_Onsite_0_10_A | 7439-97-6 | Mercury | 3 | 3 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_A | 7440-02-0 | Nickel | 1 | 1 | 0% | mg/kg | 12.6 | 12.6 | 130 | No |
| SO_Onsite_0_10_A | 85-01-8 | Phenanthrene | 1 | 1 | 0% | mg/kg | 0.03 | 0.03 | 1.04 | No |
| SO_Onsite_0_10_A | 7782-49-2 | Selenium | 4 | 4 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_A | 7440-22-4 | Silver | 5 | 5 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |
| SO_Onsite_0_10_A | 7440-28-0 | Thallium | 5 | 5 | 0% | mg/kg | 31.3 | 31.3 | 0.7 | Yes |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.23**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit B
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_B | 7440-36-0 | Antimony | 3 | 3 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_B | 7440-38-2 | Arsenic | 2 | 2 | 0% | mg/kg | 0.25 | 1.376 | 12.3 | No |
| SO_Onsite_0_10_B | 7440-41-7 | Beryllium | 1 | 1 | 0% | mg/kg | 1.8 | 1.8 | 16 | No |
| SO_Onsite_0_10_B | 7440-43-9 | Cadmium | 3 | 3 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_B | 7440-47-3 | Chromium | 1 | 1 | 0% | mg/kg | 12.7 | 12.7 | 38 | No |
| SO_Onsite_0_10_B | 7440-50-8 | Copper | 1 | 1 | 0% | mg/kg | 58.6 | 58.6 | 290 | No |
| SO_Onsite_0_10_B | 7439-97-6 | Mercury | 5 | 5 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_B | 7782-49-2 | Selenium | 6 | 6 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_B | 7440-22-4 | Silver | 7 | 7 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |
| SO_Onsite_0_10_B | 7440-28-0 | Thallium | 6 | 6 | 0% | mg/kg | 31.3 | 31.3 | 0.7 | Yes |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.24**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit C
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_C | 7440-36-0 | Antimony | 1 | 1 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_C | 7440-38-2 | Arsenic | 1 | 1 | 0% | mg/kg | 0.25 | 1.376 | 12.3 | No |
| SO_Onsite_0_10_C | 7440-43-9 | Cadmium | 1 | 1 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_C | 7439-97-6 | Mercury | 2 | 2 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_C | 7782-49-2 | Selenium | 2 | 2 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_C | 7440-22-4 | Silver | 2 | 2 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |
| SO_Onsite_0_10_C | 7440-28-0 | Thallium | 2 | 2 | 0% | mg/kg | 31.3 | 31.3 | 0.7 | Yes |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.25**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit D
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_D | 7440-36-0 | Antimony | 3 | 3 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_D | 7440-41-7 | Beryllium | 2 | 2 | 0% | mg/kg | 1.8 | 1.8 | 16 | No |
| SO_Onsite_0_10_D | 7440-43-9 | Cadmium | 2 | 2 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_D | 7440-47-3 | Chromium | 1 | 1 | 0% | mg/kg | 12.7 | 12.7 | 38 | No |
| SO_Onsite_0_10_D | 7440-50-8 | Copper | 2 | 2 | 0% | mg/kg | 58.6 | 58.6 | 290 | No |
| SO_Onsite_0_10_D | 7439-97-6 | Mercury | 5 | 5 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_D | 7782-49-2 | Selenium | 3 | 3 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_D | 7440-22-4 | Silver | 5 | 5 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.26**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit E
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_E | 120-12-7 | Anthracene | 1 | 1 | 0% | mg/kg | 0.03 | 0.03 | 2,200 | No |
| SO_Onsite_0_10_E | 7440-36-0 | Antimony | 4 | 4 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_E | 56-55-3 | Benzo(a)anthracene | 1 | 1 | 0% | mg/kg | 0.17 | 0.17 | 0.887 | No |
| SO_Onsite_0_10_E | 205-99-2 | Benzo(b)fluoranthene | 1 | 1 | 0% | mg/kg | 0.21 | 0.21 | 0.626 | No |
| SO_Onsite_0_10_E | 207-08-9 | Benzo(k)fluoranthene | 1 | 1 | 0% | mg/kg | 0.07 | 0.07 | 1.5 | No |
| SO_Onsite_0_10_E | 7440-41-7 | Beryllium | 2 | 2 | 0% | mg/kg | 1.8 | 1.8 | 16 | No |
| SO_Onsite_0_10_E | 7440-43-9 | Cadmium | 4 | 4 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_E | 7440-47-3 | Chromium | 1 | 1 | 0% | mg/kg | 12.7 | 12.7 | 38 | No |
| SO_Onsite_0_10_E | 218-01-9 | Chrysene | 1 | 1 | 0% | mg/kg | 0.12 | 0.12 | 15 | No |
| SO_Onsite_0_10_E | 7440-48-4 | Cobalt | 1 | 1 | 0% | mg/kg | 15 | 15 | 900 | No |
| SO_Onsite_0_10_E | 7440-50-8 | Copper | 2 | 2 | 0% | mg/kg | 58.6 | 58.6 | 290 | No |
| SO_Onsite_0_10_E | 57-12-5 | Cyanide | 1 | 1 | 0% | mg/kg | 0.92 | 0.92 | 120 | No |
| SO_Onsite_0_10_E | 7439-97-6 | Mercury | 5 | 5 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_E | 85-01-8 | Phenanthrene | 1 | 1 | 0% | mg/kg | 0.03 | 0.03 | 1.04 | No |
| SO_Onsite_0_10_E | 7782-49-2 | Selenium | 7 | 7 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_E | 7440-22-4 | Silver | 6 | 6 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |
| SO_Onsite_0_10_E | 7440-28-0 | Thallium | 4 | 4 | 0% | mg/kg | 31.3 | 31.3 | 0.7 | Yes |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.27**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit F
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_F | 120-12-7 | Anthracene | 1 | 1 | 0% | mg/kg | 0.03 | 0.03 | 2,200 | No |
| SO_Onsite_0_10_F | 7440-36-0 | Antimony | 2 | 2 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_F | 7440-38-2 | Arsenic | 3 | 3 | 0% | mg/kg | 0.25 | 0.25 | 12.3 | No |
| SO_Onsite_0_10_F | 56-55-3 | Benzo(a)anthracene | 1 | 1 | 0% | mg/kg | 0.17 | 0.17 | 0.887 | No |
| SO_Onsite_0_10_F | 205-99-2 | Benzo(b)fluoranthene | 1 | 1 | 0% | mg/kg | 0.21 | 0.21 | 0.626 | No |
| SO_Onsite_0_10_F | 207-08-9 | Benzo(k)fluoranthene | 1 | 1 | 0% | mg/kg | 0.07 | 0.07 | 1.5 | No |
| SO_Onsite_0_10_F | 7440-41-7 | Beryllium | 4 | 4 | 0% | mg/kg | 1.8 | 1.8 | 16 | No |
| SO_Onsite_0_10_F | 7440-43-9 | Cadmium | 8 | 8 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_F | 7440-47-3 | Chromium | 4 | 4 | 0% | mg/kg | 12.7 | 12.7 | 38 | No |
| SO_Onsite_0_10_F | 7440-48-4 | Cobalt | 1 | 1 | 0% | mg/kg | 15 | 15 | 900 | No |
| SO_Onsite_0_10_F | 7440-50-8 | Copper | 4 | 4 | 0% | mg/kg | 58.6 | 58.6 | 290 | No |
| SO_Onsite_0_10_F | 57-12-5 | Cyanide | 1 | 1 | 0% | mg/kg | 0.92 | 0.92 | 120 | No |
| SO_Onsite_0_10_F | 7439-97-6 | Mercury | 10 | 10 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_F | 7440-02-0 | Nickel | 1 | 1 | 0% | mg/kg | 12.6 | 12.6 | 130 | No |
| SO_Onsite_0_10_F | 7782-49-2 | Selenium | 9 | 9 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_F | 7440-22-4 | Silver | 10 | 10 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |
| SO_Onsite_0_10_F | 7440-28-0 | Thallium | 3 | 3 | 0% | mg/kg | 31.3 | 31.3 | 0.7 | Yes |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.28**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit G
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Detection Limit for NDs | Detection Limit for NDs | SL | Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_G | 120-12-7 | Anthracene | 1 | 1 | 0% | mg/kg | 0.03 | 0.03 | 2,200 | No |
| SO_Onsite_0_10_G | 7440-36-0 | Antimony | 7 | 7 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_G | 7440-38-2 | Arsenic | 3 | 3 | 0% | mg/kg | 0.25 | 0.25 | 12.3 | No |
| SO_Onsite_0_10_G | 56-55-3 | Benzo(a)anthracene | 1 | 1 | 0% | mg/kg | 0.17 | 0.17 | 0.887 | No |
| SO_Onsite_0_10_G | 205-99-2 | Benzo(b)fluoranthene | 1 | 1 | 0% | mg/kg | 0.21 | 0.21 | 0.626 | No |
| SO_Onsite_0_10_G | 207-08-9 | Benzo(k)fluoranthene | 1 | 1 | 0% | mg/kg | 0.07 | 0.07 | 1.5 | No |
| SO_Onsite_0_10_G | 7440-41-7 | Beryllium | 4 | 4 | 0% | mg/kg | 1.8 | 1.8 | 16 | No |
| SO_Onsite_0_10_G | 7440-43-9 | Cadmium | 5 | 5 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_G | 7440-47-3 | Chromium | 4 | 4 | 0% | mg/kg | 12.7 | 12.7 | 38 | No |
| SO_Onsite_0_10_G | 218-01-9 | Chrysene | 1 | 1 | 0% | mg/kg | 0.12 | 0.12 | 15 | No |
| SO_Onsite_0_10_G | 7440-48-4 | Cobalt | 2 | 2 | 0% | mg/kg | 15 | 15 | 900 | No |
| SO_Onsite_0_10_G | 7440-50-8 | Copper | 4 | 4 | 0% | mg/kg | 58.6 | 58.6 | 290 | No |
| SO_Onsite_0_10_G | 57-12-5 | Cyanide | 2 | 2 | 0% | mg/kg | 0.92 | 0.92 | 120 | No |
| SO_Onsite_0_10_G | 206-44-0 | Fluoranthene | 2 | 2 | 0% | mg/kg | 0.07 | 0.07 | 230 | No |
| SO_Onsite_0_10_G | 7439-97-6 | Mercury | 9 | 9 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_G | 85-01-8 | Phenanthrene | 1 | 1 | 0% | mg/kg | 0.03 | 0.03 | 1.04 | No |
| SO_Onsite_0_10_G | 129-00-0 | Pyrene | 2 | 2 | 0% | mg/kg | 0.03 | 0.03 | 230 | No |
| SO_Onsite_0_10_G | 7782-49-2 | Selenium | 7 | 7 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_G | 7440-22-4 | Silver | 9 | 9 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |
| SO_Onsite_0_10_G | 7440-28-0 | Thallium | 5 | 5 | 0% | mg/kg | 31.3 | 31.3 | 0.7 | Yes |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.29**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit H
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_H | 7440-36-0 | Antimony | 2 | 2 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_H | 7440-38-2 | Arsenic | 1 | 1 | 0% | mg/kg | 0.25 | 1.376 | 12.3 | No |
| SO_Onsite_0_10_H | 7440-43-9 | Cadmium | 2 | 2 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_H | 7439-97-6 | Mercury | 5 | 5 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_H | 7782-49-2 | Selenium | 7 | 7 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_H | 7440-22-4 | Silver | 2 | 2 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |
| SO_Onsite_0_10_H | 7440-28-0 | Thallium | 1 | 1 | 0% | mg/kg | 31.3 | 31.3 | 0.7 | Yes |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.30**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit I
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_I | 120-12-7 | Anthracene | 1 | 1 | 0% | mg/kg | 0.03 | 0.1966 | 2,200 | No |
| SO_Onsite_0_10_I | 7440-36-0 | Antimony | 3 | 3 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_I | 7440-38-2 | Arsenic | 4 | 4 | 0% | mg/kg | 0.25 | 1.376 | 12.3 | No |
| SO_Onsite_0_10_I | 7440-41-7 | Beryllium | 2 | 2 | 0% | mg/kg | 1.8 | 1.8 | 16 | No |
| SO_Onsite_0_10_I | 7440-43-9 | Cadmium | 2 | 2 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_I | 7440-47-3 | Chromium | 2 | 2 | 0% | mg/kg | 12.7 | 12.7 | 38 | No |
| SO_Onsite_0_10_I | 7440-50-8 | Copper | 2 | 2 | 0% | mg/kg | 58.6 | 58.6 | 290 | No |
| SO_Onsite_0_10_I | 86-73-7 | Fluorene | 2 | 2 | 0% | mg/kg | 0.1966 | 0.1966 | 260 | No |
| SO_Onsite_0_10_I | 7439-97-6 | Mercury | 5 | 5 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_I | 7782-49-2 | Selenium | 4 | 4 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_I | 7440-22-4 | Silver | 6 | 6 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |
| SO_Onsite_0_10_I | 7440-28-0 | Thallium | 3 | 3 | 0% | mg/kg | 31.3 | 31.3 | 0.7 | Yes |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.31**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit J
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_J | 7440-36-0 | Antimony | 1 | 1 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_J | 7440-43-9 | Cadmium | 4 | 4 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_J | 7439-97-6 | Mercury | 6 | 6 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_J | 7782-49-2 | Selenium | 6 | 6 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_J | 7440-22-4 | Silver | 5 | 5 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.32**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit K
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_K | 7440-36-0 | Antimony | 4 | 4 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_K | 7440-38-2 | Arsenic | 2 | 2 | 0% | mg/kg | 0.25 | 0.25 | 12.3 | No |
| SO_Onsite_0_10_K | 7440-41-7 | Beryllium | 4 | 4 | 0% | mg/kg | 1.8 | 1.8 | 16 | No |
| SO_Onsite_0_10_K | 7440-43-9 | Cadmium | 4 | 4 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_K | 7440-47-3 | Chromium | 4 | 4 | 0% | mg/kg | 12.7 | 12.7 | 38 | No |
| SO_Onsite_0_10_K | 7440-48-4 | Cobalt | 1 | 1 | 0% | mg/kg | 15 | 15 | 900 | No |
| SO_Onsite_0_10_K | 7440-50-8 | Copper | 4 | 4 | 0% | mg/kg | 58.6 | 58.6 | 290 | No |
| SO_Onsite_0_10_K | 57-12-5 | Cyanide | 1 | 1 | 0% | mg/kg | 0.92 | 0.92 | 120 | No |
| SO_Onsite_0_10_K | 7439-97-6 | Mercury | 6 | 6 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_K | 7782-49-2 | Selenium | 5 | 5 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_K | 7440-22-4 | Silver | 8 | 8 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |
| SO_Onsite_0_10_K | 7440-28-0 | Thallium | 4 | 4 | 0% | mg/kg | 31.3 | 31.3 | 0.7 | Yes |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

**APPENDIX Q**
**TABLE 3.33**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit L
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_L | 630-20-6 | 1,1,1,2-Tetrachloroethane | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 3 | No |
| SO_Onsite_0_10_L | 71-55-6 | 1,1,1-Trichloroethane | 18 | 18 | 0% | mg/kg | 0.006 | 0.0065 | 2 | No |
| SO_Onsite_0_10_L | 79-34-5 | 1,1,2,2-Tetrachloroethane | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 0.003 | Yes |
| SO_Onsite_0_10_L | 79-00-5 | 1,1,2-Trichloroethane | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 0.02 | No |
| SO_Onsite_0_10_L | 75-35-4 | 1,1-Dichloroethene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 0.06 | No |
| SO_Onsite_0_10_L | 120-82-1 | 1,2,4-Trichlorobenzene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 5 | No |
| SO_Onsite_0_10_L | 95-63-6 | 1,2,4-Trimethylbenzene | 13 | 13 | 0% | mg/kg | 0.00093 | 0.0065 | 5.7 | No |
| SO_Onsite_0_10_L | 95-50-1 | 1,2-Dichlorobenzene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 17 | No |
| SO_Onsite_0_10_L | 107-06-2 | 1,2-Dichloroethane (EDC) | 4 | 4 | 0% | mg/kg | 0.0063 | 0.0065 | 0.02 | No |
| SO_Onsite_0_10_L | 108-67-8 | 1,3,5-Trimethylbenzene | 12 | 12 | 0% | mg/kg | 0.00083 | 0.0065 | 2.1 | No |
| SO_Onsite_0_10_L | 541-73-1 | 1,3-Dichlorobenzene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 6.9 | No |
| SO_Onsite_0_10_L | 90-12-0 | 1-Methylnaphthalene | 1 | 1 | 0% | mg/kg | 0.243 | 0.243 | 21 | No |
| SO_Onsite_0_10_L | 91-57-6 | 2-Methylnaphthalene | 1 | 1 | 0% | mg/kg | 0.243 | 0.243 | 21 | No |
| SO_Onsite_0_10_L | 99-87-6 | 4-Isopropyltoluene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 58 | No |
| SO_Onsite_0_10_L | 83-32-9 | Acenaphthene | 1 | 1 | 0% | mg/kg | 0.243 | 0.243 | 370 | No |
| SO_Onsite_0_10_L | 208-96-8 | Acenaphthylene | 1 | 1 | 0% | mg/kg | 0.243 | 0.243 | 0.0305 | Yes |
| SO_Onsite_0_10_L | 120-12-7 | Anthracene | 1 | 1 | 0% | mg/kg | 0.03 | 0.03 | 2,200 | No |
| SO_Onsite_0_10_L | 7440-36-0 | Antimony | 4 | 4 | 0% | mg/kg | 3.8 | 3.8 | 3.1 | Yes |
| SO_Onsite_0_10_L | 7440-38-2 | Arsenic | 2 | 2 | 0% | mg/kg | 0.25 | 1.376 | 12.3 | No |
| SO_Onsite_0_10_L | 56-55-3 | Benzo(a)anthracene | 1 | 1 | 0% | mg/kg | 0.17 | 0.17 | 0.887 | No |
| SO_Onsite_0_10_L | 205-99-2 | Benzo(b)fluoranthene | 1 | 1 | 0% | mg/kg | 0.21 | 0.21 | 0.626 | No |
| SO_Onsite_0_10_L | 207-08-9 | Benzo(k)fluoranthene | 1 | 1 | 0% | mg/kg | 0.07 | 0.07 | 1.5 | No |
| SO_Onsite_0_10_L | 7440-41-7 | Beryllium | 2 | 2 | 0% | mg/kg | 1.8 | 1.8 | 16 | No |
| SO_Onsite_0_10_L | 7440-43-9 | Cadmium | 2 | 2 | 0% | mg/kg | 3.05 | 3.05 | 3.9 | No |
| SO_Onsite_0_10_L | 56-23-5 | Carbon tetrachloride | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 0.07 | No |
| SO_Onsite_0_10_L | 67-66-3 | Chloroform | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 0.25 | No |
| SO_Onsite_0_10_L | 7440-47-3 | Chromium | 2 | 2 | 0% | mg/kg | 12.7 | 12.7 | 38 | No |
| SO_Onsite_0_10_L | 156-59-2 | cis-1,2-Dichloroethene | 5 | 5 | 0% | mg/kg | 0.0062 | 0.0065 | 0.4 | No |
| SO_Onsite_0_10_L | 7440-48-4 | Cobalt | 1 | 1 | 0% | mg/kg | 15 | 15 | 900 | No |

**APPENDIX Q**
**TABLE 3.33**
Evaluation of Reporting Limits for Compounds that were Not Detected for Soil (0-2 ft) - Exposure Unit L
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | Units | FOD | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| SO_Onsite_0_10_L | 7440-50-8 | Copper | 2 | 2 | 0% | mg/kg | 58.6 | 58.6 | 290 | No |
| SO_Onsite_0_10_L | 57-12-5 | Cyanide | 1 | 1 | 0% | mg/kg | 0.92 | 0.92 | 120 | No |
| SO_Onsite_0_10_L | 100-41-4 | Ethylbenzene | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 13 | No |
| SO_Onsite_0_10_L | 86-73-7 | Fluorene | 1 | 1 | 0% | mg/kg | 0.243 | 0.243 | 260 | No |
| SO_Onsite_0_10_L | 87-68-3 | Hexachlorobutadiene | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 2 | No |
| SO_Onsite_0_10_L | 98-82-8 | Isopropylbenzene | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 37 | No |
| SO_Onsite_0_10_L | 7439-97-6 | Mercury | 5 | 5 | 0% | mg/kg | 0.05 | 0.05 | 2.3 | No |
| SO_Onsite_0_10_L | 91-20-3 | Naphthalene | 14 | 14 | 0% | mg/kg | 0.0012 | 0.243 | 12 | No |
| SO_Onsite_0_10_L | 104-51-8 | n-Butylbenzene | 13 | 13 | 0% | mg/kg | 0.006 | 0.0065 | 14 | No |
| SO_Onsite_0_10_L | 7440-02-0 | Nickel | 1 | 1 | 0% | mg/kg | 12.6 | 12.6 | 130 | No |
| SO_Onsite_0_10_L | 135-98-8 | sec-Butylbenzene | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 11 | No |
| SO_Onsite_0_10_L | 7782-49-2 | Selenium | 3 | 3 | 0% | mg/kg | 0.25 | 0.25 | 5 | No |
| SO_Onsite_0_10_L | 7440-22-4 | Silver | 6 | 6 | 0% | mg/kg | 2.5 | 2.5 | 34 | No |
| SO_Onsite_0_10_L | 127-18-4 | Tetrachloroethene | 1 | 1 | 0% | mg/kg | 0.0063 | 0.0063 | 0.06 | No |
| SO_Onsite_0_10_L | 7440-28-0 | Thallium | 3 | 3 | 0% | mg/kg | 31.3 | 31.3 | 0.7 | Yes |
| SO_Onsite_0_10_L | 108-88-3 | Toluene | 11 | 11 | 0% | mg/kg | 0.006 | 0.0065 | 12 | No |
| SO_Onsite_0_10_L | 156-60-5 | trans-1,2-Dichloroethene | 10 | 10 | 0% | mg/kg | 0.0062 | 0.0065 | 0.7 | No |
| SO_Onsite_0_10_L | 79-01-6 | Trichloroethene | 5 | 5 | 0% | mg/kg | 0.006 | 0.0065 | 0.043 | No |
| SO_Onsite_0_10_L | 108-38-3/1 | Xylene, m-, p- | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 210 | No |
| SO_Onsite_0_10_L | 95-47-6 | Xylene, o- | 14 | 14 | 0% | mg/kg | 0.006 | 0.0065 | 210 | No |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential land use
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.
SSL = USEPA Region 6 Soil Screening Levels (SSLs) for protection of migration to groundwater using a dilution-attenuation factor (DAF) of 20
Background = Data taken from URS. May 2004. *Site-Specific Environmental Baseline Survey St. Louis Army Ammunition Plant St. Louis, Missouri.*

SL for Naphthalene used as a surrogate for 1-Methylnaphthalene and 2-Methylnaphthalene.
SL for Isopropylbenzene used as a surrogate for 4-isopropyltoluene.

**APPENDIX Q**
**TABLE 3.34**
Evaluation of Reporting Limits for Compounds that were Not Detected in Groundwater Downgradient of Former Building 220 - Residential
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_220_Down_Residential | 630-20-6 | 1,1,1,2-Tetrachloroethane | 20 | 20 | 0% | µg/L | 1 | 50 | 0.43 | Yes |
| GW_220_Down_Residential | 71-55-6 | 1,1,1-Trichloroethane | 14 | 14 | 0% | µg/L | 1 | 50 | 910 | No |
| GW_220_Down_Residential | 79-34-5 | 1,1,2,2-Tetrachloroethane | 20 | 20 | 0% | µg/L | 1 | 50 | 0.055 | Yes |
| GW_220_Down_Residential | 79-00-5 | 1,1,2-Trichloroethane | 13 | 13 | 0% | µg/L | 1 | 50 | 0.2 | Yes |
| GW_220_Down_Residential | 75-34-3 | 1,1-Dichloroethane | 14 | 14 | 0% | µg/L | 1 | 50 | 120 | No |
| GW_220_Down_Residential | 75-35-4 | 1,1-Dichloroethene | 18 | 18 | 0% | µg/L | 1 | 50 | 34 | Yes |
| GW_220_Down_Residential | 563-58-6 | 1,1-Dichloropropene | 14 | 14 | 0% | µg/L | 1 | 50 | NA | NA |
| GW_220_Down_Residential | 87-61-6 | 1,2,3-Trichlorobenzene | 14 | 14 | 0% | µg/L | 1 | 50 | NA | NA |
| GW_220_Down_Residential | 96-18-4 | 1,2,3-Trichloropropane | 14 | 14 | 0% | µg/L | 1 | 50 | 0.034 | Yes |
| GW_220_Down_Residential | 120-82-1 | 1,2,4-Trichlorobenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 0.82 | Yes |
| GW_220_Down_Residential | 95-63-6 | 1,2,4-Trimethylbenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 1.5 | Yes |
| GW_220_Down_Residential | 96-12-8 | 1,2-Dibromo-3-chloropropane | 14 | 14 | 0% | µg/L | 2 | 100 | 0.0002 | Yes |
| GW_220_Down_Residential | 106-93-4 | 1,2-Dibromoethane (EDB) | 14 | 14 | 0% | µg/L | 1 | 50 | 0.0056 | Yes |
| GW_220_Down_Residential | 95-50-1 | 1,2-Dichlorobenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 4.9 | Yes |
| GW_220_Down_Residential | 107-06-2 | 1,2-Dichloroethane (EDC) | 17 | 17 | 0% | µg/L | 1 | 50 | 0.12 | Yes |
| GW_220_Down_Residential | 78-87-5 | 1,2-Dichloropropane | 14 | 14 | 0% | µg/L | 1 | 50 | 0.16 | Yes |
| GW_220_Down_Residential | 108-67-8 | 1,3,5-Trimethylbenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 1.2 | Yes |
| GW_220_Down_Residential | 541-73-1 | 1,3-Dichlorobenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 1.4 | Yes |
| GW_220_Down_Residential | 142-28-9 | 1,3-Dichloropropane | 14 | 14 | 0% | µg/L | 1 | 50 | 12 | Yes |
| GW_220_Down_Residential | 106-46-7 | 1,4-Dichlorobenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 0.47 | Yes |
| GW_220_Down_Residential | 594-20-7 | 2,2-Dichloropropane | 14 | 14 | 0% | µg/L | 1 | 50 | NA | NA |
| GW_220_Down_Residential | 78-93-3 | 2-Butanone (MEK) | 13 | 13 | 0% | µg/L | 10 | 200 | 710 | No |
| GW_220_Down_Residential | 95-49-8 | 2-Chlorotoluene | 14 | 14 | 0% | µg/L | 1 | 50 | 12 | Yes |
| GW_220_Down_Residential | 591-78-6 | 2-Hexanone | 14 | 14 | 0% | µg/L | 5 | 250 | NA | NA |
| GW_220_Down_Residential | 106-43-4 | 4-Chlorotoluene | 14 | 14 | 0% | µg/L | 1 | 50 | 12 | Yes |
| GW_220_Down_Residential | 99-87-6 | 4-Isopropyltoluene | 14 | 14 | 0% | µg/L | 1 | 50 | NA | NA |
| GW_220_Down_Residential | 108-10-1 | 4-Methyl-2-pentanone | 14 | 14 | 0% | µg/L | 5 | 250 | NA | NA |
| GW_220_Down_Residential | 67-64-1 | Acetone | 11 | 11 | 0% | µg/L | 10 | 500 | 550 | No |
| GW_220_Down_Residential | 107-02-8 | Acrolein | 14 | 14 | 0% | µg/L | 10 | 500 | 0.0042 | Yes |

**APPENDIX Q**
**TABLE 3.34**
Evaluation of Reporting Limits for Compounds that were Not Detected in Groundwater Downgradient of Former Building 220 - Residential
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_220_Down_Residential | 107-13-1 | Acrylonitrile | 14 | 14 | 0% | µg/L | 4 | 200 | 0.0389 | Yes |
| GW_220_Down_Residential | 71-43-2 | Benzene | 19 | 19 | 0% | µg/L | 1 | 50 | 0.35 | Yes |
| GW_220_Down_Residential | 108-86-1 | Bromobenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 2.3 | Yes |
| GW_220_Down_Residential | 74-97-5 | Bromochloromethane | 14 | 14 | 0% | µg/L | 1 | 50 | NA | NA |
| GW_220_Down_Residential | 75-27-4 | Bromodichloromethane | 14 | 14 | 0% | µg/L | 1 | 50 | 0.18 | Yes |
| GW_220_Down_Residential | 75-25-2 | Bromoform | 14 | 14 | 0% | µg/L | 1 | 50 | 8.3 | Yes |
| GW_220_Down_Residential | 74-83-9 | Bromomethane | 14 | 14 | 0% | µg/L | 1 | 50 | 0.87 | Yes |
| GW_220_Down_Residential | 75-15-0 | Carbon disulfide | 11 | 11 | 0% | µg/L | 1 | 50 | 100 | No |
| GW_220_Down_Residential | 56-23-5 | Carbon tetrachloride | 19 | 19 | 0% | µg/L | 1 | 50 | 0.17 | Yes |
| GW_220_Down_Residential | 108-90-7 | Chlorobenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 9.1 | Yes |
| GW_220_Down_Residential | 75-00-3 | Chloroethane | 14 | 14 | 0% | µg/L | 1 | 50 | 3.9 | Yes |
| GW_220_Down_Residential | 67-66-3 | Chloroform | 17 | 17 | 0% | µg/L | 1 | 20 | 0.17 | Yes |
| GW_220_Down_Residential | 74-87-3 | Chloromethane | 19 | 19 | 0% | µg/L | 1 | 50 | 19 | Yes |
| GW_220_Down_Residential | 156-59-2 | cis-1,2-Dichloroethene | 13 | 13 | 0% | µg/L | 1 | 5 | 6.1 | No |
| GW_220_Down_Residential | 10061-01-5 | cis-1,3-Dichloropropene | 14 | 14 | 0% | µg/L | 1 | 50 | NA | NA |
| GW_220_Down_Residential | 124-48-1 | Dibromochloromethane | 14 | 14 | 0% | µg/L | 1 | 50 | 0.13 | Yes |
| GW_220_Down_Residential | 74-95-3 | Dibromomethane | 14 | 14 | 0% | µg/L | 1 | 50 | 6.1 | Yes |
| GW_220_Down_Residential | 75-71-8 | Dichlorodifluoromethane | 14 | 14 | 0% | µg/L | 1 | 50 | 14 | Yes |
| GW_220_Down_Residential | 74-84-0 | Ethane | 2 | 2 | 0% | µg/L | 1.2 | 1.2 | NA | NA |
| GW_220_Down_Residential | 74-85-1 | Ethene | 2 | 2 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_220_Down_Residential | 100-41-4 | Ethylbenzene | 18 | 18 | 0% | µg/L | 1 | 50 | 130 | No |
| GW_220_Down_Residential | 87-68-3 | Hexachlorobutadiene | 14 | 14 | 0% | µg/L | 1 | 50 | 0.86 | Yes |
| GW_220_Down_Residential | 74-88-4 | Iodomethane | 13 | 13 | 0% | µg/L | 2 | 100 | NA | NA |
| GW_220_Down_Residential | 7439-89-6 | Iron | 1 | 1 | 0% | µg/L | 5.5 | 5.5 | 2,600 | No |
| GW_220_Down_Residential | 98-82-8 | Isopropylbenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 66 | No |
| GW_220_Down_Residential | 74-82-8 | Methane | 2 | 2 | 0% | µg/L | 2.2 | 2.7 | NA | NA |
| GW_220_Down_Residential | 1634-04-4 | Methyl tert-butyl ether (MTBE) | 13 | 13 | 0% | µg/L | 1 | 50 | 10.6 | Yes |
| GW_220_Down_Residential | 75-09-2 | Methylene chloride | 11 | 11 | 0% | µg/L | 0.53 | 50 | 4.3 | Yes |
| GW_220_Down_Residential | 91-20-3 | Naphthalene | 13 | 13 | 0% | µg/L | 1 | 50 | 0.62 | Yes |

**APPENDIX Q**
**TABLE 3.34**
Evaluation of Reporting Limits for Compounds that were Not Detected in Groundwater Downgradient of Former Building 220 - Residential
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_220_Down_Residential | 104-51-8 | n-Butylbenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 6.1 | Yes |
| GW_220_Down_Residential | 103-65-1 | n-Propylbenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 6.1 | Yes |
| GW_220_Down_Residential | 135-98-8 | sec-Butylbenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 6.1 | Yes |
| GW_220_Down_Residential | 100-42-5 | Styrene | 14 | 14 | 0% | µg/L | 1 | 50 | 160 | No |
| GW_220_Down_Residential | 98-06-6 | tert-Butylbenzene | 14 | 14 | 0% | µg/L | 1 | 50 | 6.1 | Yes |
| GW_220_Down_Residential | 127-18-4 | Tetrachloroethene | 12 | 12 | 0% | µg/L | 1 | 5 | 0.1 | Yes |
| GW_220_Down_Residential | 108-88-3 | Toluene | 13 | 13 | 0% | µg/L | 1 | 50 | 230 | No |
| GW_220_Down_Residential | 156-60-5 | trans-1,2-Dichloroethene | 17 | 17 | 0% | µg/L | 1 | 50 | 11 | Yes |
| GW_220_Down_Residential | 10061-02-6 | trans-1,3-Dichloropropene | 14 | 14 | 0% | µg/L | 1 | 50 | NA | NA |
| GW_220_Down_Residential | 79-01-6 | Trichloroethene | 10 | 10 | 0% | µg/L | 1 | 5 | 0.028 | Yes |
| GW_220_Down_Residential | 75-69-4 | Trichlorofluoromethane | 14 | 14 | 0% | µg/L | 1 | 50 | 130 | No |
| GW_220_Down_Residential | 108-05-4 | Vinyl actetate | 14 | 14 | 0% | µg/L | 2 | 100 | 41 | Yes |
| GW_220_Down_Residential | 75-01-4 | Vinyl chloride | 20 | 20 | 0% | µg/L | 1 | 50 | 0.015 | Yes |
| GW_220_Down_Residential | 108-38-3/1 | Xylene, m-, p- | 18 | 18 | 0% | µg/L | 2 | 100 | 21 | Yes |
| GW_220_Down_Residential | 95-47-6 | Xylene, o- | 12 | 12 | 0% | µg/L | 1 | 50 | 20 | Yes |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
EPA SL = Environmental Protection Agency Screening Level for protection of indoor air based on a target risk of $1x10^{-6}$
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential water
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

**APPENDIX Q**
**TABLE 3.35**
Evaluation of Reporting Limits for Compounds that were Not Detected in Groundwater Downgradient of Former Building 220 - On-Site Excavations
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| Excavations | 630-20-6 | 1,1,1,2-Tetrachloroethane | 11 | 11 | 0% | µg/L | 1 | 50 | 0.43 | Yes |
| Excavations | 71-55-6 | 1,1,1-Trichloroethane | 8 | 8 | 0% | µg/L | 1 | 50 | 910 | No |
| Excavations | 79-34-5 | 1,1,2,2-Tetrachloroethane | 11 | 11 | 0% | µg/L | 1 | 50 | 0.055 | Yes |
| Excavations | 79-00-5 | 1,1,2-Trichloroethane | 7 | 7 | 0% | µg/L | 1 | 50 | 0.2 | Yes |
| Excavations | 75-34-3 | 1,1-Dichloroethane | 8 | 8 | 0% | µg/L | 1 | 50 | 120 | No |
| Excavations | 75-35-4 | 1,1-Dichloroethene | 11 | 11 | 0% | µg/L | 1 | 50 | 34 | Yes |
| Excavations | 563-58-6 | 1,1-Dichloropropene | 8 | 8 | 0% | µg/L | 1 | 50 | NA | NA |
| Excavations | 87-61-6 | 1,2,3-Trichlorobenzene | 8 | 8 | 0% | µg/L | 1 | 50 | NA | NA |
| Excavations | 96-18-4 | 1,2,3-Trichloropropane | 8 | 8 | 0% | µg/L | 1 | 50 | 0.034 | Yes |
| Excavations | 120-82-1 | 1,2,4-Trichlorobenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 0.82 | Yes |
| Excavations | 95-63-6 | 1,2,4-Trimethylbenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 1.5 | Yes |
| Excavations | 96-12-8 | chloropropane | 8 | 8 | 0% | µg/L | 2 | 100 | 0.0002 | Yes |
| Excavations | 106-93-4 | 1,2-Dibromoethane (EDB) | 8 | 8 | 0% | µg/L | 1 | 50 | 0.0056 | Yes |
| Excavations | 95-50-1 | 1,2-Dichlorobenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 4.9 | Yes |
| Excavations | 107-06-2 | 1,2-Dichloroethane (EDC) | 10 | 10 | 0% | µg/L | 1 | 50 | 0.12 | Yes |
| Excavations | 78-87-5 | 1,2-Dichloropropane | 8 | 8 | 0% | µg/L | 1 | 50 | 0.16 | Yes |
| Excavations | 108-67-8 | 1,3,5-Trimethylbenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 1.2 | Yes |
| Excavations | 541-73-1 | 1,3-Dichlorobenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 1.4 | Yes |
| Excavations | 142-28-9 | 1,3-Dichloropropane | 8 | 8 | 0% | µg/L | 1 | 50 | 12 | Yes |
| Excavations | 106-46-7 | 1,4-Dichlorobenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 0.47 | Yes |
| Excavations | 594-20-7 | 2,2-Dichloropropane | 8 | 8 | 0% | µg/L | 1 | 50 | NA | NA |
| Excavations | 78-93-3 | 2-Butanone (MEK) | 7 | 7 | 0% | µg/L | 10 | 50 | 710 | No |
| Excavations | 95-49-8 | 2-Chlorotoluene | 8 | 8 | 0% | µg/L | 1 | 50 | 12 | Yes |
| Excavations | 591-78-6 | 2-Hexanone | 8 | 8 | 0% | µg/L | 5 | 250 | NA | NA |
| Excavations | 106-43-4 | 4-Chlorotoluene | 8 | 8 | 0% | µg/L | 1 | 50 | 12 | Yes |
| Excavations | 99-87-6 | 4-Isopropyltoluene | 8 | 8 | 0% | µg/L | 1 | 50 | NA | NA |
| Excavations | 108-10-1 | 4-Methyl-2-pentanone | 8 | 8 | 0% | µg/L | 5 | 250 | NA | NA |
| Excavations | 67-64-1 | Acetone | 7 | 7 | 0% | µg/L | 10 | 500 | 550 | No |
| Excavations | 107-02-8 | Acrolein | 8 | 8 | 0% | µg/L | 10 | 500 | 0.0042 | Yes |

**APPENDIX Q**
**TABLE 3.35**
Evaluation of Reporting Limits for Compounds that were Not Detected in Groundwater Downgradient of Former Building 220 - On-Site Excavations
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| Excavations | 107-13-1 | Acrylonitrile | 8 | 8 | 0% | µg/L | 4 | 200 | 0.039 | Yes |
| Excavations | 71-43-2 | Benzene | 10 | 10 | 0% | µg/L | 1 | 50 | 0.35 | Yes |
| Excavations | 108-86-1 | Bromobenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 2.3 | Yes |
| Excavations | 74-97-5 | Bromochloromethane | 8 | 8 | 0% | µg/L | 1 | 50 | NA | NA |
| Excavations | 75-27-4 | Bromodichloromethane | 8 | 8 | 0% | µg/L | 1 | 50 | 0.18 | Yes |
| Excavations | 75-25-2 | Bromoform | 8 | 8 | 0% | µg/L | 1 | 50 | 8.3 | Yes |
| Excavations | 74-83-9 | Bromomethane | 8 | 8 | 0% | µg/L | 1 | 50 | 0.87 | Yes |
| Excavations | 75-15-0 | Carbon disulfide | 5 | 5 | 0% | µg/L | 1 | 50 | 100 | No |
| Excavations | 56-23-5 | Carbon tetrachloride | 10 | 10 | 0% | µg/L | 1 | 50 | 0.17 | Yes |
| Excavations | 108-90-7 | Chlorobenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 9.1 | Yes |
| Excavations | 75-00-3 | Chloroethane | 8 | 8 | 0% | µg/L | 1 | 50 | 3.9 | Yes |
| Excavations | 67-66-3 | Chloroform | 9 | 9 | 0% | µg/L | 1 | 5 | 0.17 | Yes |
| Excavations | 74-87-3 | Chloromethane | 11 | 11 | 0% | µg/L | 1 | 50 | 19 | Yes |
| Excavations | 156-59-2 | cis-1,2-Dichloroethene | 10 | 10 | 0% | µg/L | 1 | 5 | 6.1 | No |
| Excavations | 10061-01-5 | cis-1,3-Dichloropropene | 8 | 8 | 0% | µg/L | 1 | 50 | NA | NA |
| Excavations | 124-48-1 | Dibromochloromethane | 8 | 8 | 0% | µg/L | 1 | 50 | 0.13 | Yes |
| Excavations | 74-95-3 | Dibromomethane | 8 | 8 | 0% | µg/L | 1 | 50 | 6.1 | Yes |
| Excavations | 75-71-8 | Dichlorodifluoromethane | 8 | 8 | 0% | µg/L | 1 | 50 | 14 | Yes |
| Excavations | 74-84-0 | Ethane | 1 | 1 | 0% | µg/L | 1.2 | 1.2 | NA | NA |
| Excavations | 74-85-1 | Ethene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| Excavations | 100-41-4 | Ethylbenzene | 10 | 10 | 0% | µg/L | 1 | 50 | 130 | No |
| Excavations | 87-68-3 | Hexachlorobutadiene | 8 | 8 | 0% | µg/L | 1 | 50 | 0.86 | Yes |
| Excavations | 74-88-4 | Iodomethane | 8 | 8 | 0% | µg/L | 2 | 100 | NA | NA |
| Excavations | 98-82-8 | Isopropylbenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 66 | No |
| Excavations | 74-82-8 | Methane | 1 | 1 | 0% | µg/L | 2.2 | 2.2 | NA | NA |
| Excavations | 1634-04-4 | (MTBE) | 8 | 8 | 0% | µg/L | 1 | 50 | 10.6 | Yes |
| Excavations | 75-09-2 | Methylene chloride | 6 | 6 | 0% | µg/L | 1 | 50 | 4.3 | Yes |
| Excavations | 91-20-3 | Naphthalene | 7 | 7 | 0% | µg/L | 1 | 50 | 0.62 | Yes |
| Excavations | 104-51-8 | n-Butylbenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 6.1 | Yes |

**APPENDIX Q**
**TABLE 3.35**
Evaluation of Reporting Limits for Compounds that were Not Detected in Groundwater Downgradient of Former Building 220 - On-Site Excavations
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| Excavations | 103-65-1 | n-Propylbenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 6.1 | Yes |
| Excavations | 135-98-8 | sec-Butylbenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 6.1 | Yes |
| Excavations | 100-42-5 | Styrene | 8 | 8 | 0% | µg/L | 1 | 50 | 160 | No |
| Excavations | 98-06-6 | tert-Butylbenzene | 8 | 8 | 0% | µg/L | 1 | 50 | 6.1 | Yes |
| Excavations | 127-18-4 | Tetrachloroethene | 7 | 7 | 0% | µg/L | 1 | 5 | 0.1 | Yes |
| Excavations | 108-88-3 | Toluene | 7 | 7 | 0% | µg/L | 1 | 50 | 230 | No |
| Excavations | 156-60-5 | trans-1,2-Dichloroethene | 11 | 11 | 0% | µg/L | 1 | 50 | 11 | Yes |
| Excavations | 10061-02-6 | trans-1,3-Dichloropropene | 8 | 8 | 0% | µg/L | 1 | 50 | NA | NA |
| Excavations | 79-01-6 | Trichloroethene | 7 | 7 | 0% | µg/L | 1 | 5 | 0.028 | Yes |
| Excavations | 75-69-4 | Trichlorofluoromethane | 8 | 8 | 0% | µg/L | 1 | 50 | 130 | No |
| Excavations | 108-05-4 | Vinyl actetate | 8 | 8 | 0% | µg/L | 2 | 100 | 41 | Yes |
| Excavations | 75-01-4 | Vinyl chloride | 11 | 11 | 0% | µg/L | 1 | 50 | 0.015 | Yes |
| Excavations | 108-38-3/1 | Xylene, m-, p- | 9 | 9 | 0% | µg/L | 2 | 100 | 21 | Yes |
| Excavations | 95-47-6 | Xylene, o- | 6 | 6 | 0% | µg/L | 1 | 50 | 20 | Yes |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
EPA SL = Environmental Protection Agency Screening Level for protection of indoor air based on a target risk of $1x10^{-6}$
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential water
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

**APPENDIX Q**
**TABLE 3.36**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Offsite | 630-20-6 | 1,1,1,2-Tetrachloroethane | 12 | 12 | 0% | µg/L | 1 | 20 | 0.43 | Yes |
| GW_Offsite | 71-55-6 | 1,1,1-Trichloroethane | 8 | 8 | 0% | µg/L | 1 | 20 | 910 | No |
| GW_Offsite | 79-34-5 | 1,1,2,2-Tetrachloroethane | 12 | 12 | 0% | µg/L | 1 | 20 | 0.055 | Yes |
| GW_Offsite | 79-00-5 | 1,1,2-Trichloroethane | 8 | 8 | 0% | µg/L | 1 | 20 | 0.2 | Yes |
| GW_Offsite | 75-34-3 | 1,1-Dichloroethane | 8 | 8 | 0% | µg/L | 1 | 20 | 120 | No |
| GW_Offsite | 75-35-4 | 1,1-Dichloroethene | 10 | 10 | 0% | µg/L | 1 | 20 | 34 | No |
| GW_Offsite | 563-58-6 | 1,1-Dichloropropene | 8 | 8 | 0% | µg/L | 1 | 20 | NA | NA |
| GW_Offsite | 87-61-6 | 1,2,3-Trichlorobenzene | 8 | 8 | 0% | µg/L | 1 | 20 | NA | NA |
| GW_Offsite | 96-18-4 | 1,2,3-Trichloropropane | 8 | 8 | 0% | µg/L | 1 | 20 | 0.034 | Yes |
| GW_Offsite | 120-82-1 | 1,2,4-Trichlorobenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 0.82 | Yes |
| GW_Offsite | 95-63-6 | 1,2,4-Trimethylbenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 1.5 | Yes |
| GW_Offsite | 96-12-8 | 1,2-Dibromo-3-chloropropane | 8 | 8 | 0% | µg/L | 2 | 40 | 0.0002 | Yes |
| GW_Offsite | 106-93-4 | 1,2-Dibromoethane (EDB) | 8 | 8 | 0% | µg/L | 1 | 20 | 0.0056 | Yes |
| GW_Offsite | 95-50-1 | 1,2-Dichlorobenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 4.9 | Yes |
| GW_Offsite | 107-06-2 | 1,2-Dichloroethane (EDC) | 9 | 9 | 0% | µg/L | 1 | 5 | 0.12 | Yes |
| GW_Offsite | 78-87-5 | 1,2-Dichloropropane | 8 | 8 | 0% | µg/L | 1 | 20 | 0.16 | Yes |
| GW_Offsite | 108-67-8 | 1,3,5-Trimethylbenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 1.2 | Yes |
| GW_Offsite | 541-73-1 | 1,3-Dichlorobenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 1.4 | Yes |
| GW_Offsite | 142-28-9 | 1,3-Dichloropropane | 8 | 8 | 0% | µg/L | 1 | 20 | 12 | Yes |
| GW_Offsite | 106-46-7 | 1,4-Dichlorobenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 0.47 | Yes |
| GW_Offsite | 594-20-7 | 2,2-Dichloropropane | 8 | 8 | 0% | µg/L | 1 | 20 | NA | NA |
| GW_Offsite | 78-93-3 | 2-Butanone (MEK) | 8 | 8 | 0% | µg/L | 10 | 200 | 710 | No |
| GW_Offsite | 95-49-8 | 2-Chlorotoluene | 8 | 8 | 0% | µg/L | 1 | 20 | 12 | Yes |
| GW_Offsite | 591-78-6 | 2-Hexanone | 8 | 8 | 0% | µg/L | 5 | 100 | NA | NA |
| GW_Offsite | 106-43-4 | 4-Chlorotoluene | 8 | 8 | 0% | µg/L | 1 | 20 | 12 | Yes |
| GW_Offsite | 99-87-6 | 4-Isopropyltoluene | 8 | 8 | 0% | µg/L | 1 | 20 | NA | NA |
| GW_Offsite | 108-10-1 | 4-Methyl-2-pentanone | 8 | 8 | 0% | µg/L | 5 | 100 | NA | NA |
| GW_Offsite | 67-64-1 | Acetone | 6 | 6 | 0% | µg/L | 10 | 200 | 550 | No |
| GW_Offsite | 107-02-8 | Acrolein | 8 | 8 | 0% | µg/L | 10 | 200 | 0.0042 | Yes |

**APPENDIX Q**
**TABLE 3.36**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Offsite | 107-13-1 | Acrylonitrile | 8 | 8 | 0% | µg/L | 4 | 80 | 0.039 | Yes |
| GW_Offsite | 71-43-2 | Benzene | 12 | 12 | 0% | µg/L | 1 | 20 | 0.35 | Yes |
| GW_Offsite | 108-86-1 | Bromobenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 2.3 | Yes |
| GW_Offsite | 74-97-5 | Bromochloromethane | 8 | 8 | 0% | µg/L | 1 | 20 | NA | NA |
| GW_Offsite | 75-27-4 | Bromodichloromethane | 8 | 8 | 0% | µg/L | 1 | 20 | 0.18 | Yes |
| GW_Offsite | 75-25-2 | Bromoform | 8 | 8 | 0% | µg/L | 1 | 20 | 8.3 | Yes |
| GW_Offsite | 74-83-9 | Bromomethane | 8 | 8 | 0% | µg/L | 1 | 20 | 0.87 | Yes |
| GW_Offsite | 75-15-0 | Carbon disulfide | 8 | 8 | 0% | µg/L | 1 | 20 | 100 | No |
| GW_Offsite | 56-23-5 | Carbon tetrachloride | 12 | 12 | 0% | µg/L | 1 | 20 | 0.17 | Yes |
| GW_Offsite | 108-90-7 | Chlorobenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 9.1 | Yes |
| GW_Offsite | 75-00-3 | Chloroethane | 8 | 8 | 0% | µg/L | 1 | 20 | 3.9 | Yes |
| GW_Offsite | 67-66-3 | Chloroform | 11 | 11 | 0% | µg/L | 1 | 20 | 0.17 | Yes |
| GW_Offsite | 74-87-3 | Chloromethane | 11 | 11 | 0% | µg/L | 1 | 20 | 19 | Yes |
| GW_Offsite | 156-59-2 | cis-1,2-Dichloroethene | 6 | 6 | 0% | µg/L | 1 | 5 | 6.1 | No |
| GW_Offsite | 10061-01-5 | cis-1,3-Dichloropropene | 8 | 8 | 0% | µg/L | 1 | 20 | NA | NA |
| GW_Offsite | 124-48-1 | Dibromochloromethane | 8 | 8 | 0% | µg/L | 1 | 20 | 0.13 | Yes |
| GW_Offsite | 74-95-3 | Dibromomethane | 8 | 8 | 0% | µg/L | 1 | 20 | 6.1 | Yes |
| GW_Offsite | 75-71-8 | Dichlorodifluoromethane | 8 | 8 | 0% | µg/L | 1 | 20 | 14 | Yes |
| GW_Offsite | 74-84-0 | Ethane | 2 | 2 | 0% | µg/L | 1.2 | 1.2 | NA | NA |
| GW_Offsite | 74-85-1 | Ethene | 2 | 2 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Offsite | 100-41-4 | Ethylbenzene | 10 | 10 | 0% | µg/L | 1 | 20 | 130 | No |
| GW_Offsite | 87-68-3 | Hexachlorobutadiene | 8 | 8 | 0% | µg/L | 1 | 20 | 0.86 | Yes |
| GW_Offsite | 74-88-4 | Iodomethane | 7 | 7 | 0% | µg/L | 2 | 40 | NA | NA |
| GW_Offsite | 7439-89-6 | Iron | 2 | 2 | 0% | µg/L | 5.5 | 5.5 | 2,600 | No |
| GW_Offsite | 98-82-8 | Isopropylbenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 66 | No |
| GW_Offsite | 74-82-8 | Methane | 2 | 2 | 0% | µg/L | 2.7 | 3 | NA | NA |
| GW_Offsite | 1634-04-4 | Methyl tert-butyl ether (MTBE) | 7 | 7 | 0% | µg/L | 1 | 20 | 10.6 | Yes |
| GW_Offsite | 75-09-2 | Methylene chloride | 7 | 7 | 0% | µg/L | 0.53 | 20 | 4.3 | Yes |
| GW_Offsite | 91-20-3 | Naphthalene | 8 | 8 | 0% | µg/L | 1 | 20 | 0.62 | Yes |

**APPENDIX Q**
**TABLE 3.36**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Offsite | 104-51-8 | n-Butylbenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 6.1 | Yes |
| GW_Offsite | 103-65-1 | n-Propylbenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 6.1 | Yes |
| GW_Offsite | 135-98-8 | sec-Butylbenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 6.1 | Yes |
| GW_Offsite | 100-42-5 | Styrene | 8 | 8 | 0% | µg/L | 1 | 20 | 160 | No |
| GW_Offsite | 98-06-6 | tert-Butylbenzene | 8 | 8 | 0% | µg/L | 1 | 20 | 6.1 | Yes |
| GW_Offsite | 127-18-4 | Tetrachloroethene | 8 | 8 | 0% | µg/L | 1 | 5 | 0.1 | Yes |
| GW_Offsite | 108-88-3 | Toluene | 8 | 8 | 0% | µg/L | 1 | 20 | 230 | No |
| GW_Offsite | 156-60-5 | trans-1,2-Dichloroethene | 9 | 9 | 0% | µg/L | 1 | 20 | 11 | Yes |
| GW_Offsite | 10061-02-6 | trans-1,3-Dichloropropene | 8 | 8 | 0% | µg/L | 1 | 20 | NA | NA |
| GW_Offsite | 79-01-6 | Trichloroethene | 6 | 6 | 0% | µg/L | 1 | 5 | 0.028 | Yes |
| GW_Offsite | 75-69-4 | Trichlorofluoromethane | 8 | 8 | 0% | µg/L | 1 | 20 | 130 | No |
| GW_Offsite | 108-05-4 | Vinyl actetate | 8 | 8 | 0% | µg/L | 2 | 40 | 41 | No |
| GW_Offsite | 75-01-4 | Vinyl chloride | 12 | 12 | 0% | µg/L | 1 | 20 | 0.015 | Yes |
| GW_Offsite | 108-38-3/1 | Xylene, m-, p- | 11 | 11 | 0% | µg/L | 2 | 40 | 21 | Yes |
| GW_Offsite | 95-47-6 | Xylene, o- | 8 | 8 | 0% | µg/L | 1 | 20 | 20 | No |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
EPA SL = Environmental Protection Agency Screening Level for protection of indoor air based on a target risk of $1x10^{-6}$
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential water
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

**APPENDIX Q**
**TABLE 3.37**
Evaluation of Reporting Limits for Compounds that were Not Detected in On-site Groundwater
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Onsite | 630-20-6 | 1,1,1,2-Tetrachloroethane | 4 | 4 | 0% | µg/L | 1 | 5 | 0.43 | Yes |
| GW_Onsite | 71-55-6 | 1,1,1-Trichloroethane | 3 | 3 | 0% | µg/L | 1 | 1 | 910 | No |
| GW_Onsite | 79-34-5 | 1,1,2,2-Tetrachloroethane | 4 | 4 | 0% | µg/L | 1 | 5 | 0.055 | Yes |
| GW_Onsite | 79-00-5 | 1,1,2-Trichloroethane | 3 | 3 | 0% | µg/L | 1 | 1 | 0.2 | Yes |
| GW_Onsite | 75-34-3 | 1,1-Dichloroethane | 3 | 3 | 0% | µg/L | 1 | 1 | 120 | No |
| GW_Onsite | 75-35-4 | 1,1-Dichloroethene | 4 | 4 | 0% | µg/L | 1 | 5 | 34 | No |
| GW_Onsite | 563-58-6 | 1,1-Dichloropropene | 3 | 3 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Onsite | 87-61-6 | 1,2,3-Trichlorobenzene | 3 | 3 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Onsite | 96-18-4 | 1,2,3-Trichloropropane | 3 | 3 | 0% | µg/L | 1 | 1 | 0.034 | Yes |
| GW_Onsite | 120-82-1 | 1,2,4-Trichlorobenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 0.82 | Yes |
| GW_Onsite | 95-63-6 | 1,2,4-Trimethylbenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 1.5 | No |
| GW_Onsite | 96-12-8 | chloropropane | 3 | 3 | 0% | µg/L | 2 | 2 | 0.0002 | Yes |
| GW_Onsite | 106-93-4 | 1,2-Dibromoethane (EDB) | 3 | 3 | 0% | µg/L | 1 | 1 | 0.0056 | Yes |
| GW_Onsite | 95-50-1 | 1,2-Dichlorobenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 4.9 | No |
| GW_Onsite | 107-06-2 | 1,2-Dichloroethane (EDC) | 2 | 2 | 0% | µg/L | 1 | 1 | 0.12 | Yes |
| GW_Onsite | 78-87-5 | 1,2-Dichloropropane | 3 | 3 | 0% | µg/L | 1 | 1 | 0.16 | Yes |
| GW_Onsite | 108-67-8 | 1,3,5-Trimethylbenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 1.2 | No |
| GW_Onsite | 541-73-1 | 1,3-Dichlorobenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 1.4 | No |
| GW_Onsite | 142-28-9 | 1,3-Dichloropropane | 3 | 3 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Onsite | 106-46-7 | 1,4-Dichlorobenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 0.47 | Yes |
| GW_Onsite | 594-20-7 | 2,2-Dichloropropane | 3 | 3 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Onsite | 78-93-3 | 2-Butanone (MEK) | 3 | 3 | 0% | µg/L | 10 | 10 | 710 | No |
| GW_Onsite | 95-49-8 | 2-Chlorotoluene | 3 | 3 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Onsite | 591-78-6 | 2-Hexanone | 3 | 3 | 0% | µg/L | 5 | 5 | NA | NA |
| GW_Onsite | 106-43-4 | 4-Chlorotoluene | 3 | 3 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Onsite | 99-87-6 | 4-Isopropyltoluene | 3 | 3 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Onsite | 108-10-1 | 4-Methyl-2-pentanone | 3 | 3 | 0% | µg/L | 5 | 5 | NA | NA |
| GW_Onsite | 67-64-1 | Acetone | 2 | 2 | 0% | µg/L | 10 | 10 | 550 | No |
| GW_Onsite | 107-02-8 | Acrolein | 3 | 3 | 0% | µg/L | 10 | 10 | 0.0042 | Yes |

**APPENDIX Q**
**TABLE 3.37**
Evaluation of Reporting Limits for Compounds that were Not Detected in On-site Groundwater
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Onsite | 107-13-1 | Acrylonitrile | 3 | 3 | 0% | µg/L | 4 | 4 | 0.039 | Yes |
| GW_Onsite | 71-43-2 | Benzene | 4 | 4 | 0% | µg/L | 1 | 5 | 0.35 | Yes |
| GW_Onsite | 108-86-1 | Bromobenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 2.3 | No |
| GW_Onsite | 74-97-5 | Bromochloromethane | 3 | 3 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Onsite | 75-27-4 | Bromodichloromethane | 3 | 3 | 0% | µg/L | 1 | 1 | 0.18 | Yes |
| GW_Onsite | 75-25-2 | Bromoform | 3 | 3 | 0% | µg/L | 1 | 1 | 8.3 | No |
| GW_Onsite | 74-83-9 | Bromomethane | 3 | 3 | 0% | µg/L | 1 | 1 | 0.87 | Yes |
| GW_Onsite | 75-15-0 | Carbon disulfide | 3 | 3 | 0% | µg/L | 1 | 1 | 100 | No |
| GW_Onsite | 56-23-5 | Carbon tetrachloride | 3 | 3 | 0% | µg/L | 1 | 5 | 0.17 | Yes |
| GW_Onsite | 108-90-7 | Chlorobenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 9.1 | No |
| GW_Onsite | 75-00-3 | Chloroethane | 3 | 3 | 0% | µg/L | 1 | 1 | 3.9 | No |
| GW_Onsite | 67-66-3 | Chloroform | 4 | 4 | 0% | µg/L | 1 | 5 | 0.17 | Yes |
| GW_Onsite | 74-87-3 | Chloromethane | 4 | 4 | 0% | µg/L | 1 | 10 | 19 | No |
| GW_Onsite | 156-59-2 | cis-1,2-Dichloroethene | 4 | 4 | 0% | µg/L | 1 | 5 | 6.1 | No |
| GW_Onsite | 10061-01-5 | cis-1,3-Dichloropropene | 3 | 3 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Onsite | 124-48-1 | Dibromochloromethane | 3 | 3 | 0% | µg/L | 1 | 1 | 0.13 | Yes |
| GW_Onsite | 74-95-3 | Dibromomethane | 3 | 3 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Onsite | 75-71-8 | Dichlorodifluoromethane | 3 | 3 | 0% | µg/L | 1 | 1 | 14 | No |
| GW_Onsite | 74-84-0 | Ethane | 1 | 1 | 0% | µg/L | 1.2 | 1.2 | NA | NA |
| GW_Onsite | 74-85-1 | Ethene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Onsite | 100-41-4 | Ethylbenzene | 4 | 4 | 0% | µg/L | 1 | 5 | 130 | No |
| GW_Onsite | 87-68-3 | Hexachlorobutadiene | 3 | 3 | 0% | µg/L | 1 | 1 | 0.86 | Yes |
| GW_Onsite | 74-88-4 | Iodomethane | 3 | 3 | 0% | µg/L | 2 | 2 | NA | NA |
| GW_Onsite | 7439-89-6 | Iron | 1 | 1 | 0% | µg/L | 5.5 | 5.5 | 2,600 | No |
| GW_Onsite | 98-82-8 | Isopropylbenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 66 | No |
| GW_Onsite | 7439-96-5 | Manganese | 1 | 1 | 0% | µg/L | 0:35 | 0.35 | 170 | No |
| GW_Onsite | 74-82-8 | Methane | 1 | 1 | 0% | µg/L | 2.4 | 2.4 | NA | NA |
| GW_Onsite | 1634-04-4 | (MTBE) | 3 | 3 | 0% | µg/L | 1 | 1 | 10.6 | No |
| GW_Onsite | 75-09-2 | Methylene chloride | 3 | 3 | 0% | µg/L | 0.54 | 1 | 4.3 | No |

**APPENDIX Q**
**TABLE 3.37**
Evaluation of Reporting Limits for Compounds that were Not Detected in On-site Groundwater
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Onsite | 91-20-3 | Naphthalene | 3 | 3 | 0% | µg/L | 1 | 1 | 0.62 | Yes |
| GW_Onsite | 104-51-8 | n-Butylbenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Onsite | 103-65-1 | n-Propylbenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Onsite | 135-98-8 | sec-Butylbenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Onsite | 100-42-5 | Styrene | 3 | 3 | 0% | µg/L | 1 | 1 | 160 | No |
| GW_Onsite | 98-06-6 | tert-Butylbenzene | 3 | 3 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Onsite | 127-18-4 | Tetrachloroethene | 4 | 4 | 0% | µg/L | 1 | 5 | 0.1 | Yes |
| GW_Onsite | 108-88-3 | Toluene | 3 | 3 | 0% | µg/L | 1 | 1 | 230 | No |
| GW_Onsite | 156-60-5 | trans-1,2-Dichloroethene | 4 | 4 | 0% | µg/L | 1 | 5 | 11 | No |
| GW_Onsite | 10061-02-6 | trans-1,3-Dichloropropene | 3 | 3 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Onsite | 79-01-6 | Trichloroethene | 4 | 4 | 0% | µg/L | 1 | 5 | 0.028 | Yes |
| GW_Onsite | 75-69-4 | Trichlorofluoromethane | 3 | 3 | 0% | µg/L | 1 | 1 | 130 | No |
| GW_Onsite | 108-05-4 | Vinyl actetate | 3 | 3 | 0% | µg/L | 2 | 2 | 41 | No |
| GW_Onsite | 75-01-4 | Vinyl chloride | 4 | 4 | 0% | µg/L | 1 | 5 | 0.015 | Yes |
| GW_Onsite | 108-38-3/1 | Xylene, m-, p- | 4 | 4 | 0% | µg/L | 2 | 5 | 21 | No |
| GW_Onsite | 95-47-6 | Xylene, o- | 3 | 3 | 0% | µg/L | 1 | 1 | 20 | No |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
EPA SL = Environmental Protection Agency Screening Level for protection of indoor air based on a target risk of $1x10^{-6}$
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential water
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

**APPENDIX Q**
**TABLE 3.38**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater Residence 6321
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Res6321 | 630-20-6 | 1,1,1,2-Tetrachloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.43 | Yes |
| GW_Res6321 | 71-55-6 | 1,1,1-Trichloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 910 | No |
| GW_Res6321 | 79-34-5 | 1,1,2,2-Tetrachloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.055 | Yes |
| GW_Res6321 | 79-00-5 | 1,1,2-Trichloroethane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 0.2 | Yes |
| GW_Res6321 | 75-34-3 | 1,1-Dichloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 120 | No |
| GW_Res6321 | 75-35-4 | 1,1-Dichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 34 | No |
| GW_Res6321 | 563-58-6 | 1,1-Dichloropropene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res6321 | 87-61-6 | 1,2,3-Trichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res6321 | 96-18-4 | 1,2,3-Trichloropropane | 1 | 1 | 0% | µg/L | 1.8 | 1.8 | 0.034 | Yes |
| GW_Res6321 | 120-82-1 | 1,2,4-Trichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.82 | Yes |
| GW_Res6321 | 95-63-6 | 1,2,4-Trimethylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 1.5 | No |
| GW_Res6321 | 96-12-8 | chloropropane | 1 | 1 | 0% | µg/L | 4 | 4 | 0.0002 | Yes |
| GW_Res6321 | 106-93-4 | 1,2-Dibromoethane (EDB) | 1 | 1 | 0% | µg/L | 1 | 1 | 0.0056 | Yes |
| GW_Res6321 | 95-50-1 | 1,2-Dichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 4.9 | No |
| GW_Res6321 | 107-06-2 | 1,2-Dichloroethane (EDC) | 1 | 1 | 0% | µg/L | 1 | 1 | 0.12 | Yes |
| GW_Res6321 | 78-87-5 | 1,2-Dichloropropane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 0.16 | Yes |
| GW_Res6321 | 108-67-8 | 1,3,5-Trimethylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 1.2 | No |
| GW_Res6321 | 541-73-1 | 1,3-Dichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 1.4 | No |
| GW_Res6321 | 142-28-9 | 1,3-Dichloropropane | 1 | 1 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Res6321 | 106-46-7 | 1,4-Dichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.47 | Yes |
| GW_Res6321 | 594-20-7 | 2,2-Dichloropropane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | NA | NA |
| GW_Res6321 | 78-93-3 | 2-Butanone (MEK) | 1 | 1 | 0% | µg/L | 10 | 10 | 710 | No |
| GW_Res6321 | 95-49-8 | 2-Chlorotoluene | 1 | 1 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Res6321 | 591-78-6 | 2-Hexanone | 1 | 1 | 0% | µg/L | 5 | 5 | - | No |
| GW_Res6321 | 106-43-4 | 4-Chlorotoluene | 1 | 1 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Res6321 | 99-87-6 | 4-Isopropyltoluene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res6321 | 108-10-1 | 4-Methyl-2-pentanone | 1 | 1 | 0% | µg/L | 5 | 5 | NA | NA |
| GW_Res6321 | 107-02-8 | Acrolein | 1 | 1 | 0% | µg/L | 10 | 10 | 0.0042 | Yes |
| GW_Res6321 | 107-13-1 | Acrylonitrile | 1 | 1 | 0% | µg/L | 4 | 4 | 0.039 | Yes |

**APPENDIX Q**
**TABLE 3.38**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater Residence 6321
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Res6321 | 71-43-2 | Benzene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.35 | Yes |
| GW_Res6321 | 108-86-1 | Bromobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 2.3 | No |
| GW_Res6321 | 74-97-5 | Bromochloromethane | 1 | 1 | 0% | µg/L | 1.5 | 1.5 | NA | NA |
| GW_Res6321 | 75-27-4 | Bromodichloromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.18 | Yes |
| GW_Res6321 | 75-25-2 | Bromoform | 1 | 1 | 0% | µg/L | 1.2 | 1.2 | 8.3 | No |
| GW_Res6321 | 74-83-9 | Bromomethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.87 | Yes |
| GW_Res6321 | 75-15-0 | Carbon disulfide | 1 | 1 | 0% | µg/L | 1 | 1 | 100 | No |
| GW_Res6321 | 56-23-5 | Carbon tetrachloride | 1 | 1 | 0% | µg/L | 1 | 1 | 0.17 | Yes |
| GW_Res6321 | 108-90-7 | Chlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 9.1 | No |
| GW_Res6321 | 75-00-3 | Chloroethane | 1 | 1 | 0% | µg/L | 1.9 | 1.9 | 3.9 | No |
| GW_Res6321 | 67-66-3 | Chloroform | 1 | 1 | 0% | µg/L | 1 | 1 | 0.17 | Yes |
| GW_Res6321 | 74-87-3 | Chloromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 19 | No |
| GW_Res6321 | 156-59-2 | cis-1,2-Dichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res6321 | 10061-01-5 | cis-1,3-Dichloropropene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res6321 | 124-48-1 | Dibromochloromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.13 | Yes |
| GW_Res6321 | 74-95-3 | Dibromomethane | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res6321 | 75-71-8 | Dichlorodifluoromethane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 14 | No |
| GW_Res6321 | 100-41-4 | Ethylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 130 | No |
| GW_Res6321 | 87-68-3 | Hexachlorobutadiene | 1 | 1 | 0% | µg/L | 1.8 | 1.8 | 0.86 | Yes |
| GW_Res6321 | 74-88-4 | Iodomethane | 1 | 1 | 0% | µg/L | 2 | 2 | NA | NA |
| GW_Res6321 | 98-82-8 | Isopropylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 66 | No |
| GW_Res6321 | 1634-04-4 | (MTBE) | 1 | 1 | 0% | µg/L | 1 | 1 | 10.6 | No |
| GW_Res6321 | 75-09-2 | Methylene chloride | 1 | 1 | 0% | µg/L | 1 | 1 | 4.3 | No |
| GW_Res6321 | 91-20-3 | Naphthalene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.62 | Yes |
| GW_Res6321 | 104-51-8 | n-Butylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res6321 | 103-65-1 | n-Propylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res6321 | 135-98-8 | sec-Butylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res6321 | 100-42-5 | Styrene | 1 | 1 | 0% | µg/L | 1 | 1 | 160 | No |
| GW_Res6321 | 98-06-6 | tert-Butylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |

**APPENDIX Q**
**TABLE 3.38**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater Residence 6321
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Res6321 | 127-18-4 | Tetrachloroethene | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 0.1 | Yes |
| GW_Res6321 | 108-88-3 | Toluene | 1 | 1 | 0% | µg/L | 1 | 1 | 230 | No |
| GW_Res6321 | 156-60-5 | trans-1,2-Dichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 11 | No |
| GW_Res6321 | 10061-02-6 | trans-1,3-Dichloropropene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res6321 | 79-01-6 | Trichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.028 | Yes |
| GW_Res6321 | 75-69-4 | Trichlorofluoromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 130 | No |
| GW_Res6321 | 108-05-4 | Vinyl actetate | 1 | 1 | 0% | µg/L | 2 | 2 | 41 | No |
| GW_Res6321 | 75-01-4 | Vinyl chloride | 1 | 1 | 0% | µg/L | 1 | 1 | 0.015 | Yes |
| GW_Res6321 | 108-38-3/1 | Xylene, m-, p- | 1 | 1 | 0% | µg/L | 2 | 2 | 21 | No |
| GW_Res6321 | 95-47-6 | Xylene, o- | 1 | 1 | 0% | µg/L | 1 | 1 | 20 | No |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
EPA SL = Environmental Protection Agency Screening Level for protection of indoor air based on a target risk of $1x10^{-6}$
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential water
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

**APPENDIX Q**
**TABLE 3.39**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater Residence 6317
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Res6317 | 630-20-6 | 1,1,1,2-Tetrachloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.43 | Yes |
| GW_Res6317 | 71-55-6 | 1,1,1-Trichloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 910 | No |
| GW_Res6317 | 79-34-5 | 1,1,2,2-Tetrachloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.055 | Yes |
| GW_Res6317 | 79-00-5 | 1,1,2-Trichloroethane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 0.2 | Yes |
| GW_Res6317 | 75-34-3 | 1,1-Dichloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 120 | No |
| GW_Res6317 | 75-35-4 | 1,1-Dichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 34 | No |
| GW_Res6317 | 563-58-6 | 1,1-Dichloropropene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res6317 | 87-61-6 | 1,2,3-Trichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res6317 | 96-18-4 | 1,2,3-Trichloropropane | 1 | 1 | 0% | µg/L | 1.8 | 1.8 | 0.034 | Yes |
| GW_Res6317 | 120-82-1 | 1,2,4-Trichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.82 | Yes |
| GW_Res6317 | 95-63-6 | 1,2,4-Trimethylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 1.5 | No |
| GW_Res6317 | 96-12-8 | chloropropane | 1 | 1 | 0% | µg/L | 4 | 4 | 0.0002 | Yes |
| GW_Res6317 | 106-93-4 | 1,2-Dibromoethane (EDB) | 1 | 1 | 0% | µg/L | 1 | 1 | 0.0056 | Yes |
| GW_Res6317 | 95-50-1 | 1,2-Dichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 4.9 | No |
| GW_Res6317 | 107-06-2 | 1,2-Dichloroethane (EDC) | 1 | 1 | 0% | µg/L | 1 | 1 | 0.12 | Yes |
| GW_Res6317 | 78-87-5 | 1,2-Dichloropropane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 0.16 | Yes |
| GW_Res6317 | 108-67-8 | 1,3,5-Trimethylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 1.2 | No |
| GW_Res6317 | 541-73-1 | 1,3-Dichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 1.4 | No |
| GW_Res6317 | 142-28-9 | 1,3-Dichloropropane | 1 | 1 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Res6317 | 106-46-7 | 1,4-Dichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.47 | Yes |
| GW_Res6317 | 594-20-7 | 2,2-Dichloropropane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | NA | NA |
| GW_Res6317 | 78-93-3 | 2-Butanone (MEK) | 1 | 1 | 0% | µg/L | 10 | 10 | 710 | No |
| GW_Res6317 | 95-49-8 | 2-Chlorotoluene | 1 | 1 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Res6317 | 591-78-6 | 2-Hexanone | 1 | 1 | 0% | µg/L | 5 | 5 | NA | NA |
| GW_Res6317 | 106-43-4 | 4-Chlorotoluene | 1 | 1 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Res6317 | 99-87-6 | 4-Isopropyltoluene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res6317 | 108-10-1 | 4-Methyl-2-pentanone | 1 | 1 | 0% | µg/L | 5 | 5 | NA | NA |
| GW_Res6317 | 67-64-1 | Acetone | 1 | 1 | 0% | µg/L | 12 | 12 | 550 | No |
| GW_Res6317 | 107-02-8 | Acrolein | 1 | 1 | 0% | µg/L | 10 | 10 | 0.0042 | Yes |

**APPENDIX Q**
**TABLE 3.39**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater Residence 6317
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Res6317 | 107-13-1 | Acrylonitrile | 1 | 1 | 0% | µg/L | 4 | 4 | 0.039 | Yes |
| GW_Res6317 | 71-43-2 | Benzene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.35 | Yes |
| GW_Res6317 | 108-86-1 | Bromobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 2.3 | No |
| GW_Res6317 | 74-97-5 | Bromochloromethane | 1 | 1 | 0% | µg/L | 1.5 | 1.5 | NA | NA |
| GW_Res6317 | 75-27-4 | Bromodichloromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.18 | Yes |
| GW_Res6317 | 75-25-2 | Bromoform | 1 | 1 | 0% | µg/L | 1.2 | 1.2 | 8.3 | No |
| GW_Res6317 | 74-83-9 | Bromomethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.87 | Yes |
| GW_Res6317 | 75-15-0 | Carbon disulfide | 1 | 1 | 0% | µg/L | 1 | 1 | 100 | No |
| GW_Res6317 | 56-23-5 | Carbon tetrachloride | 1 | 1 | 0% | µg/L | 1 | 1 | 0.17 | Yes |
| GW_Res6317 | 108-90-7 | Chlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 9.1 | No |
| GW_Res6317 | 75-00-3 | Chloroethane | 1 | 1 | 0% | µg/L | 1.9 | 1.9 | 3.9 | No |
| GW_Res6317 | 67-66-3 | Chloroform | 1 | 1 | 0% | µg/L | 1 | 1 | 0.17 | Yes |
| GW_Res6317 | 74-87-3 | Chloromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 19 | No |
| GW_Res6317 | 156-59-2 | cis-1,2-Dichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res6317 | 10061-01-5 | cis-1,3-Dichloropropene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res6317 | 124-48-1 | Dibromochloromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.13 | Yes |
| GW_Res6317 | 74-95-3 | Dibromomethane | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res6317 | 75-71-8 | Dichlorodifluoromethane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 14 | No |
| GW_Res6317 | 100-41-4 | Ethylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 130 | No |
| GW_Res6317 | 87-68-3 | Hexachlorobutadiene | 1 | 1 | 0% | µg/L | 1.8 | 1.8 | 0.86 | Yes |
| GW_Res6317 | 74-88-4 | Iodomethane | 1 | 1 | 0% | µg/L | 2 | 2 | NA | NA |
| GW_Res6317 | 98-82-8 | Isopropylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 66 | No |
| GW_Res6317 | 1634-04-4 | (MTBE) | 1 | 1 | 0% | µg/L | 1 | 1 | 10.6 | No |
| GW_Res6317 | 75-09-2 | Methylene chloride | 1 | 1 | 0% | µg/L | 1 | 1 | 4.3 | No |
| GW_Res6317 | 91-20-3 | Naphthalene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.62 | Yes |
| GW_Res6317 | 104-51-8 | n-Butylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res6317 | 103-65-1 | n-Propylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res6317 | 135-98-8 | sec-Butylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res6317 | 100-42-5 | Styrene | 1 | 1 | 0% | µg/L | 1 | 1 | 160 | No |

**APPENDIX Q**

**TABLE 3.39**

Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater Residence 6317

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Res6317 | 98-06-6 | tert-Butylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res6317 | 127-18-4 | Tetrachloroethene | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 0.1 | Yes |
| GW_Res6317 | 108-88-3 | Toluene | 1 | 1 | 0% | µg/L | 1 | 1 | 230 | No |
| GW_Res6317 | 156-60-5 | trans-1,2-Dichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 11 | No |
| GW_Res6317 | 10061-02-6 | trans-1,3-Dichloropropene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res6317 | 79-01-6 | Trichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.028 | Yes |
| GW_Res6317 | 75-69-4 | Trichlorofluoromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 130 | No |
| GW_Res6317 | 108-05-4 | Vinyl actetate | 1 | 1 | 0% | µg/L | 2 | 2 | 41 | No |
| GW_Res6317 | 75-01-4 | Vinyl chloride | 1 | 1 | 0% | µg/L | 1 | 1 | 0.015 | Yes |
| GW_Res6317 | 108-38-3/1 | Xylene, m-, p- | 1 | 1 | 0% | µg/L | 2 | 2 | 21 | No |
| GW_Res6317 | 95-47-6 | Xylene, o- | 1 | 1 | 0% | µg/L | 1 | 1 | 20 | No |

**Screening Level (SL)**

SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)

The following Screening Levels were used to develop the final SLs used for this comparison.

EPA SL = Environmental Protection Agency Screening Level for protection of indoor air based on a target risk of $1x10^{-6}$

MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential water

MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

**APPENDIX Q**
**TABLE 3.40**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater Residence 4701
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Res4701 | 630-20-6 | 1,1,1,2-Tetrachloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.43 | Yes |
| GW_Res4701 | 71-55-6 | 1,1,1-Trichloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 910 | No |
| GW_Res4701 | 79-34-5 | 1,1,2,2-Tetrachloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.055 | Yes |
| GW_Res4701 | 79-00-5 | 1,1,2-Trichloroethane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 0.2 | Yes |
| GW_Res4701 | 75-34-3 | 1,1-Dichloroethane | 1 | 1 | 0% | µg/L | 1 | 1 | 120 | No |
| GW_Res4701 | 75-35-4 | 1,1-Dichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 34 | No |
| GW_Res4701 | 563-58-6 | 1,1-Dichloropropene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res4701 | 87-61-6 | 1,2,3-Trichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res4701 | 96-18-4 | 1,2,3-Trichloropropane | 1 | 1 | 0% | µg/L | 1.8 | 1.8 | 0.034 | Yes |
| GW_Res4701 | 120-82-1 | 1,2,4-Trichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.82 | Yes |
| GW_Res4701 | 95-63-6 | 1,2,4-Trimethylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 1.5 | No |
| GW_Res4701 | 96-12-8 | chloropropane | 1 | 1 | 0% | µg/L | 4 | 4 | 0.0002 | Yes |
| GW_Res4701 | 106-93-4 | 1,2-Dibromoethane (EDB) | 1 | 1 | 0% | µg/L | 1 | 1 | 0.0056 | Yes |
| GW_Res4701 | 95-50-1 | 1,2-Dichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 4.9 | No |
| GW_Res4701 | 107-06-2 | 1,2-Dichloroethane (EDC) | 1 | 1 | 0% | µg/L | 1 | 1 | 0.12 | Yes |
| GW_Res4701 | 78-87-5 | 1,2-Dichloropropane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 0.16 | Yes |
| GW_Res4701 | 108-67-8 | 1,3,5-Trimethylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 1.2 | No |
| GW_Res4701 | 541-73-1 | 1,3-Dichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 1.4 | No |
| GW_Res4701 | 142-28-9 | 1,3-Dichloropropane | 1 | 1 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Res4701 | 106-46-7 | 1,4-Dichlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.47 | Yes |
| GW_Res4701 | 594-20-7 | 2,2-Dichloropropane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | NA | NA |
| GW_Res4701 | 78-93-3 | 2-Butanone (MEK) | 1 | 1 | 0% | µg/L | 10 | 10 | 710 | No |
| GW_Res4701 | 95-49-8 | 2-Chlorotoluene | 1 | 1 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Res4701 | 591-78-6 | 2-Hexanone | 1 | 1 | 0% | µg/L | 5 | 5 | NA | NA |
| GW_Res4701 | 106-43-4 | 4-Chlorotoluene | 1 | 1 | 0% | µg/L | 1 | 1 | 12 | No |
| GW_Res4701 | 99-87-6 | 4-Isopropyltoluene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res4701 | 108-10-1 | 4-Methyl-2-pentanone | 1 | 1 | 0% | µg/L | 5 | 5 | NA | NA |
| GW_Res4701 | 67-64-1 | Acetone | 1 | 1 | 0% | µg/L | 12 | 12 | 550 | No |
| GW_Res4701 | 107-02-8 | Acrolein | 1 | 1 | 0% | µg/L | 10 | 10 | 0.0042 | Yes |

**APPENDIX Q**
**TABLE 3.40**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater Residence 4701
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Res4701 | 107-13-1 | Acrylonitrile | 1 | 1 | 0% | µg/L | 4 | 4 | 0.039 | Yes |
| GW_Res4701 | 71-43-2 | Benzene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.35 | Yes |
| GW_Res4701 | 108-86-1 | Bromobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 2.3 | No |
| GW_Res4701 | 74-97-5 | Bromochloromethane | 1 | 1 | 0% | µg/L | 1.5 | 1.5 | NA | NA |
| GW_Res4701 | 75-27-4 | Bromodichloromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.18 | Yes |
| GW_Res4701 | 75-25-2 | Bromoform | 1 | 1 | 0% | µg/L | 1.2 | 1.2 | 8.3 | No |
| GW_Res4701 | 74-83-9 | Bromomethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.87 | Yes |
| GW_Res4701 | 75-15-0 | Carbon disulfide | 1 | 1 | 0% | µg/L | 1 | 1 | 100 | No |
| GW_Res4701 | 56-23-5 | Carbon tetrachloride | 1 | 1 | 0% | µg/L | 1 | 1 | 0.17 | Yes |
| GW_Res4701 | 108-90-7 | Chlorobenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 9.1 | No |
| GW_Res4701 | 75-00-3 | Chloroethane | 1 | 1 | 0% | µg/L | 1.9 | 1.9 | 3.9 | No |
| GW_Res4701 | 67-66-3 | Chloroform | 1 | 1 | 0% | µg/L | 1 | 1 | 0.17 | Yes |
| GW_Res4701 | 74-87-3 | Chloromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 19 | No |
| GW_Res4701 | 156-59-2 | cis-1,2-Dichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res4701 | 10061-01-5 | cis-1,3-Dichloropropene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res4701 | 124-48-1 | Dibromochloromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 0.13 | Yes |
| GW_Res4701 | 74-95-3 | Dibromomethane | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res4701 | 75-71-8 | Dichlorodifluoromethane | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 14 | No |
| GW_Res4701 | 100-41-4 | Ethylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 130 | No |
| GW_Res4701 | 87-68-3 | Hexachlorobutadiene | 1 | 1 | 0% | µg/L | 1.8 | 1.8 | 0.86 | Yes |
| GW_Res4701 | 74-88-4 | Iodomethane | 1 | 1 | 0% | µg/L | 2 | 2 | NA | NA |
| GW_Res4701 | 98-82-8 | Isopropylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 66 | No |
| GW_Res4701 | 1634-04-4 | (MTBE) | 1 | 1 | 0% | µg/L | 1 | 1 | 10.6 | No |
| GW_Res4701 | 75-09-2 | Methylene chloride | 1 | 1 | 0% | µg/L | 1 | 1 | 4.3 | No |
| GW_Res4701 | 91-20-3 | Naphthalene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.62 | Yes |
| GW_Res4701 | 104-51-8 | n-Butylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res4701 | 103-65-1 | n-Propylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res4701 | 135-98-8 | sec-Butylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res4701 | 100-42-5 | Styrene | 1 | 1 | 0% | µg/L | 1 | 1 | 160 | No |

**APPENDIX Q**
**TABLE 3.40**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Groundwater Residence 4701
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| GW_Res4701 | 98-06-6 | tert-Butylbenzene | 1 | 1 | 0% | µg/L | 1 | 1 | 6.1 | No |
| GW_Res4701 | 127-18-4 | Tetrachloroethene | 1 | 1 | 0% | µg/L | 1.1 | 1.1 | 0.1 | Yes |
| GW_Res4701 | 108-88-3 | Toluene | 1 | 1 | 0% | µg/L | 1 | 1 | 230 | No |
| GW_Res4701 | 156-60-5 | trans-1,2-Dichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 11 | No |
| GW_Res4701 | 10061-02-6 | trans-1,3-Dichloropropene | 1 | 1 | 0% | µg/L | 1 | 1 | NA | NA |
| GW_Res4701 | 79-01-6 | Trichloroethene | 1 | 1 | 0% | µg/L | 1 | 1 | 0.028 | Yes |
| GW_Res4701 | 75-69-4 | Trichlorofluoromethane | 1 | 1 | 0% | µg/L | 1 | 1 | 130 | No |
| GW_Res4701 | 108-05-4 | Vinyl actetate | 1 | 1 | 0% | µg/L | 2 | 2 | 41 | No |
| GW_Res4701 | 75-01-4 | Vinyl chloride | 1 | 1 | 0% | µg/L | 1 | 1 | 0.015 | Yes |
| GW_Res4701 | 108-38-3/1 | Xylene, m-, p- | 1 | 1 | 0% | µg/L | 2 | 2 | 21 | No |
| GW_Res4701 | 95-47-6 | Xylene, o- | 1 | 1 | 0% | µg/L | 1 | 1 | 20 | No |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
The following Screening Levels were used to develop the final SLs used for this comparison.
EPA SL = Environmental Protection Agency Screening Level for protection of indoor air based on a target risk of $1x10^{-6}$
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for residential water
MSSLs adjusted downward by a factor of 10 to account for cumulative effects from multiple noncarcinogens acting on the same target organ.

**APPENDIX Q**
**TABLE 3.41**
Evaluation of Reporting Limits for Compounds that were Not Detected in Off-site Resident Indoor Air
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Sample Group | CAS | Analyte | Number of Analysis | Number of Non-Detects | FOD | Units | Minimum Detection Limit for NDs | Maximum Detection Limit for NDs | SL | Does RL Exceed Standard? |
|---|---|---|---|---|---|---|---|---|---|---|
| Indoor Air | 127-18-4 | Tetrachloroethene | 1 | 1 | 0% | UG/M3 | 0.25 | 0.25 | 0.33 | No |
| Indoor Air | 156-60-5 | trans-1,2-Dichloroethene | 2 | 2 | 0% | UG/M3 | 0.036 | 0.043 | 63 | No |
| Indoor Air | 75-01-4 | Vinyl chloride | 3 | 3 | 0% | UG/M3 | 0.023 | 0.043 | 0.16 | No |

**Screening Level (SL)**
SLs were identified as described in Section 3.1 of Work Planning Document (CH2M HILL, 2008)
MSSL = USEPA Region 6 Medium-Specific Screening Levels (MSSLs) for ambient air

**APPENDIX Q**
**TABLE 4.1**
Summary of Soil Chemicals of Potential Concern - Sitewide Analysis
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | Surface Soil On-site (0-2 feet) | Subsurface Soil On-site (0-10 feet) |
|---|---|---|---|
| **CAS** | **Analyte** | **MaxDet Exceeds SL?** | **MaxDet Exceeds SL?** |
| 7440-38-2 | Arsenic | Yes | Yes |
| 7439-92-1 | Lead | Yes | Yes |
| 50-32-8 | Benzo(a)pyrene | Yes | Yes |
| 127-18-4 | Tetrachloroethene | Yes | Yes |
| 79-01-6 | Trichloroethene | Yes | Yes |

**Note:**
Average concentration of lead was less than the respective screening levels.
SL = Screening Level

**APPENDIX Q**
**TABLE 4.2**
Summary of Subsurface Soil (0-10 Ft) Chemicals of Potential Concern - On-Site Exposure Units A through L
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| CAS | Analyte | Exposure Unit A MaxDet Exceeds SL? | Exposure Unit B MaxDet Exceeds SL? | Exposure Unit C MaxDet Exceeds SL? | Exposure Unit D MaxDet Exceeds SL? | Exposure Unit E MaxDet Exceeds SL? | Exposure Unit F MaxDet Exceeds SL? | Exposure Unit G MaxDet Exceeds SL? | Exposure Unit H MaxDet Exceeds SL? | Exposure Unit I MaxDet Exceeds SL? | Exposure Unit J MaxDet Exceeds SL? | Exposure Unit K MaxDet Exceeds SL? | Exposure Unit L MaxDet Exceeds SL? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7429-90-5 | Aluminum | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 7440-36-0 | Antimony | Yes | Yes | Yes | | Yes | Yes | | | | | | |
| 7440-38-2 | Arsenic | | Yes | | | Yes | Yes | | Yes | | Yes | | |
| 7440-47-3 | Chromium | | | | | Yes | | | | | | | |
| 7440-50-8 | Copper | | | | | | | | | | Yes | | |
| 7439-89-6 | Iron | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 7439-92-1 | Lead | Yes | Yes | | | | Yes | Yes | | | | | Yes |
| 7439-96-5 | Manganese | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 7782-49-2 | Selenium | Yes | | | | | | | | | | | Yes |
| 7440-22-4 | Silver | | | | | | | | Yes | | | | |
| 7440-28-0 | Thallium | | | | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 7440-62-2 | Vanadium | | | | | Yes | Yes | Yes | | | | Yes | Yes |
| 205-99-2 | Benzo(b)fluoranthene | | | | | | | Yes | | | Yes | | |
| 156-59-2 | cis-1,2-Dichloroethene | | | | | | | | | | | | Yes |
| 127-18-4 | Tetrachloroethene | | | | | | | | | | | | Yes |
| 79-01-6 | Trichloroethene | | | | | | | | | | | | Yes |

**Note:**
Average concentration of lead was less than the respective screening levels for all exposure units A through L.
SL = Screening Level

**APPENDIX Q**
**TABLE 4.3**
Summary of Groundwater Chemicals of Potential Concern
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | Downgradient of Former Building 220 (Tap Water and Indoor Air) | Downgradient of Former Building 220 (Groundwater in Excavations) | Off-Site Groundwater (Groundwater in Excavation) | On-Site Groundwater (Excluding Area Downgradient of Former Building 220) (Tap Water and Indoor Air) |
|---|---|---|---|---|---|
| **CAS** | **Analyte** | **MaxDet Exceeds SL?** | **MaxDet Exceeds SL?** | **MaxDet Exceeds SL?** | **MaxDet Exceeds SL?** |
| 7439-96-5 | Manganese | Yes | | Yes | |
| 91-20-3 | Naphthalene | Yes | Yes | | |
| 630-20-6 | 1,1,1,2-Tetrachloroethane | Yes | Yes | | |
| 79-34-5 | 1,1,2,2-Tetrachloroethane | Yes | Yes | | |
| 79-00-5 | 1,1,2-Trichloroethane | Yes | Yes | | |
| 107-06-2 | 1,2-Dichloroethane (EDC) | Yes | Yes | Yes | Yes |
| 71-43-2 | Benzene | Yes | Yes | | |
| 56-23-5 | Carbon tetrachloride | Yes | Yes | | Yes |
| 67-66-3 | Chloroform | Yes | Yes | Yes | |
| 156-59-2 | cis-1,2-Dichloroethene | Yes | Yes | Yes | |
| 127-18-4 | Tetrachloroethene | Yes | Yes | Yes | |
| 156-60-5 | trans-1,2-Dichloroethene | Yes | Yes | | |
| 79-01-6 | Trichloroethene | Yes | Yes | Yes | |
| 75-01-4 | Vinyl chloride | Yes | Yes | | |

**Note:**
No chemicals were detected at concentrations exceeding screening levels at three off-site residences.
SL = Screening Level

**APPENDIX Q**
**TABLE 5.1**
Summary of Calculation of Soil Exposure Point Concentrations - Sitewide Analysis
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

***On-site Surface Soil (0-2 feet)***

| Variable | Number of Detected Values | Number of Nondetected Values | % Nondetected Values | Minimum | Maximum | Mean | Median | Method | UCL | EPC | Max Used? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 75 | 3 | 3.85% | 4 | 36.3 | 9.498 | 8.11 | 95% KM (BCA) UCL | 10.33 | 10.33 | No |
| Benzo(a)pyrene | 17 | 0 | 0.00% | 0.0472 | 0.505 | 0.188 | 0.143 | 95% KM (Chebyshev) UCL | 0.347 | 0.347 | No |
| Lead | 99 | 0 | 0.00% | 11.9 | 1,416 | 137.8 | 65.9 | 95% KM (Chebyshev) UCL | 239.8 | 239.8 | No |
| Tetrachloroethene | 9 | 0 | 0.00% | 0.0012 | 6.4 | 0.777 | 0.052 | 95% KM (Chebyshev) UCL | 3.844 | 3.844 | No |
| Trichloroethene | 6 | 3 | 33.33% | 0.0011 | 0.81 | 0.238 | 0.0115 | 95% KM (BCA) UCL | 0.378 | 0.378 | No |

***On-site Subsurface Soil (0-10 feet)***

| Variable | Number of Detected Values | Number of Nondetected Values | % Nondetected Values | Minimum | Maximum | Mean | Median | Method | UCL | EPC | Max Used? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 94 | 3 | 3.09% | 4 | 36.3 | 8.956 | 7.5 | 95% KM (BCA) UCL | 9.71 | 9.71 | No |
| Benzo(a)pyrene | 36 | 0 | 0.00% | 0.0039 | 0.505 | 0.145 | 0.099 | Use 95% Approximate Gamma UCL | 0.188 | 0.188 | No |
| Lead | 119 | 0 | 0.00% | 7.37 | 1,416 | 123.5 | 56.14 | Use 95% H-UCL | 134.5 | 134.5 | No |
| Tetrachloroethene | 17 | 1 | 5.56% | 0.00046 | 6.4 | 0.771 | 0.048 | 95% KM (Chebyshev) UCL | 2.6 | 2.6 | No |
| Trichloroethene | 13 | 5 | 27.78% | 0.0011 | 0.81 | 0.172 | 0.032 | 95% KM (Chebyshev) UCL | 0.379 | 0.379 | No |

**Note:**
Units are milligram/kilogram
UCL = Upper Confidence Limit
EPC = Exposure Point Concentration

APPENDIX Q
TABLE 5.2
Summary of Calculation of Soil Exposure Point Concentrations - Exposure Units A through L
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

***On-site Subsurface Soil (0-10 feet)***

| Exposure Unit | Variable | Number of Detected Values | Number of Nondetected Values | % Nondetected Values | Minimum | Maximum | Mean | Median | Method | UCL | EPC | Max Used? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Aluminum | 9 | 0 | 0.00% | 5,748.20 | 7,845 | 6,708.24 | 6,840 | Use 95% Student's-t UCL | 7,146.22 | 7,146 | No |
| | Antimony | 3 | 5 | 62.50% | 1.2 | 5.293179 | 2.564393 | 1.2 | 95% KM (t) UCL | 2.8221844 | 2.822184 | No |
| | Iron | 9 | 0 | 0.00% | 10,700 | 21,855 | 13,971.44 | 13,306 | Use 95% Approximate Gamma UCL | 16,025.34 | 16,025.34 | No |
| | Lead | 10 | 0 | 0.00% | 28.345 | 1,022.90 | 236.0005 | 111.08 | Use 95% Chebyshev (MVUE) UCL | 563.81276 | 563.81276 | No |
| | Manganese | 9 | 0 | 0.00% | 440 | 601 | 526.49 | 518 | Use 95% Student's-t UCL | 557.32186 | 557.32186 | No |
| | Selenium | 1 | 4 | 80.00% | 12.4 | 12.4 | 12.4 | 12.4 | NA | NA | 12.4 | Yes[2] |
| B | Aluminum | 8 | 0 | 0.00% | 5,500 | 11,600 | 7,242.76 | 6,678.50 | Use 95% Approximate Gamma UCL | 8,645.40 | 8,645.395 | No |
| | Antimony | 3 | 3 | 50.00% | 2.76 | 3.15 | 2.9233333 | 2.86 | 95% KM (t) UCL | 3.1589973 | 3.15 | Yes[1] |
| | Arsenic | 5 | 2 | 28.57% | 7.280546 | 18.9 | 13.996109 | 13.7 | 95% KM (Percentile Bootstrap) UCL | 16.014286 | 16.014286 | No |
| | Iron | 8 | 0 | 0.00% | 10,659 | 17,630 | 12833 | 12,221.50 | Use 95% Student's-t UCL | 14,349.43 | 14,349.43 | No |
| | Lead | 9 | 0 | 0.00% | 31 | 1,416 | 267.97422 | 74.4 | Use 95% Chebyshev (MVUE) UCL | 626.68651 | 626.68651 | No |
| | Manganese | 8 | 0 | 0.00% | 435.2 | 708 | 524.275 | 487 | Use 95% Student's-t UCL | 585.99532 | 585.99532 | No |
| C | Aluminum | 4 | 0 | 0.00% | 6,382.40 | 8,259 | 7,322.38 | 7,324.05 | NA | NA | 8,259 | Yes[3] |
| | Antimony | 1 | 1 | 50.00% | 4.24 | 4.24 | 4.24 | 4.24 | NA | NA | 4.24 | Yes[3] |
| | Iron | 4 | 0 | 0.00% | 13,258 | 17,675 | 15,184.75 | 14,903 | NA | NA | 17,675 | Yes[3] |
| | Manganese | 4 | 0 | 0.00% | 423.08 | 611 | 510.92 | 504.8 | NA | NA | 611 | Yes[3] |
| D | Aluminum | 6 | 0 | 0.00% | 6,987 | 12,900 | 9,170.43 | 7,841.80 | Use 95% Approximate Gamma UCL | 11,965.24 | 11,965.236 | No |
| | Iron | 6 | 0 | 0.00% | 11,678 | 19,100 | 15,879.17 | 16,424 | Use 95% Student's-t UCL | 18,185.23 | 18,185.230 | No |
| | Manganese | 6 | 0 | 0.00% | 306 | 1,040 | 628.6 | 606.3 | Use 95% Student's-t UCL | 837.64849 | 837.64849 | No |
| | Thallium | 3 | 0 | 0.00% | 2.74 | 4.66 | 3.6733333 | 3.62 | NA | NA | 4.66 | Yes[3] |
| E | Aluminum | 7 | 0 | 0.00% | 6,292 | 10,600 | 8,026.14 | 7,775 | Use 95% Student's-t UCL | 9,044.47 | 9,044.475 | No |
| | Antimony | 1 | 4 | 80.00% | 14.1 | 14.1 | 14.1 | 14.1 | NA | NA | 14.1 | Yes[2] |
| | Arsenic | 7 | 0 | 0.00% | 5.12 | 16.5 | 10.412454 | 11 | Use 95% Student's-t UCL | 13.731445 | 13.731445 | No |
| | Chromium | 8 | 1 | 11.11% | 13 | 57.7 | 21.78425 | 17 | 95% KM (Chebyshev) UCL | 41.473602 | 41.473602 | No |
| | Iron | 7 | 0 | 0.00% | 5,800 | 17,300 | 13,810 | 14,793 | Use 95% Student's-t UCL | 16,625.45 | 16,625.451 | No |
| | Manganese | 7 | 0 | 0.00% | 509 | 1,060 | 688.65286 | 619 | Use 95% Student's-t UCL | 841.18169 | 841.18169 | No |
| | Thallium | 1 | 4 | 80.00% | 5.07 | 5.07 | 5.07 | 5.07 | NA | NA | 5.07 | Yes[2] |
| | Vanadium | 6 | 0 | 0.00% | 20.3 | 44.1 | 27.003667 | 24.75 | Use 95% Approximate Gamma UCL | 35.264133 | 35.264133 | No |
| F | Aluminum | 11 | 0 | 0.00% | 6,464.20 | 11,100 | 8,486.15 | 8492 | Use 95% Student's-t UCL | 9,311.99 | 9,311.992 | No |
| | Antimony | 2 | 2 | 50.00% | 2.2 | 5.73 | 3.965 | 3.965 | NA | NA | 5.73 | Yes[3] |
| | Arsenic | 11 | 3 | 21.43% | 4.93 | 14.5 | 7.77696 | 7.4 | 95% KM (Percentile Bootstrap) UCL | 8.4897091 | 8.4897091 | No |
| | Iron | 11 | 0 | 0.00% | 13,429 | 18,600 | 15,736.36 | 15,605 | Use 95% Student's-t UCL | 16,528.24 | 16,528.239 | No |
| | Lead | 16 | 0 | 0.00% | 11.9 | 1,118 | 136.45488 | 50.1 | Use 99% Chebyshev (Mean, Sd) UCL | 835.63315 | 835.63315 | No |
| | Manganese | 11 | 0 | 0.00% | 516 | 1,025.30 | 693.59455 | 639 | Use 95% Approximate Gamma UCL | 776.39401 | 776.39401 | No |
| | Thallium | 2 | 3 | 60.00% | 0.3 | 2.18 | 1.24 | 1.24 | 95% KM (BCA) UCL | NA | 2.18 | Yes |
| | Vanadium | 8 | 0 | 0.00% | 22.045 | 46.1 | 26.088875 | 22.9615 | or 95% Modified-t UCL | 32.025943 | 32.025943 | No |
| | Aluminum | 11 | 0 | 0.00% | 6,837.10 | 14,655 | 9,527.92 | 8,710 | Use 95% Student's-t UCL | 10,917.84 | 10,917.844 | No |
| | Benzo(b)fluoranthene | 2 | 1 | 33.33% | 0.1298 | 0.8186 | 0.4742 | 0.4742 | NA | NA | 0.8186 | Yes[3] |

**APPENDIX Q**
**TABLE 5.2**
Summary of Calculation of Soil Exposure Point Concentrations - Exposure Units A through L
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

***On-site Subsurface Soil (0-10 feet)***

| Exposure Unit | Variable | Number of Detected Values | Number of Nondetected Values | % Nondetected Values | Minimum | Maximum | Mean | Median | Method | UCL | EPC | Max Used? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G | Iron | 11 | 0 | 0.00% | 6,000 | 22,519 | 16,224.09 | 16,074 | Use 95% Student's-t UCL | 18,450.28 | 18,450.278 | No |
| | Lead | 12 | 0 | 0.00% | 11 | 983 | 133.457 | 57.9 | Use 95% Chebyshev (MVUE) UCL | 274.85561 | 274.85561 | No |
| | Manganese | 11 | 0 | 0.00% | 601 | 1,070 | 814.05364 | 766.83 | Use 95% Student's-t UCL | 901.73951 | 901.73951 | No |
| | Thallium | 2 | 5 | 71.43% | 1.94 | 5.19 | 3.565 | 3.565 | 95% KM (t) UCL | 6.7226668 | 5.19 | Yes[1] |
| | Vanadium | 9 | 0 | 0.00% | 22.2 | 50.2 | 31.372667 | 27.9 | Use 95% Student's-t UCL | 37.161342 | 37.161342 | No |
| H | Aluminum | 7 | 0 | 0.00% | 5,395.60 | 8,960 | 7,181.50 | 7440 | Use 95% Student's-t UCL | 8,007.99 | 8,007.994 | No |
| | Arsenic | 18 | 1 | 5.26% | 4.035499 | 23.5 | 9.3670015 | 8.3 | 95% KM (BCA) UCL | 10.762753 | 10.762753 | No |
| | Iron | 7 | 0 | 0.00% | 12,114 | 15,913 | 14,146.14 | 14,421 | Use 95% Student's-t UCL | 15,124.79 | 15,124.785 | No |
| | Manganese | 7 | 0 | 0.00% | 530 | 656.17 | 584.62429 | 570.17 | Use 95% Student's-t UCL | 619.44778 | 619.44778 | No |
| | Silver | 5 | 2 | 28.57% | 0.72 | 82.6 | 22.226 | 3.85 | 95% KM (Chebyshev) UCL | 68.029619 | 68.029619 | No |
| | Thallium | 1 | 1 | 50.00% | 4.52 | 4.52 | 4.52 | 4.52 | NA | NA | 4.52 | Yes[3] |
| I | Aluminum | 8 | 0 | 0.00% | 7,161.80 | 9,440 | 8,180.09 | 7,925.50 | Use 95% Student's-t UCL | 8,813.95 | 8,813.951 | No |
| | Iron | 8 | 0 | 0.00% | 13,876 | 17,800 | 15,669.25 | 15,503.50 | Use 95% Student's-t UCL | 16,525.95 | 16,525.946 | No |
| | Manganese | 8 | 0 | 0.00% | 562 | 1,120 | 789.63875 | 722.5 | Use 95% Student's-t UCL | 921.43907 | 921.43907 | No |
| | Thallium | 1 | 3 | 75.00% | 5.78 | 5.78 | 5.78 | 5.78 | NA | NA | 5.78 | Yes[3] |
| J | Aluminum | 8 | 0 | 0.00% | 4,192.70 | 9,733.40 | 7,377.23 | 7,542.30 | Use 95% Student's-t UCL | 8,429.01 | 8,429.006 | No |
| | Arsenic | 22 | 0 | 0.00% | 5.729168 | 36.3 | 10.27105 | 8.18 | or 95% Modified-t UCL | 12.900648 | 12.900648 | No |
| | Benzo(b)fluoranthene | 10 | 0 | 0.00% | 0.0172 | 0.7669 | 0.3261 | 0.32145 | Use 95% Student's-t UCL | 0.4652647 | 0.4652647 | No |
| | Copper | 8 | 0 | 0.00% | 11.975 | 410.2 | 77.38325 | 19.7545 | Use 95% Approximate Gamma UCL | 213.1959 | 213.1959 | No |
| | Iron | 8 | 0 | 0.00% | 9,094.20 | 18,123 | 15,353.03 | 15,880.50 | Use 95% Student's-t UCL | 17,260.25 | 17,260.246 | No |
| | Manganese | 8 | 0 | 0.00% | 336.26 | 938.2 | 622.63 | 594.39 | Use 95% Student's-t UCL | 756.55501 | 756.55501 | No |
| | Thallium | 4 | 0 | 0.00% | 0.2 | 8.64 | 2.36 | 0.3 | NA | NA | 8.64 | Yes[3] |
| K | Aluminum | 12 | 0 | 0.00% | 5,136.10 | 10,700 | 8,545.80 | 8,974.50 | Use 95% Student's-t UCL | 9,407.55 | 9,407.555 | No |
| | Iron | 12 | 0 | 0.00% | 4,600 | 17,500 | 14,698 | 15,758.50 | Use 95% Student's-t UCL | 16,480.27 | 16,480.268 | No |
| | Manganese | 12 | 0 | 0.00% | 539.37 | 1,050 | 748.35 | 669.845 | Use 95% Student's-t UCL | 8,42.13868 | 1050 | No |
| | Thallium | 1 | 4 | 80.00% | 7.67 | 7.67 | 7.67 | 7.67 | NA | NA | 7.67 | Yes[2] |
| | Vanadium | 9 | 0 | 0.00% | 18.389 | 48 7 | 27.405889 | 25.438 | or 95% Modified-t UCL | 32.978831 | 32.978831 | No |

**APPENDIX Q**
**TABLE 5.2**
Summary of Calculation of Soil Exposure Point Concentrations - Exposure Units A through L
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

***On-site Subsurface Soil (0-10 feet)***

| Exposure Unit | Variable | Number of Detected Values | Number of Nondetected Values | % Nondetected Values | Minimum | Maximum | Mean | Median | Method | UCL | EPC | Max Used? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | Aluminum | 6 | 0 | 0.00% | 5,510.80 | 8,681 | 7,523.13 | 8,022 | Use 95% Student's-t UCL | 8,591.42 | 8,591.424 | No |
| | cis-1,2-Dichloroethene | 13 | 5 | 27.78% | 0.00067 | 0.7 | 0.12149 | 0.032 | 95% KM (Chebyshev) UCL | 0.2880133 | 0.2880133 | No |
| | Iron | 8 | 0 | 0.00% | 4,900 | 23,197 | 14363.875 | 15,588 | Use 95% Student's-t UCL | 17,843.67 | 17,843.672 | No |
| | Lead | 8 | 0 | 0.00% | 14.9 | 510 | 136.8375 | 82.5 | Use 95% Approximate Gamma UCL | 305.91792 | 305.91792 | No |
| | Manganese | 7 | 0 | 0.00% | 528.3 | 1050 | 719.61429 | 665 | Use 95% Student's-t UCL | 857.37033 | 857.37033 | No |
| | Selenium | 3 | 3 | 50.00% | 0.6 | 6.42 | 4.2233333 | 5.65 | 95% KM (Percentile Bootstrap) UCL | 6.42 | 6.42 | No |
| | Tetrachloroethene | 17 | 1 | 5.56% | 0.00046 | 6.4 | 0.7705212 | 0.048 | 95% KM (Chebyshev) UCL | 2.6000243 | 2.6000243 | No |
| | Thallium | 2 | 3 | 60.00% | 2.23 | 2.36 | 2.295 | 2.295 | 95% KM (t) UCL | 2.43357 | 2.36 | Yes[1] |
| | Trichloroethene | 13 | 5 | 27.78% | 0.0011 | 0.81 | 0.1723692 | 0.032 | 95% KM (Chebyshev) UCL | 0.3791797 | 0.3791797 | No |
| | Vanadium | 6 | 0 | 0.00% | 19.7 | 51.2 | 28.416667 | 25.9 | Use 95% Approximate Gamma UCL | 39.934674 | 39.934674 | No |

**Notes:**
(1) Maximum detected concentration was used because the calculated UCL exceeds the maximum detected concentration
(2) Maximum detected concentration was used because of the small number of detected concentrations.
(3) Maximum detected concentration was used because of the small number of samples.
UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
NA = Not applicable or not available
Units are milligram/kilogram

**APPENDIX Q**
**TABLE 5.3**
Summary of Calculation of Groundwater Exposure Point Concentrations
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

***Downgradient of Former Building 220 (Residential)***

| Variable | Number of Detected Values | Number of Nondetected Values | % Nondetected Values | Minimum | Maximum | Mean | Median | UCL | UCL Basis | EPC | Max Used? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 1 | 20 | 95.24% | 16 | 16 | 16 | 16 | NA | NA | 16 | Yes[2] |
| 1,1,2,2-Tetrachloroethane | 1 | 20 | 95.24% | 0.58 | 0.58 | 0.58 | 0.58 | NA | NA | 0.58 | Yes[2] |
| 1,1,2-Trichloroethane | 1 | 13 | 92.86% | 2.3 | 2.3 | 2.3 | 2.3 | NA | NA | 2.3 | Yes[2] |
| 1,2-Dichloroethane (EDC) | 4 | 17 | 80.95% | 3.3 | 189 | 110.575 | 125 | 46.292944 | 95% KM (t) UCL | 46.292944 | No |
| Benzene | 2 | 19 | 90.48% | 0.22 | 4 | 2.11 | 2.11 | 4.4417416 | 99% KM (Chebyshev) UCL | 4 | Yes[1] |
| Carbon tetrachloride | 2 | 19 | 90.48% | 2.7 | 4,160 | 2,081.35 | 2,081.35 | 2,919.17 | 99% KM (Chebyshev) UCL | 2,919.1709 | No |
| Chloroform | 4 | 17 | 80.95% | 0.35 | 790 | 208.5375 | 21.9 | 112.93894 | 95% KM (t) UCL | 112.93894 | No |
| cis-1,2-Dichloroethene | 8 | 13 | 61.90% | 1.5 | 281 | 85.225 | 28 | 64.704303 | 95% KM (t) UCL | 64.704303 | No |
| Manganese | 2 | 0 | 0.00% | NA | 283 | NA | NA | NA | NA | 283 | Yes[3] |
| Naphthalene | 1 | 13 | 92.86% | 10.1 | 10.1 | 10.1 | 10.1 | NA | NA | 10.1 | Yes[2] |
| Tetrachloroethene | 9 | 12 | 57.14% | 0.64 | 34,900 | 9,005.92 | 5 | 25,733.82 | 99% KM (Chebyshev) UCL | 25,733.823 | No |
| trans-1,2-Dichloroethene | 4 | 17 | 80.95% | 0.54 | 12 | 3.5175 | 0.765 | 12 | 95% KM (BCA) UCL | 12 | No |
| Trichloroethene | 11 | 10 | 47.62% | 0.41 | 1,620 | 392.5136 | 18 | 419.8 | 95% KM (BCA) UCL | 419.8 | No |
| Vinyl chloride | 1 | 20 | 95.24% | 0.32 | 0.32 | 0.32 | 0.32 | NA | NA | 0.32 | Yes[2] |

***Downgradient of Former Building 220 (On-site Excavations)***

| Variable | Number of Detected Values | Number of Nondetected Values | % Nondetected Values | Minimum | Maximum | Mean | Median | UCL | UCL Basis | EPC | Max Used? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 1 | 5 | 83.33% | 16 | 16 | 16 | 16 | NA | NA | 16 | Yes[2] |
| 1,1,2,2-Tetrachloroethane | 1 | 3 | 75.00% | 0.58 | 0.58 | 0.58 | 0.58 | NA | NA | 0.58 | Yes[3] |
| 1,1,2-Trichloroethane | 1 | 3 | 75.00% | 2.3 | 2.3 | 2.3 | 2.3 | NA | NA | 2.3 | Yes[3] |
| 1,2-Dichloroethane (EDC) | 2 | 4 | 66.67% | 3.3 | 189 | 96.15 | 96.15 | 431.8 | 99% KM (Chebyshev) UCL | 189 | Yes[1] |
| Benzene | 2 | 4 | 66.67% | 0.22 | 4 | 2.11 | 2.11 | 12.68 | 99% KM (Chebyshev) UCL | 4 | Yes[1] |
| Carbon tetrachloride | 2 | 4 | 66.67% | 2.7 | 4,160 | 2,081 | 2,081 | 9,596 | 99% KM (Chebyshev) UCL | 4,160 | Yes[1] |
| Chloroform | 3 | 2 | 40.00% | 20 | 790 | 277.9 | 23.8 | 1,851 | 99% KM (Chebyshev) UCL | 790 | Yes[1] |
| cis-1,2-Dichloroethene | 2 | 3 | 60.00% | 250 | 281 | 265.5 | 265.5 | 272.9 | 95% KM (t) UCL | 272.9 | No |
| Naphthalene | 1 | 3 | 75.00% | 10.1 | 10.1 | 10.1 | 10.1 | NA | NA | 10.1 | Yes[3] |
| Tetrachloroethene | 6 | 2 | 25.00% | 0.64 | 34,900 | 10,651 | 2.94 | 61,601 | 99% KM (Chebyshev) UCL | 34,900 | Yes[1] |
| trans-1,2-Dichloroethene | 1 | 4 | 80.00% | 12 | 12 | 12 | 12 | NA | NA | 12 | Yes[2] |
| Trichloroethene | 5 | 2 | 28.57% | 0.41 | 1,620 | 812.2 | 1,040 | 1,145 | 95% KM (t) UCL | 1,145 | No |
| Vinyl chloride | 1 | 0 | 0.00% | 0.32 | 0.32 | 0.32 | 0.32 | NA | NA | 0.32 | Yes[3] |

**APPENDIX Q**
**TABLE 5.3**
Summary of Calculation of Groundwater Exposure Point Concentrations
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

***Off-site Groundwater (Residential and Excavations)***

| Variable | Number of Detected Values | Number of Nondetected Values | % Nondetected Values | Minimum | Maximum | Mean | Median | UCL | UCL Basis | EPC | Max Used? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dichloroethane (EDC) | 3 | 9 | 75.00% | 3 | 150 | 84.33333 | 100 | 52.920425 | 95% KM (t) | 52.920425 | No |
| cis-1,2-Dichloroethene | 6 | 6 | 50.00% | 1.5 | 82.2 | 25.13333 | 9.7 | 26.987422 | 95% KM (t) | 26.987422 | No |
| Manganese | 2 | 0 | 0.00% | 283 | 2,010 | 1,147 | 1,147 | NA | NA | 2010 | Yes[3] |
| Tetrachloroethene | 4 | 8 | 66.67% | 2.9 | 9,440 | 4,286.70 | 3,851.95 | 3,353.90 | 95% KM (t) | 3,353.8985 | No |
| Trichloroethene | 6 | 6 | 50.00% | 5.1 | 129 | 42.78333 | 17.4 | 45.510054 | 95% KM (t) | 45.510054 | No |
| Chloroform | 1 | 12 | 91.67% | 0.35 | 0.35 | 0.35 | 0.35 | NA | NA | 0.35 | Yes[2] |

***On-site Groundwater Excluding Area Downgradient of Former Building 220 (Residential)***

| Variable | Number of Detected Values | Number of Nondetected Values | % Nondetected Values | Minimum | Maximum | Mean | Median | UCL | UCL Basis | EPC | Max Used? |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dichloroethane (EDC) | 2 | 2 | 50.00% | 3.3 | 4.4 | 4 | 4 | NA | NA | 4.4 | Yes[3] |
| Carbon tetrachloride | 1 | 3 | 75.00% | 0.38 | 0.38 | 0.38 | 0.38 | NA | NA | 0.38 | Yes[3] |

**Notes:**
[1] Maximum detected concentration was used because the calculated UCL exceeds the maximum detected concentration
[2] Maximum detected concentration was used because of the small number of detected concentrations.
[3] Maximum detected concentration was used because of the small number of samples.
Units are microgram/liter
UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
NA = Not applicable or not available

**APPENDIX Q**
**TABLE 6.1**
Exposure Factors for the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Route | Parameter Code | Parameter Definition | Receptor Population / Receptor Age / Units | Resident Adult Value | Resident Adult Reference | Resident Child Value | Resident Child Rationale/ Reference | Age-Adjusted Value | Intake Equation/Model Name |
|---|---|---|---|---|---|---|---|---|---|
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | EPC | Calculated | EPC | Calculated | | Chronic Daily Intake (CDI) (mg/kg-day) = |
| (Soil ) | IR-S | Ingestion Rate of Soil | mg/day | 100 | USEPA 2002 | 200 | USEPA 2002 | | CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT-N |
| | EF | Exposure Frequency | days/year | 350 | USEPA 2002 | 350 | USEPA 2002 | | |
| | ED | Exposure Duration | years | 24 | USEPA 2002 | 6 | USEPA 2002 | | |
| | CF1 | Conversion Factor 1 | kg/mg | 1.0E-06 | — | 1.0E-06 | — | | |
| | BW | Body Weight | kg | 70 | USEPA 2002 | 15 | USEPA 2002 | | |
| | AT-N | Averaging Time (Noncancer) | days | 8,760 | USEPA 2002 | 2,190 | USEPA 2002 | | |
| | CF1 | Conversion Factor 1 | kg/mg | | | | | 0.000001 | CDI[a] (mg/kg-day) = |
| | CS | Chemical Concentration in Soil | mg/kg | | | | | EPC | CS x IR-S-Adj x EF x CF1 x 1/AT-C |
| | EF | Exposure Frequency | days/year | | | | | 350 | IR-S-Adj (mg-year/kd-day) = |
| | IR-S-Adj | Ingestion Rate of Soil, Age-adjusted | mg-year/kg-day | | | | | 114.3 | (ED-C x IR-S-C / BW-C) + (ED-A x IR-S-A / BW-A) |
| | AT-C | Averaging Time (Cancer) | days | | | | | 25550 | |
| Dermal | CS | Chemical Concentration in Soil | mg/kg | EPC | Calculated | EPC | Calculated | | Dermally Absorbed Dose (DAD) (mg/kg-day) = |
| (Soil ) | SA | Skin Surface Area Available for Contact | $cm^2$ | 5,700 | USEPA 2002 | 2,800 | USEPA 2002 | | CS x SA x SSAF x DABS x CF1 x EF x ED x 1/BW x 1/AT |
| | SSAF | Soil-to-Skin Adherence Factor | $mg/cm^2$-day | 0.07 | USEPA 2002 | 0.2 | USEPA 2002 | | |
| | DABS | Dermal Absorption Factor Solids | -- | chemical-specific | USEPA 2004 | chemical-specific | USEPA 2004 | | |
| | CF1 | Conversion Factor 1 | kg/mg | 1.0E-06 | — | 1.0E-06 | — | | |
| | EF | Exposure Frequency | days/year | 350 | USEPA 2002 | 350 | USEPA 2002 | | |
| | ED | Exposure Duration | years | 24 | USEPA 2002 | 6 | USEPA 2002 | | |
| | BW | Body Weight | kg | 70 | USEPA 2002 | 15 | USEPA 2002 | | |
| | AT-N | Averaging Time (Noncancer) | days | 8,760 | USEPA 2002 | 2,190 | USEPA 2002 | | |
| | CF1 | Conversion Factor 1 | kg/mg | | | | | 0.000001 | DAD[a] (mg/kg-day) = |
| | CS | Chemical Concentration in Soil | mg/kg | | | | | EPC | CS x DA-Adj x DABS x CF1 x EF x 1/AT |
| | EF | Exposure Frequency | days/year | | | | | 350 | DA-Adj (mg-year/kg-day) = |
| | DABS | Dermal Absorption Factor Solids | -- | | | | | chemical-specific | (ED-C x SA-C x SSAF-C / BW-C) + |
| | DA-Adj | Dermal Absorption, Age-adjusted | mg-year/kg-day | | | | | 360.8 | (ED-A x SA-A x SSAF-A / BW-A) |
| | AT-C | Averaging Time (Cancer) | days | | | | | 25550 | |
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | EPC | - - | EPC | - - | | Daily Average Concentration (DAC) ($mg/m^3$) = |
| (Soil ) | CA | Chemical Concentration in Air | $mg/m^3$ | Calculated | Calculated | Calculated | Calculated | | CA x EF x ED x 1/AT |
| | PEF | Particulate Emission Factor | $m^3/kg$ | 1.36E+09 | USEPA 2002 | 1.36E+09 | USEPA 2002 | | |
| | VF | Volatilization Factor for volatile constituents | $m^3/kg$ | chemical-specific | USEPA 2002 | chemical-specific | USEPA 2002 | | CA ($mg/m^3$) = CS (1/PEF + 1/VF) |
| | EF | Exposure Frequency | days/year | 350 | USEPA 2002 | 350 | USEPA 2002 | | |
| | ED | Exposure Duration | years | 24 | USEPA 2002 | 6 | USEPA 2002 | 30 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 8,760 | USEPA 2002 | 2,190 | USEPA 2002 | | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | USEPA 2002 | 25,550 | USEPA 2002 | | |

Sources:
USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* OSWER 9355.4-24.
USEPA. 2004. *Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual* (Part E, Supplemental Guidance for Dermal Risk Assessment). Final. USEPA/540/R/99/005.

*Notes:*
[a] Evaluation of carcinogenic chemicals for age-adjusted resident.

**APPENDIX Q**
**TABLE 6.2**
Exposure Factors for the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Exposure Route | Parameter Code | Parameter Definition | Receptor Population Units | Industrial Worker Value | Industrial Worker Rationale/ Reference | Intake Equation/Model Name |
|---|---|---|---|---|---|---|
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | EPC | — | Chronic Daily Intake (CDI) (mg/kg-day) = |
| (Soil) | IR-S | Ingestion Rate of Soil | mg/day | 50 | USEPA 2002 | CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT |
| | EF | Exposure Frequency | days/year | 250 | USEPA 2002 | |
| | ED | Exposure Duration | years | 25 | USEPA 2002 | |
| | BW | Body Weight | kg | 70 | USEPA 2002 | |
| | CF1 | Conversion Factor 1 | kg/mg | 0.000001 | — | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | USEPA 2002 | |
| | AT-N | Averaging Time (Noncancer) | days | 9,125 | USEPA 2002 | |
| Dermal | CS | Chemical Concentration in Soil | mg/kg | EPC | — | Dermally Absorbed Dose (DAD) (mg/kg-day) = |
| (Soil) | SA | Skin Surface Area Available for Contact | $cm^2$ | 3,300 | USEPA 2002 | CS x SA x SSAF x DABS x CF1 x EF x ED x 1/BW x 1/AT |
| | SSAF | Soil to Skin Adherence Factor | $mg/cm^2$-day | 0.07 | USEPA 2002 | |
| | DABS | Dermal Absorption Factor Solids | — | chemical-specific | USEPA 2004 | |
| | EF | Exposure Frequency | days/year | 250 | USEPA 2002 | |
| | ED | Exposure Duration | years | 25 | USEPA 2002 | |
| | BW | Body Weight | kg | 70 | USEPA 2002 | |
| | CF1 | Conversion Factor 1 | kg/mg | 0.000001 | — | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | USEPA 2002 | |
| | AT-N | Averaging Time (Noncancer) | days | 9,125 | USEPA 2002 | |
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | EPC | - - | Daily Average Concentration (DAC) ($mg/m^3$) = |
| (Soil) | CA | Chemical Concentration in Air | $mg/m^3$ | calculated | calculated | CA x EF x ED x 1/AT |
| | PEF | Particulate Emission Factor | $m^3/kg$ | 1.36E+09 | USEPA 2002 | |
| | VF | Volatilization Factor for volatile constituents | $m^3/kg$ | chemical-specific | USEPA 2002 | CA ($mg/m^3$) = CS (1/PEF + 1/VF) |
| | EF | Exposure Frequency | days/year | 250 | USEPA 2002 | |
| | ED | Exposure Duration | years | 25 | USEPA 2002 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | USEPA 2002 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 9,125 | USEPA 2002 | |

Sources:
USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* OSWER 9355.4-24.
USEPA. 2004. *Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual* (Part E, Supplemental Guidance for Dermal Risk Assessment) Final.USEPA/540/R/99/005.

**APPENDIX Q**
**TABLE 6.3**
Exposure Factors for the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Exposure Route | Parameter Code | Parameter Definition | Receptor Population | Construction Worker | | Intake Equation/Model Name |
|---|---|---|---|---|---|---|
| | | | Units | Value | Rationale/ Reference | |
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | EPC | — | Chronic Daily Intake (CDI) (mg/kg-day) = |
| (Soil) | IR-S | Ingestion Rate of Soil | mg/day | 330 | USEPA 2002 | CS x IR-S x EF x ED x CF1 x 1/BW x 1/AT |
| | EF | Exposure Frequency | days/year | 250 | USEPA 2002 | |
| | ED | Exposure Duration | years | 1 | USEPA 2002 | |
| | BW | Body Weight | kg | 70 | USEPA 2002 | |
| | CF1 | Conversion Factor 1 | kg/mg | 0.000001 | — | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | USEPA 2002 | |
| | AT-N | Averaging Time (Noncancer) | days | 365 | USEPA 2002 | |
| Dermal | CS | Chemical Concentration in Soil | mg/kg | EPC | — | Dermally Absorbed Dose (DAD) (mg/kg-day) = |
| (Soil) | SA | Skin Surface Area Available for Contact | $cm^2$ | 3,300 | USEPA 2002 | CS x SA x SSAF x DABS x CF1 x EF x ED x 1/BW x 1/AT |
| | SSAF | Soil to Skin Adherence Factor | $mg/cm^2$-day | 0.3 | USEPA 2002 | |
| | DABS | Dermal Absorption Factor Solids | — | chemical-specific | USEPA 2004 | |
| | EF | Exposure Frequency | days/year | 250 | USEPA 2002 | |
| | ED | Exposure Duration | years | 1 | USEPA 2002 | |
| | BW | Body Weight | kg | 70 | USEPA 2002 | |
| | CF1 | Conversion Factor 1 | kg/mg | 0.000001 | — | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | USEPA 2002 | |
| | AT-N | Averaging Time (Noncancer) | days | 365 | USEPA 2002 | |
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | EPC | - - | Daily Average Concentration (DAC) ($mg/m^3$) = |
| (Soil) | CA | Chemical Concentration in Air | $mg/m^3$ | calculated | calculated | CA x EF x ED x 1/AT |
| | PEF | Particulate Emission Factor | $m^3/kg$ | 1.36E+09 | USEPA 2002 | |
| | VF | Volatilization Factor for volatile constituents | $m^3/kg$ | chemical-specific | USEPA 2002 | CA ($mg/m^3$) = CS (1/PEF + 1/VF) |
| | EF | Exposure Frequency | days/year | 250 | USEPA 2002 | |
| | ED | Exposure Duration | years | 1 | USEPA 2002 | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | USEPA 2002 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 365 | USEPA 2002 | |

Sources:

USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* OSWER 9355.4-24.

USEPA. 2004. *Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual* (Part E, Supplemental Guidance for Dermal Risk Assessment) Final.USEPA/540/R/99/005.

**APPENDIX Q**
**TABLE 6.4**
Exposure Factors for the Human Health Risk Assessment
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | Construction Worker | | |
|---|---|---|---|---|---|---|
| **Exposure Route** | **Parameter Code** | **Parameter Definition** | **Receptor Population Units** | **Value** | **Rationale/ Reference** | **Intake Equation/Model Name** |
| Dermal | CW | Chemical Concentration in Water | µg/l | EPC | calculated | Dermally Absorbed Dose (DAD) (mg/kg-day) = |
| (Groundwater) | DAevent | Dermally Absorbed Dose per Event | $mg/cm^2$-event | calculated | calculated | DAevent x SA x EV x EF x ED x 1/BW x 1/AT |
| | FA | Fraction absorbed water | dimensionless | chemical-specific | USEPA 2004 | Inorganics: DAevent ($mg/cm^2$-event) = |
| | $K_p$ | Permeability Coefficient | cm/hr | chemical-specific | USEPA 2004 | Kp x CW x $t_{event}$ x CF2 x CF3 |
| | $\tau$ | Lag Time | hr/event | chemical-specific | USEPA 2004 | Organics : |
| | $t^*$ | Time to Reach Steady-state | hours | chemical-specific | USEPA 2004 | $t_{event}<t^*$: DAevent ($mg/cm^2$-event) = |
| | B | Ratio of Permeability of Stratum Corneum to Epidermis | dimensionless | chemical-specific | USEPA 2004 | 2 x FA x Kp x CW x (sqrt((6 x $\tau$ x $t_{event}$)/$\pi$)) |
| | $t_{event}$ | Event Time | hr/event | 2 | [a] | x CF2 x CF3 |
| | SA | Skin Surface Area Available for Contact | $cm^2$ | 3,300 | USEPA 2004[b] | $t_{event}>t^*$: DAevent ($mg/cm^2$-event) = |
| | EV | Event Frequency | events/day | 1 | — | FA x Kp x CW x ( $t_{event}$/(1+B) + 2 x $\tau$ x |
| | EF | Exposure Frequency | days/year | 30 | [c] | ((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3 |
| | ED | Exposure Duration | years | 0.082 | [d] | |
| | BW | Body Weight | kg | 70 | USEPA 1991 | |
| | AT-N | Averaging Time (Noncancer) | days | 30 | [d] | |
| | CF2 | Conversion Factor 2 | mg/µg | 0.001 | — | |
| | CF3 | Conversion Factor 3 | $l/cm^3$ | 0.001 | — | |
| | DAevent-Adj | Dermally Absorbed Dose per Event - Age Adjusted | mg-year/event-kg | — | — | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | USEPA 1989 | |
| Inhalation | CW | Chemical Concentration in Water | µg/l | EPC | calculated | Daily Average Concentration (DAC) ($mg/m^3$) = |
| (Groundwater) | CA | Chemical Concentration in Air | $mg/m^3$ | calculated | calculated | CA x EF x ED x 1/AT |
| | EF | Exposure Frequency | days/year | 30 | [c] | |
| | ED | Exposure Duration | years | 0.082 | [d] | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | USEPA 2002 | |
| | AT-N | Averaging Time (Non-Cancer) | days | 30 | [d] | |

Sources:
USEPA. 1989. *Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual*, Part A. OERR. EPA/540/1-89/002.
USEPA. 1991. *Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors.* Interim Final. OSWER Directive 9285.6-03.
USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* OSWER 9355.4-24.
USEPA. 2004. *Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual* (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Notes:
a. Professional judgment assuming 2 hrs per event.
b. SA includes head, hands, and forearms.
c. Professional judgment assuming groundwater contact 30 days during construction.
d. Value based on discussion with Missouri Department of Health and Senior Services, August 27, 2008.

**APPENDIX Q**

**TABLE 6.5**

Exposure Factors for the Human Health Risk Assessment

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Exposure Route | Parameter Code | Parameter Definition | Receptor Population Units | Adult Value | Adult Rationale/ Reference | Child Value | Child Rationale/ Reference | Age-Adjusted Value | Intake Equation/Model Name |
|---|---|---|---|---|---|---|---|---|---|
| Ingestion | CW | Chemical Concentration in Water | µg/l | RME | | RME | RME | | Chronic Daily Intake (CDI) (mg/kg-day) = |
| (Groundwater) | IR-W | Ingestion Rate of Water (A=adult, C=child) | L/day | 2 | USEPA, 1989 | 1 | USEPA, 1997 | | CW x IR-W x EF x ED x CF1 x 1/BW x 1/AT |
| | EF | Exposure Frequency | days/year | 350 | USEPA, 1991 | 350 | USEPA, 1991 | | |
| | ED | Exposure Duration (A=adult, C=child) | years | 24 | USEPA, 1991 | 6 | USEPA, 1991 | | |
| | BW | Body Weight (A=adult, C=child) | kg | 70 | USEPA, 1989 | 15 | USEPA, 1991 | | |
| | AT-N | Averaging Time (Non-Cancer) | days | 8,760 | USEPA, 1989 | 2,190 | USEPA, 1989 | | |
| | CF1 | Conversion Factor 1 | mg/µg | 1.0E-03 | - - | 1.0E-03 | - - | | |
| | CW | Chemical Concentration in Water | µg/l | | | | | RME | CDI (mg/kg-day) = |
| | IR-W-Adj | Ingestion Rate of Water, Age-adjusted | liter-year/kg-day | | | | | 1.1 | CW x IR-W-Adj x EF x CF1 x 1/AT |
| | EF | Exposure Frequency | days/year | | | | | 350 | IR-W-Adj (liter-year/kd-day) = |
| | AT-C | Averaging Time (Cancer) | days | | | | | 25,550 | (ED-C x IR-W-C / BW-C) + (ED-A x IR-W-A / BW-A) |
| | CF1 | Conversion Factor 1 | mg/µg | | | | | 1.0E-03 | |
| Dermal | CW | Chemical Concentration in Water | µg/l | RME | RME | RME | RME | | CDI (mg/kg-day) = |
| (Groundwater) | DAevent | Dermally Absorbed Dose per Event (A=adult, C=child) | $mg/cm^2$-event | calculated | calculated | calculated | calculated | | DAevent x SA x EV x EF x ED-A x 1/BW x 1/AT |
| | FA | Fraction absorbed water | dimensionless | chem-specific | USEPA, 2004 | chem-specific | USEPA, 2004 | | |
| | Kp | Permeability Coefficient | cm/hr | chem-specific | USEPA, 2004 | chem-specific | USEPA, 2004 | | Inorganics: DAevent-A ($mg/cm^2$-event) = |
| | $\tau$ | Lag Time | hr/event | chem-specific | USEPA, 2004 | chem-specific | USEPA, 2004 | | Kp x CW x $t_{event}$ x CF1 x CF2 |
| | t* | Time to Reach Steady-state | hours | chem-specific | USEPA, 2004 | chem-specific | USEPA, 2004 | | |
| | B | Ratio of Permeability of Stratum Corneum to Epidermis | dimensionless | chem-specific | USEPA, 2004 | chem-specific | USEPA, 2004 | | Organics : |
| | $t_{event}$ | Event Time | hr/event | 0.58 | USEPA, 2004 | 1.00 | USEPA, 2004 | | $t_{event}$<t*: DAevent-A ($mg/cm^2$-event) = |
| | SA | Skin Surface Area (A=adult, C-child) | $cm^2$ | 18,000 | USEPA, 2004 | 6,600 | USEPA, 2004 | | 2 x FA x Kp x CW x (sqrt((6 x $\tau$ x $t_{event}$)/$\pi$)) x CF1 x CF2 |
| | EV | Event Frequency | events/day | 1 | USEPA, 2004 | 1 | USEPA, 2004 | | |
| | EF | Exposure Frequency | days/year | 350 | USEPA, 1991 | 350 | USEPA, 1991 | | |
| | ED | Exposure Duration (A=adult, C=child) | years | 24 | USEPA, 1991 | 6 | USEPA, 1991 | | $t_{event}$>t*: DAevent-A ($mg/cm^2$-event) = |
| | BW | Body Weight (A=adult, C=child) | kg | 70 | USEPA, 1989 | 15 | USEPA, 1991 | | FA x Kp x CW x ( $t_{event}$/(1+B) + 2 x $\tau$ x |
| | AT-N | Averaging Time (Non-Cancer) | days | 8,760 | USEPA, 1989 | 2190 | USEPA, 1989 | | ((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF1 x CF2 |
| | CF1 | Conversion Factor 1 | mg/µg | 1.0E-03 | - - | 1.0E-03 | - - | | |
| | CF2 | Conversion Factor 2 | $l/cm^3$ | 1.0E-03 | - - | 1.0E-03 | - - | | |
| | CW | Chemical Concentration in Water | µg/l | | | | | RME | CDI (mg/kg-day) = DA-Adj x EF x EV x 1/AT |
| | DA-Adj | Dermally Absorbed Dose, Age-adjusted | mg-year/event-kg | | | | | calculated | DA-Adj = (DAevent-A x SA-A x ED-A x 1/BW-A) |
| | EV | Event Frequency | events/day | | | | | 1 | + (Daevent-C x SA-C x ED-C x 1/BW-C) |
| | EF | Exposure Frequency | days/year | | | | | 350 | |
| | AT-C | Averaging Time (Cancer) | days | | | | | 25,550 | |
| | CF1 | Conversion Factor 1 | mg/µg | | | | | 1.0E-03 | |
| Inhalation | CW | Chemical Concentration in Water | µg/l | RME | RME | RME | RME | | Daily Average Concentration (DAC) (mg/m3) = |
| (Groundwater) | CA | Chemical Concentration in Air | $mg/m^3$ | Calculated | Calculated | Calculated | Calculated | | CA x EF x ED x 1/AT |
| | EF | Exposure Frequency | days/year | 350 | USEPA 2002 | 350 | USEPA 2002 | | |
| | ED | Exposure Duration | years | 24 | USEPA 2002 | 6 | USEPA 2002 | | |
| | AT-N | Averaging Time (Non-Cancer) | days | 8,760 | USEPA 2002 | 2,190 | USEPA 2002 | | |
| | CW | Chemical Concentration in Water | µg/l | | | | | RME | Daily Average Concentration (DAC) (mg/m3) = |
| | CA | Chemical Concentration in Air | $mg/m^3$ | | | | | Calculated | CA x EF x ED x 1/AT |
| | EF | Exposure Frequency | days/year | | | | | 350 | |
| | ED | Exposure Duration | years | | | | | 30 | |
| | AT-C | Averaging Time (Cancer) | days | | | | | 25,550 | |

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. USEPA/540/1-89/002

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

USEPA, 1997: Exposure Factors Handbook. USEPA/600/P-95/002Fa.

USEPA, 2004: Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual. Part E Supplemental Guidance for Dermal Risk Assessment) Final.

**APPENDIX Q**
**TABLE 6.6**
*Calculation of Volatilization Factor*
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical | Diffusivity In Air ($D_i$) ($cm^2/s$) | Henry's Law Constant (H') (unitless) | Diffusivity in Water ($D_w$) ($cm^2/s$) | Soil Organic Carbon Partition Coeff. ($K_{oc}$) ($cm^3/g$) | Soil Water Partition Coeff. ($K_d = K_{oc} \times F_{oc}$) ($g/cm^3$) | Solubility in Water (S) (mg/L) | Apparent Diffusivity ($D_A$) ($cm^2/s$) | Volatilization Factor (VF) ($m^3/kg$) | Soil Saturation Concentration ($C_{sat}$) (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|
| cis-1,2-Dichloroethene | 7.36E-02 | 1.67E-01 | 1.13E-05 | 3.55E+01 | 2.13E-01 | 3.50E+03 | 1.90E-03 | 2.04E+03 | |
| Tetrachloroethene | 7.20E-02 | 7.54E-01 | 8.20E-06 | 1.55E+02 | 9.30E-01 | 2.00E+02 | 2.47E-03 | 1.79E+03 | |
| Trichloroethene | 7.90E-02 | 4.22E-01 | 9.10E-06 | 1.66E+02 | 9.96E-01 | 1.10E+03 | 1.51E-03 | 2.28E+03 | |

**Volatilization factor (VF) = ($m^3/kg$)**

$$\frac{Q/C * (3.14 * D_A * T)^{1/2} * 10^{-4}\ m^2/cm^2}{2 * r_b * D_A}$$

**Apparent Diffusivity ($D_A$) = ($cm^2/s$)**

$$\frac{[(Q_a^{10/3} * D_i * H' + Q_w^{10/3} * D_w)/n^2]}{(r_b * K_d + Q_w + Q_a * H')}$$

**Soil Saturation Concentration (mg/kg)**

$$S/r_b * (K_d * r_b + Q_w + H' * Q_a)$$

| Parameters | Values |
|---|---|
| Q/C - Inverse of the mean concentration at the center of a 1-acre-square source ($g/m^2$-s per $kg/m^3$) | 48.9 |
| T - Exposure interval(s) | 9.5E+08 |
| $r_b$ - Soil bulk density ($g/cm^3$) | 1.5 |
| $Q_a$ - Air-filled soil porosity ($L_{air}/L_{water}$) = n - $Q_w$ | 0.28 |
| n - Total soil porosity (Lpore/Lsoil) = 1 - ($r_b/r_s$) | 0.43 |
| $Q_w$ - Water-filled soil porosity (Lwater/Lsoil) | 0.15 |
| $r_s$ - Soil particle density ($g/cm^3$) | 2.65 |
| $f_{oc}$ - fraction organic carbon in soil (g/g) | 0.006 |

Q/C value for 10 acre source area in Zone V, Lincoln, Nebraska from USEPA 1996, *Soil Screening Guidance: User's Guide, EPA/540/R-96/018.*

**APPENDIX Q**
**TABLE 7**
Toxicity Factors for COPCs
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | Carcinogenic Toxicity Values | | | | Non-Carcinogenic Toxicity Values | | | | | | Dermal Toxicity Values | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chemical | CAS # | WOE Class | Ref[a] | ABSgi | ABSd | SFo (mg/kg-day)$^{-1}$ | Ref[a] | URF (ug/m$^3$)$^{-1}$ | Ref[a] | Chronic RfDo (mg/kg-day) | Ref[a] | RfDo Target Organ | Chronic RfC (mg/m$^3$) | Ref[a] | RfC Target Organ | SFd (mg/kg-day)$^{-1}$ | Chronic RfDd (mg/kg-day) |
| Aluminum | 7429-90-5 | | | >50% | 0.1% | | | | | 1.0E+00 | P | nervous system | 5.0E-03 | P | nervous system | | 1.0E+00 |
| Antimony | 7440-36-0 | | | 15% | 0.1% | | | | | 4.0E-04 | I | blood | | | | | 6.0E-05 |
| Arsenic | 7440-38-2 | A | I | 95% | 3% | 1.5E+00 | I | 4.3E-03 | I | 3.0E-04 | I | skin | 3.0E-05 | C | developmental, cardiovascular system, nervous system | 1.5E+00 | 3.0E-04 |
| Chromium | 7440-47-3 | D | I | 1.3% | 0.1% | | | 1.2E-02 | I | | | | | | | | |
| Copper | 7440-50-8 | | | >50% | 0.1% | | | | | 4.0E-02 | H | gastrointestinal | | | | | 4.0E-02 |
| Iron | 7439-89-6 | | | >50% | 0.1% | | | | | 7.0E-01 | P | gastrointestinal | | | | | 7.0E-01 |
| Manganese | 7439-96-5 | D | I | 4% | 0.1% | | | | | 1.4E-01 | I | nervous system | 5.0E-05 | I | nervous system | | 5.6E-03 |
| Selenium | 7782-49-2 | D | I | 30-80% | 0.1% | | | | | 5.0E-03 | I | whole body | | | | | 5.0E-03 |
| Silver | 7440-22-4 | D | I | 4% | 0.1% | | | | | 5.0E-03 | I | skin | | | | | 2.0E-04 |
| Thallium | 7440-28-0 | D | I | >50% | 0.1% | | | | | 6.5E-05 | S | blood | | | | | 6.5E-05 |
| Vanadium | 7440-62-2 | | | 2.6% | 0.1% | | | | | 7.0E-03 | H | kidney | | | | | 1.8E-04 |
| Benzo(a)pyrene | 50-32-8 | B2 | I | 58-89% | 13% | 7.3E+00 | I | 1.1E-03 | C | | | | | | | 7.3E+00 | |
| Benzo(b)fluoranthene | 205-99-2 | B2 | I | >50% | 13% | 7.3E-01 | RSL | 1.1E-04 | C | | | | | | | | |
| Naphthalene | 91-20-3 | C | I | 58-89% | 13% | | | 3.4E-05 | C | 2.0E-02 | I | whole body | 3.0E-03 | I | respiratory | | 2.0E-02 |
| 1,1,1,2-Tetrachloroethane | 630-20-6 | C | I | >50% | | 2.6E-02 | I | 7.4E-06 | I | 3.0E-02 | I | kidney, liver | | | | 2.6E-02 | 3.0E-02 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | C | I | >50% | | 2.0E-01 | I | 5.8E-05 | I | 4.0E-03 | P | liver | | | | 2.0E-01 | 4.0E-03 |
| 1,1,2-Trichloroethane | 79-00-5 | C | I | >50% | | 5.7E-02 | I | 1.6E-05 | I | 4.0E-03 | I | blood | | | | 5.7E-02 | 4.0E-03 |
| 1,2-Dichloroethane (EDC) | 107-06-2 | B2 | I | >50% | | 9.1E-02 | I | 2.6E-05 | I | 2.0E-02 | P | kidney, liver | 2.4E+00 | A | kidney, liver | 9.1E-02 | 2.0E-02 |
| Benzene | 71-43-2 | A | I | >50% | | 5.5E-02 | I | 7.8E-06 | I | 4.0E-03 | I | blood | 3.0E-02 | I | blood | 5.5E-02 | 4.0E-03 |
| Carbon tetrachloride | 56-23-5 | B2 | I | >50% | | 1.3E-01 | I | 1.5E-05 | I | 7.0E-04 | I | liver | 1.9E-01 | A | liver | 1.3E-01 | 7.0E-04 |
| Chloroform | 67-66-3 | B2 | I | >50% | | 3.1E-02 | C | 2.3E-05 | I | 1.0E-02 | I | liver | 9.8E-02 | A | liver | 3.1E-02 | 1.0E-02 |
| cis-1,2-Dichloroethene | 156-59-2 | D | I | >50% | | | | | | 1.0E-02 | P | blood | | | | | 1.0E-02 |
| Tetrachloroethene | 127-18-4 | | | >50% | | 5.4E-01 | C | 5.9E-06 | C | 1.0E-02 | I | liver | 2.7E-01 | A | nervous system | 5.4E-01 | 1.0E-02 |
| trans-1,2-Dichloroethene | 156-60-5 | | | >50% | | | | | | 2.0E-02 | I | kidney | 6.0E-02 | P | kidney | | 2.0E-02 |
| Trichloroethene | 79-01-6 | | | >50% | | 1.3E-02 | C | 2.0E-06 | C | 3.0E-04 | N | liver, kidney, fetus | 6.0E-01 | C | nervous system, eyes | 1.3E-02 | 3.0E-04 |
| | | | | | | 4.0E-01 | N | 1.1E-04 | N | | | | 3.5E-02 | N | nervous system, liver, endocrine system | 4.0E-01 | |
| Vinyl chloride- Continuous lifetime exposure from birth | 75-01-4 | A | I | >50% | | 1.5E+00 | I | 8.8E-03 | I | 3.0E-03 | I | liver | 1.0E-01 | I | liver | 1.5E+00 | 3.0E-03 |
| Vinyl chloride- Continuous lifetime exposure during adulthood | 75-01-4 | A | I | >50% | | 7.2E-01 | I | 4.4E-06 | I | 3.0E-03 | I | liver | 1.0E-01 | I | liver | 7.2E-01 | 3.0E-03 |

**Reference (Ref):**
ABSgi and ABSd were obtained from Supplemental Guidance to RAGS: Dermal Risk Assessment (EPA, 2004)
I = Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS)
P = Provisional Peer-Reviewed Toxicity Values (PPRTV)
C = California Environmental Protection Agency
H = Health Effects Assessment Summary Table (HEAST)
S = Regional Screening Level (RSL) table
A = Agency for Toxic Substances and Disease Registry
N = National Center for Environmental Assessment
R6 = Region 6 Medium-Specific Screening Levels (MSSLs)
RSL = Regional Screening Level Table (Oak Ridge National Laboratory, 2008)

Weight of Evidence Classification Description (WOE)
A - Human carcinogen, based on evidence from epidemiological studies.
B1 - Probable human carcinogen; limited human data are available.
B2 - Probable human carcinogen; sufficient evidence in animals and inadequate or no evidence in humans.
C - Possible human carcinogen, based on limited evidence in animals.
D - Not classifiable as to human carcinogenicity.

**Note:**
Total Chromium (1/6 ratio Cr VI/Cr III) values in R6 MSSL is used for chromium.
A default $ABS_d$ of 0.1% was used for inorganic chemicals if no chemical specific value was available.

RfC - Inhalation Reference Concentration
RfDd - Dermal Reference Dose
RfDo - Oral Reference Dose
SFo - Oral Slope Factor
SFd - Dermal Slope Factor
URF - Inhalation Unit Risk Factor

Dermal toxicity factors calculated as follows:
SFd: If ABSgi <= 0.50, SFd = SFo/ABSgi; otherwise SFd = SFo
RfDd: If ABSgi <= 0.50, RfDd = RfDo x ABSgi; otherwise RfDd = RfDo
ABSd - Dermal absorption factor
ABSgi - Gastrointestinal absorption factor

In applying vinyl chloride toxicity data, CLEfB has been applied to children and CLEdA has been applied to adults
CLEfB- Continuous Lifetime Exposure from Birth
CLEdA- Continuous Lifetime Exposure during Adulthood

# Risk Assessment Guidance for Superfund: Table 8

**APPENDIX Q**
**TABLE 8.1**
Potential Excess Lifetime Cancer Risk from Soil (0-2 feet) - Industrial Worker RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(ug/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC ($mg/m^3$) | ELCR | Total ELCR |
| Arsenic | A | 1.5E+00 | 1.5E+00 | 4.3E-03 | 1.0E+01 | 3.0E-02 | 9.5E-01 | 1.8E-06 | 2.7E-06 | 2.5E-07 | 3.8E-07 | 1.9E-09 | 8.0E-09 | 3.1E-06 |
| Benzo(a)pyrene | B2 | 7.3E+00 | 7.3E+00 | 1.1E-03 | 3.5E-01 | 1.3E-01 | 1.0E+00 | 6.1E-08 | 4.4E-07 | 3.6E-08 | 2.7E-07 | 6.2E-11 | 6.9E-11 | 7.1E-07 |
| Tetrachloroethene | NA | 5.4E-01 | 5.4E-01 | 5.9E-06 | 3.8E+00 | NA | 1.0E+00 | 6.7E-07 | 3.6E-07 | 3.1E-06 | 1.7E-06 | 5.3E-04 | 3.1E-06 | 5.1E-06 |
| Trichloroethene | NA | 1.3E-02 | 1.3E-02 | 2.0E-06 | 3.8E-01 | NA | 1.0E+00 | 6.6E-08 | 8.6E-10 | 3.1E-07 | 4.0E-09 | 4.0E-05 | 8.1E-08 | 8.6E-08 |
| **ELCR Subtotals** | | | | | | | | | 3.5E-06 | | 2.3E-06 | | 3.2E-06 | |
| | | | | | | | | | | | | | **Estimated Total Risk =** | **9.0E-06** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
DAC = daily average concentration
$\mu g/m^3$ = microgram per cubic meter
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
CDI = chronic daily intake
DAD = dermally absorbed dose
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.2**
Potential Noncarcinogenic Risk from Soil (0-2 feet) - Industrial Worker RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Arsenic | 3.0E-04 | 3.0E-04 | 3.0E-05 | 1.03E+01 | 3.0E-02 | 9.5E-01 | skin | developmental, cardiovascular system, nervous system | 5.1E-06 | 1.7E-02 | 2.5E-07 | 8.3E-04 | 5.2E-09 | 1.7E-04 | 1.8E-02 |
| Benzo(a)pyrene | NA | NA | NA | 3.47E-01 | 1.3E-01 | 1.0E+00 | | | 1.7E-07 | NA | NA | NA | 1.7E-10 | NA | NA |
| Tetrachloroethene | 1.0E-02 | 1.0E-02 | 2.7E-01 | 3.84E+00 | NA | 1.0E+00 | liver | nervous system | 1.9E-06 | 1.9E-04 | 8.7E-06 | 8.7E-04 | 1.5E-03 | 5.5E-03 | 6.5E-03 |
| Trichloroethene | NA | NA | 6.0E-01 | 3.78E-01 | NA | 1.0E+00 | | nervous system, eyes | 1.8E-07 | NA | NA | NA | 1.1E-04 | 1.9E-04 | 1.9E-04 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.7E-02 | | 1.7E-03 | | 5.8E-03 | |
| | | | | | | | | | | | | | | **Total HI =** | **2.5E-02** |

[b]Chronic toxicity values were used if subchronic toxicity values were not available.

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Cardiovascular: | 1.7E-04 |
| Total Developmental: | 1.7E-04 |
| Total Nervous System: | 5.8E-03 |
| Total Eyes: | 1.9E-04 |
| Total Skin: | 1.8E-02 |
| Total Liver: | 1.1E-03 |

**APPENDIX Q**
**TABLE 8.3**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Construction Worker RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(ug/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| Arsenic | A | 1.5E+00 | 1.5E+00 | 4.3E-03 | 9.7E+00 | 3.0E-02 | 9.5E-01 | 4.5E-07 | 6.7E-07 | 4.0E-08 | 6.0E-08 | 7.0E-11 | 3.0E-10 | 7.3E-07 |
| Benzo(a)pyrene | B2 | 7.3E+00 | 7.3E+00 | 1.1E-03 | 1.9E-01 | 1.3E-01 | 1.0E+00 | 8.7E-09 | 6.3E-08 | 3.4E-09 | 2.5E-08 | 1.4E-12 | 1.5E-12 | 8.8E-08 |
| Tetrachloroethene | NA | 5.4E-01 | 5.4E-01 | 5.9E-06 | 2.6E+00 | NA | 1.0E+00 | 1.2E-07 | 6.5E-08 | 3.6E-07 | 1.9E-07 | 1.4E-05 | 8.4E-08 | 3.4E-07 |
| Trichloroethene | NA | 1.3E-02 | 1.3E-02 | 2.0E-06 | 3.8E-01 | NA | 1.0E+00 | 1.7E-08 | 2.3E-10 | 5.2E-08 | 6.8E-10 | 1.6E-06 | 3.2E-09 | 4.2E-09 |
| **ELCR Subtotals** | | | | | | | | | 8.0E-07 | | 2.8E-07 | | 8.7E-08 | |
| | | | | | | | | | | | | | **Estimated Total Risk =** | **1.2E-06** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
DAC = daily average concentration
$\mu g/m^3$ = microgram per cubic meter
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
CDI = chronic daily intake
DAD = dermally absorbed dose
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.4**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Construction Worker RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Arsenic | 3.0E-04 | 3.0E-04 | 3.0E-05 | 9.71E+00 | 3.0E-02 | 9.5E-01 | skin | developmental, cardiovascular system, nervous system | 3.1E-05 | 1.0E-01 | 2.8E-06 | 9.4E-03 | 4.9E-09 | 1.6E-04 | 1.1E-01 |
| Benzo(a)pyrene | NA | NA | NA | 1.88E-01 | 1.3E-01 | 1.0E+00 | | | 6.1E-07 | NA | NA | NA | 9.5E-11 | NA | NA |
| Tetrachloroethene | 1.0E-02 | 1.0E-02 | 2.7E-01 | 2.60E+00 | NA | 1.0E+00 | liver | nervous system | 8.4E-06 | 8.4E-04 | 2.5E-05 | 2.5E-03 | 1.0E-03 | 3.7E-03 | 7.0E-03 |
| Trichloroethene | NA | NA | 6.0E-01 | 3.79E-01 | NA | 1.0E+00 | | nervous system, eyes | 1.2E-06 | NA | NA | NA | 1.1E-04 | 1.9E-04 | 1.9E-04 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.1E-01 | | 1.2E-02 | | 4.0E-03 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.2E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Cardiovascular: | 1.6E-04 |
| Total Developmental: | 1.6E-04 |
| Total Nervous System: | 4.0E-03 |
| Total Eyes: | 1.9E-04 |
| Total Skin: | 1.1E-01 |
| Total Liver: | 3.4E-03 |

**APPENDIX Q**
**TABLE 8.5**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area A*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(\mu g/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 7.15E+03 | 1.0E-03 | 1.0E+00 | 1.1E-02 | NA | NA | NA | 2.2E-06 | NA | NA |
| Antimony | NA | NA | NA | NA | 2.82E+00 | 1.0E-03 | 1.5E-01 | 4.4E-06 | NA | NA | NA | 8.5E-10 | NA | NA |
| Iron | NA | NA | NA | NA | 1.60E+04 | 1.0E-03 | 1.0E+00 | 2.5E-02 | NA | NA | NA | 4.8E-06 | NA | NA |
| Manganese | D | NA | NA | NA | 5.57E+02 | 1.0E-03 | 4.0E-02 | 8.7E-04 | NA | NA | NA | 1.7E-07 | NA | NA |
| Selenium | D | NA | NA | NA | 1.24E+01 | 1.0E-03 | 1.0E+00 | 1.9E-05 | NA | NA | NA | 3.7E-09 | NA | NA |
| **ELCR Subtotals** | | | | | | | | | NA | | NA | | NA | |
| | | | | | | | | | | | | **Estimated Total Risk =** | | **NA** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
$\mu g/m^3$ = microgram per cubic meter
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.6**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area A*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC ($mg/m^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC ($mg/m^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 7.15E+03 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 9.8E-03 | 9.8E-03 | 3.9E-05 | 3.9E-05 | 5.0E-06 | 1.0E-03 | 1.1E-02 |
| Antimony | 4.0E-04 | 6.0E-05 | NA | 2.82E+00 | 1.0E-03 | 1.5E-01 | blood | | 3.9E-06 | 9.7E-03 | 1.5E-08 | 2.6E-04 | 2.0E-09 | NA | 9.9E-03 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.60E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.2E-02 | 3.1E-02 | 8.8E-05 | 1.3E-04 | 1.1E-05 | NA | 3.1E-02 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 5.57E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 7.6E-04 | 5.5E-03 | 3.0E-06 | 5.4E-04 | 3.9E-07 | 7.9E-03 | 1.4E-02 |
| Selenium | 5.0E-03 | 5.0E-03 | NA | 1.24E+01 | 1.0E-03 | 1.0E+00 | whole body | | 1.7E-05 | 3.4E-03 | 6.8E-08 | 1.4E-05 | 8.7E-09 | NA | 3.4E-03 |
| **Subtotal Hazard Indices** | | | | | | | | | | 6.0E-02 | | 9.8E-04 | | 8.9E-03 | |
| | | | | | | | | | | | | | | **Total HI =** | **7.0E-02** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 9.9E-03 |
| Total Gastrointestinal: | 3.1E-02 |
| Total Nervous System: | 2.5E-02 |
| Total Whole Body: | 3.4E-03 |

APPENDIX Q
TABLE 8.7
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area A*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 7.15E+03 | 0.001 | 1.0E+00 | nervous system | nervous system | 9.1E-02 | 9.1E-02 | 2.6E-04 | 2.6E-04 | 5.0E-06 | 1.0E-03 | 9.3E-02 |
| Antimony | 4.0E-04 | 6.0E-05 | NA | 2.82E+00 | 0.001 | 1.5E-01 | blood | | 3.6E-05 | 9.0E-02 | 1.0E-07 | 1.7E-03 | 2.0E-09 | NA | 9.2E-02 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.60E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 2.0E-01 | 2.9E-01 | 5.7E-04 | 8.2E-04 | 1.1E-05 | NA | 2.9E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 5.57E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 7.1E-03 | 5.1E-02 | 2.0E-05 | 3.6E-03 | 3.9E-07 | 7.9E-03 | 6.2E-02 |
| Selenium | 5.0E-03 | 5.0E-03 | NA | 1.24E+01 | 0.001 | 1.0E+00 | whole body | | 1.6E-04 | 3.2E-02 | 4.4E-07 | 8.9E-05 | 8.7E-09 | NA | 3.2E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | 5.6E-01 | | 6.4E-03 | | 8.9E-03 | |
| | | | | | | | | | | | | | | **Total HI =** | **5.7E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 9.2E-02 |
| Total Gastrointestinal: | 2.9E-01 |
| Total Nervous System: | 1.5E-01 |
| Total Whole Body: | 3.2E-02 |

**APPENDIX Q**
**TABLE 8.8**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area B*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(\mu g/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 8.65E+03 | 1.0E-03 | 1.0E+00 | 1.4E-02 | NA | NA | NA | 2.6E-06 | NA | |
| Antimony | NA | NA | NA | NA | 3.15E+00 | 1.0E-03 | 1.5E-01 | 4.9E-06 | NA | NA | NA | 9.5E-10 | NA | |
| Arsenic | A | 1.5E+00 | 1.5E+00 | 4.30E-03 | 1.60E+01 | 3.0E-02 | 9.5E-01 | 2.5E-05 | 4E-05 | 2.4E-06 | 4E-06 | 4.8E-09 | 2E-08 | 4E-05 |
| Iron | NA | NA | NA | NA | 1.43E+04 | 1.0E-03 | 1.0E+00 | 2.2E-02 | NA | NA | NA | 4.3E-06 | NA | |
| Manganese | D | NA | NA | NA | 5.86E+02 | 1.0E-03 | 4.0E-02 | 9.2E-04 | NA | NA | NA | 1.8E-07 | NA | |
| **ELCR Subtotals** | | | | | | | | | 4E-05 | | 4E-06 | | 2E-08 | |
| | | | | | | | | | | | | | **Estimated Total Risk =** | **4E-05** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
$\mu g/m^3$ = microgram per cubic meter
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.9**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area B*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.65E+03 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 1.2E-02 | 1.2E-02 | 4.7E-05 | 4.7E-05 | 6.1E-06 | 1.2E-03 | 1.3E-02 |
| Antimony | 4.0E-04 | 6.0E-05 | NA | 3.15E+00 | 1.0E-03 | 1.5E-01 | blood | | 4.3E-06 | 1.1E-02 | 1.7E-08 | 2.9E-04 | 2.2E-09 | NA | 1.1E-02 |
| Arsenic | 3.0E-04 | 3.0E-04 | 3.0E-05 | 1.60E+01 | 3.0E-02 | 9.5E-01 | skin | developmental, cardiovascular system, nervous | 2.2E-05 | 7.3E-02 | 2.6E-06 | 8.8E-03 | 1.1E-08 | 3.8E-04 | 8.2E-02 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.43E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.0E-02 | 2.8E-02 | 7.8E-05 | 1.1E-04 | 1.0E-05 | NA | 2.8E-02 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 5.86E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 8.0E-04 | 5.7E-03 | 3.2E-06 | 5.7E-04 | 4.1E-07 | 8.3E-03 | 1.5E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.3E-01 | | 9.8E-03 | | 9.9E-03 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.5E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.1E-02 |
| Total Cardiovascular: | 3.8E-04 |
| Total Developmental: | 3.8E-04 |
| Total Gastrointestinal: | 2.8E-02 |
| Total Nervous System: | 2.8E-02 |
| Total Skin: | 8.2E-02 |

**APPENDIX Q**
**TABLE 8.10**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area B*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.65E+03 | 0.001 | 1.0E+00 | nervous system | nervous system | 1.1E-01 | 1.1E-01 | 3.1E-04 | 3.1E-04 | 6.1E-06 | 1.2E-03 | 1.1E-01 |
| Antimony | 4.0E-04 | 6.0E-05 | NA | 3.15E+00 | 0.001 | 1.5E-01 | blood | | 4.0E-05 | 1.0E-01 | 1.1E-07 | 1.9E-03 | 2.2E-09 | NA | 1.0E-01 |
| Arsenic | 3.0E-04 | 3.0E-04 | 3.0E-05 | 1.60E+01 | 0.030 | 9.5E-01 | skin | developmental, cardiovascular system, nervous system | 2.0E-04 | 6.8E-01 | 1.7E-05 | 5.7E-02 | 1.1E-08 | 3.8E-04 | 7.4E-01 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.43E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 1.8E-01 | 2.6E-01 | 5.1E-04 | 7.3E-04 | 1.0E-05 | NA | 2.6E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 5.86E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 7.5E-03 | 5.4E-02 | 2.1E-05 | 3.7E-03 | 4.1E-07 | 8.3E-03 | 6.6E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.2E+00 | | 6.4E-02 | | 9.9E-03 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.3E+00** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.0E-01 |
| Total Cardiovascular: | 3.8E-04 |
| Total Developmental: | 3.8E-04 |
| Total Gastrointestinal: | 2.6E-01 |
| Total Nervous System: | 1.8E-01 |
| Total Skin: | 7.4E-01 |

APPENDIX Q
TABLE 8.11
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area C*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | SFo (mg/kg-day)$^{-1}$ | $SF_d$ (mg/kg-day)$^{-1}$ | URF (mg/m$^3$)$^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC (mg/m$^3$) | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 8.26E+03 | 1.0E-03 | 1.0E+00 | 1.3E-02 | NA | NA | NA | 2.5E-06 | NA | NA |
| Antimony | NA | NA | NA | NA | 4.24E+00 | 1.0E-03 | 1.5E-01 | 6.6E-06 | NA | NA | NA | 1.3E-09 | NA | NA |
| Iron | NA | NA | NA | NA | 1.77E+04 | 1.0E-03 | 1.0E+00 | 2.8E-02 | NA | NA | NA | 5.3E-06 | NA | NA |
| Manganese | D | NA | NA | NA | 6.11E+02 | 1.0E-03 | 4.0E-02 | 9.5E-04 | NA | NA | NA | 1.8E-07 | NA | NA |
| **ELCR Subtotals** | | | | | | | | | NA | | NA | | NA | |
| | | | | | | | | | | | | **Estimated Total Risk =** | | **NA** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
µg/m$^3$ = microgram per cubic meter
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.12**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area C*

| | | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC ($mg/m^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC ($mg/m^3$) | HQ | Total HI |
| Aluminum | NA | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.26E+03 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 1.1E-02 | 1.1E-02 | 4.5E-05 | 4.5E-05 | 5.8E-06 | 1.2E-03 | 1.3E-02 |
| Antimony | NA | 4.0E-04 | 6.0E-05 | NA | 4.24E+00 | 1.0E-03 | 1.5E-01 | blood | | 5.8E-06 | 1.5E-02 | 2.3E-08 | 3.9E-04 | 3.0E-09 | NA | 1.5E-02 |
| Iron | NA | 7.0E-01 | 7.0E-01 | NA | 1.77E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.4E-02 | 3.5E-02 | 9.7E-05 | 1.4E-04 | 1.2E-05 | NA | 3.5E-02 |
| Manganese | D | 1.4E-01 | 5.6E-03 | 5.0E-05 | 6.11E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 8.4E-04 | 6.0E-03 | 3.3E-06 | 6.0E-04 | 4.3E-07 | 8.6E-03 | 1.5E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | | 6.6E-02 | | 1.2E-03 | | 9.8E-03 | |
| | | | | | | | | | | | | | | | **Total HI =** | **7.7E-02** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.5E-02 |
| Total Gastrointestinal: | 3.5E-02 |
| Total Nervous System: | 2.8E-02 |

**APPENDIX Q**
**TABLE 8.13**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area C*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.26E+03 | 0.001 | 1.0E+00 | nervous system | nervous system | 1.1E-01 | 1.1E-01 | 3.0E-04 | 3.0E-04 | 5.8E-06 | 1.2E-03 | 1.1E-01 |
| Antimony | 4.0E-04 | 6.0E-05 | NA | 4.24E+00 | 0.001 | 1.5E-01 | blood | | 5.4E-05 | 1.4E-01 | 1.5E-07 | 2.5E-03 | 3.0E-09 | NA | 1.4E-01 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.77E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 2.3E-01 | 3.2E-01 | 6.3E-04 | 9.0E-04 | 1.2E-05 | NA | 3.2E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 6.11E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 7.8E-03 | 5.6E-02 | 2.2E-05 | 3.9E-03 | 4.3E-07 | 8.6E-03 | 6.8E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | 6.2E-01 | | 7.6E-03 | | 9.8E-03 | |
| | | | | | | | | | | | | | | **Total HI =** | **6.4E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.4E-01 |
| Total Gastrointestinal: | 3.2E-01 |
| Total Nervous System: | 1.8E-01 |

**APPENDIX Q**
**TABLE 8.14**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area D*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(ug/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 1.20E+04 | 1.0E-03 | 1.0E+00 | 1.9E-02 | NA | NA | NA | 3.6E-06 | NA | NA |
| Iron | NA | NA | NA | NA | 1.82E+04 | 1.0E-03 | 1.0E+00 | 2.8E-02 | NA | NA | NA | 5.5E-06 | NA | NA |
| Manganese | D | NA | NA | NA | 8.38E+02 | 1.0E-03 | 4.0E-02 | 1.3E-03 | NA | NA | NA | 2.5E-07 | NA | NA |
| Thallium | D | NA | NA | NA | 4.66E+00 | 1.0E-03 | 1.0E+00 | 7.3E-06 | NA | NA | NA | 1.4E-09 | NA | NA |
| **ELCR Subtotals** | | | | | | | | | NA | | NA | | NA | |
| | | | | | | | | | | | | **Estimated Total Risk =** | | **NA** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
$ug/m^3$ = microgram per cubic meter
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.15**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area D*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 1.20E+04 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 1.6E-02 | 1.6E-02 | 6.5E-05 | 6.5E-05 | 8.4E-06 | 1.7E-03 | 1.8E-02 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.82E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.5E-02 | 3.6E-02 | 9.9E-05 | 1.4E-04 | 1.3E-05 | NA | 3.6E-02 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 8.38E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 1.1E-03 | 8.2E-03 | 4.6E-06 | 8.2E-04 | 5.9E-07 | 1.2E-02 | 2.1E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 4.66E+00 | 1.0E-03 | 1.0E+00 | blood | | 6.4E-06 | 9.8E-02 | 2.5E-08 | 3.9E-04 | 3.3E-09 | NA | 9.9E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.6E-01 | | 1.4E-03 | | 1.3E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.7E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 9.9E-02 |
| Total Gastrointestinal: | 3.6E-02 |
| Total Nervous System: | 3.9E-02 |

**APPENDIX Q**
**TABLE 8.16**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area D*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 1.20E+04 | 0.001 | 1.0E+00 | nervous system | nervous system | 1.5E-01 | 1.5E-01 | 4.3E-04 | 4.3E-04 | 8.4E-06 | 1.7E-03 | 1.6E-01 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.82E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 2.3E-01 | 3.3E-01 | 6.5E-04 | 9.3E-04 | 1.3E-05 | NA | 3.3E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 8.38E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 1.1E-02 | 7.6E-02 | 3.0E-05 | 5.4E-03 | 5.9E-07 | 1.2E-02 | 9.4E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 4.66E+00 | 0.001 | 1.0E+00 | blood | | 6.0E-05 | 9.2E-01 | 1.7E-07 | 2.6E-03 | 3.3E-09 | NA | 9.2E-01 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.5E+00 | | 9.3E-03 | | 1.3E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.5E+00** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 9.2E-01 |
| Total Gastrointestinal: | 3.3E-01 |
| Total Nervous System: | 2.5E-01 |

**APPENDIX Q**
**TABLE 8.17**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area E*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(\mu g/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 9.04E+03 | 1.0E-03 | 1.0E+00 | 1.4E-02 | NA | NA | NA | 2.7E-06 | NA | |
| Antimony | NA | NA | NA | NA | 1.41E+01 | 1.0E-03 | 1 5E-01 | 2.2E-05 | NA | NA | NA | 4 3E-09 | NA | |
| Arsenic | A | 1.5E+00 | 1.5E+00 | 4.30E-03 | 1.37E+01 | 3.0E-02 | 9.5E-01 | 2.1E-05 | 3E-05 | 2.0E-06 | 3E-06 | 4.1E-09 | 2E-08 | 4E-05 |
| Chromium | D | NA | NA | 1.20E-02 | 4.15E+01 | 1.0E-03 | 1.3E-02 | 6.5E-05 | NA | NA | NA | 1.3E-08 | 2E-07 | 2E-07 |
| Iron | NA | NA | NA | NA | 1.66E+04 | 1.0E-03 | 1.0E+00 | 2.6E-02 | NA | NA | NA | 5.0E-06 | NA | |
| Manganese | D | NA | NA | NA | 8.41E+02 | 1.0E-03 | 4.0E-02 | 1.3E-03 | NA | NA | NA | 2.0E-07 | NA | |
| Thallium | D | NA | NA | NA | 5.07E+00 | 1.0E-03 | 1.0E+00 | 7.9E-06 | NA | NA | NA | 1.2E-09 | NA | |
| Vanadium | NA | NA | NA | NA | 3.53E+01 | 1.0E-03 | 2.6E-02 | 5.5E-05 | NA | NA | NA | 8.52E-09 | NA | |
| **ELCR Subtotals** | | | | | | | | | 3E-05 | | 3E-06 | | 2E-07 | |
| | | | | | | | | | | | | **Estimated Total Risk =** | | **4E-05** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
$\mu g/m^3$ = microgram per cubic meter
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.18**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area E*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC ($mg/m^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC ($mg/m^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 9.04E+03 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 1.2E-02 | 1.2E-02 | 4.9E-05 | 4.9E-05 | 6.4E-06 | 1.3E-03 | 1.4E-02 |
| Antimony | 4.0E-04 | 6.0E-05 | NA | 1.41E+01 | 1.0E-03 | 1 5E-01 | blood | | 1.9E-05 | 4.8E-02 | 7.7E-08 | 1.3E-03 | 9.9E-09 | NA | 5.0E-02 |
| Arsenic | 3.0E-04 | 3.0E-04 | 3.0E-05 | 1.37E+01 | 3.0E-02 | 9.5E-01 | skin | developmental, cardiovascular system, nervous system | 1.9E-05 | 6.3E-02 | 2.3E-06 | 7.5E-03 | 9.7E-09 | 3.2E-04 | 7.1E-02 |
| Chromium | NA | NA | NA | 4.15E+01 | 1.0E-03 | 1.3E-02 | | | 5.7E-05 | NA | NA | NA | 2.9E-08 | NA | |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.66E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.3E-02 | 3.3E-02 | 9.1E-05 | 1.3E-04 | 1.2E-05 | NA | 3.3E-02 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 8.41E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 1.2E-03 | 8.2E-03 | 4.6E-06 | 8.2E-04 | 5.9E-07 | 1.2E-02 | 2.1E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 5.07E+00 | 1.0E-03 | 1.0E+00 | blood | | 6.9E-06 | 1.1E-01 | 2.8E-08 | 4.3E-04 | 3.6E-09 | NA | 1.1E-01 |
| Vanadium | 7.0E-03 | 1.8E-04 | NA | 3.53E+01 | 1.0E-03 | 2.6E-02 | kidney | | 4.8E-05 | 6.9E-03 | 1.9E-07 | 1.1E-03 | 2.5E-08 | NA | 8.0E-03 |
| **Subtotal Hazard Indices** | | | | | | | | | | 2.8E-01 | | 1.1E-02 | | 1.3E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **3.0E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.6E-01 |
| Total Gastrointestinal: | 3.3E-02 |
| Total Nervous System: | 3.5E-02 |
| Total Developmental: | 3.2E-04 |
| Total Kidney: | 8.0E-03 |
| Total Skin: | 7.0E-02 |
| Total Cardiovascular: | 3.2E-04 |

APPENDIX Q
TABLE 8.19
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area E*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 9.04E+03 | 0.001 | 1.0E+00 | nervous system | nervous system | 1.2E-01 | 1.2E-01 | 3.2E-04 | 3.2E-04 | 6.4E-06 | 1.3E-03 | 1.2E-01 |
| Antimony | 4.0E-04 | 6.0E-05 | NA | 1.41E+01 | 0.001 | 1.5E-01 | blood | | 1.8E-04 | 4.5E-01 | 5.0E-07 | 8.4E-03 | 9.9E-09 | NA | 4.6E-01 |
| Arsenic | 3.0E-04 | 3.0E-04 | 3.0E-05 | 1.37E+01 | 0.030 | 9.5E-01 | skin | developmental, cardiovascular system, nervous system | 1.8E-04 | 5.9E-01 | 1.5E-05 | 4.9E-02 | 9.7E-09 | 3.2E-04 | 6.3E-01 |
| Chromium | NA | NA | NA | 4.15E+01 | 0.001 | 1.3E-02 | | | 5.3E-04 | NA | NA | NA | 2.9E-08 | NA | |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.66E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 2.1E-01 | 3.0E-01 | 6.0E-04 | 8.5E-04 | 1.2E-05 | NA | 3.0E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 8.41E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 1.1E-02 | 7.7E-02 | 3.0E-05 | 5.4E-03 | 5.9E-07 | 1.2E-02 | 9.4E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 5.07E+00 | 0.001 | 1.0E+00 | blood | | 6.5E-05 | 1.0E+00 | 1.8E-07 | 2.8E-03 | 3.6E-09 | NA | 1.0E+00 |
| Vanadium | 7.0E-03 | 1.8E-04 | NA | 3.53E+01 | 0.001 | 2.6E-02 | kidney | | 4.5E-04 | 6.4E-02 | 1.3E-06 | 6.9E-03 | 2.5E-08 | NA | 7.1E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | 2.6E+00 | | 7.4E-02 | | 1.3E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **2.7E+00** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.5E+00 |
| Total Gastrointestinal: | 3.0E-01 |
| Total Nervous System: | 2.1E-01 |
| Total Developmental: | 3.2E-04 |
| Total Kidney: | 7.1E-02 |
| Total Skin: | 6.3E-01 |
| Total Cardiovascular: | 3.2E-04 |

**APPENDIX Q**
**TABLE 8.20**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area F*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(mg/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 9.31E+03 | 1.0E-03 | 1.0E+00 | 1.5E-02 | NA | NA | NA | 2.8E-06 | NA | |
| Antimony | NA | NA | NA | NA | 5.73E+00 | 1.0E-03 | 1.5E-01 | 8.9E-06 | NA | NA | NA | 1.7E-09 | NA | |
| Arsenic | A | 1.5E+00 | 1.5E+00 | 4.30E-03 | 8.49E+00 | 3.0E-02 | 9.5E-01 | 1.3E-05 | 2E-05 | 1.3E-06 | 2E-06 | 2.6E-09 | 1E-08 | 2E-05 |
| Iron | NA | NA | NA | NA | 1.65E+04 | 1.0E-03 | 1.0E+00 | 2.6E-02 | NA | NA | NA | 5.0E-06 | NA | |
| Manganese | D | NA | NA | NA | 7.76E+02 | 1.0E-03 | 4.0E-02 | 1.2E-03 | NA | NA | NA | 2.3E-07 | NA | |
| Thallium | D | NA | NA | NA | 2.18E+00 | 1.0E-03 | 1.0E+00 | 3.4E-06 | NA | NA | NA | 5.3E-10 | NA | |
| Vanadium | NA | NA | NA | NA | 3.20E+01 | 1.0E-03 | 2.6E-02 | 5.0E-05 | NA | NA | NA | 7.7E-09 | NA | |
| **ELCR Subtotals** | | | | | | | | | 2E-05 | | 2E-06 | | 1E-08 | |
| | | | | | | | | | | | | **Estimated Total Risk =** | | **2E-05** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
$\mu g/m^3$ = *microgram per cubic meter*
URF = Inhalation unit risk factor
WOE = weight of evidence

APPENDIX Q
TABLE 8.21
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area F*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 9.31E+03 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 1.3E-02 | 1.3E-02 | 5.1E-05 | 5.1E-05 | 6.6E-06 | 1.3E-03 | 1.4E-02 |
| Antimony | 4.0E-04 | 6.0E-05 | NA | 5.73E+00 | 1.0E-03 | 1.5E-01 | blood | | 7.8E-06 | 2.0E-02 | 3.1E-08 | 5.2E-04 | 4.0E-09 | NA | 2.0E-02 |
| Arsenic | 3.0E-04 | 3.0E-04 | 3.0E-05 | 8.49E+00 | 3.0E-02 | 9.5E-01 | skin | developmental, cardiovascular system, nervous system | 1.2E-05 | 3.9E-02 | 1.4E-06 | 4.6E-03 | 6.0E-09 | 2.0E-04 | 4.4E-02 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.65E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.3E-02 | 3.2E-02 | 9.0E-05 | 1.3E-04 | 1.2E-05 | NA | 3.2E-02 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 7.76E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 1.1E-03 | 7.6E-03 | 4.2E-06 | 7.6E-04 | 5.5E-07 | 1.1E-02 | 1.9E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 2.18E+00 | 1.0E-03 | 1.0E+00 | blood | | 3.0E-06 | 4.6E-02 | 1.2E-08 | 1.8E-04 | 1.5E-09 | NA | 4.6E-02 |
| Vanadium | 7.0E-03 | 1.8E-04 | NA | 3.20E+01 | 1.0E-03 | 2.6E-02 | kidney | | 4.4E-05 | 6.3E-03 | 1.8E-07 | 9.6E-04 | 2.3E-08 | NA | 7.2E-03 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.6E-01 | | 7.2E-03 | | 1.2E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.8E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 6.6E-02 |
| Total Gastrointestinal: | 3.2E-02 |
| Total Nervous System: | 3.4E-02 |
| Total Developmental: | 2.0E-04 |
| Total Kidney: | 7.2E-03 |
| Total Skin: | 4.3E-02 |
| Total Cardiovascular: | 2.0E-04 |

**APPENDIX Q**
**TABLE 8.22**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area F*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 9.31E+03 | 0.001 | 1.0E+00 | nervous system | nervous system | 1.2E-01 | 1.2E-01 | 3.3E-04 | 3.3E-04 | 6.6E-06 | 1.3E-03 | 1.2E-01 |
| Antimony | 4.0E-04 | 6.0E-05 | NA | 5.73E+00 | 0.001 | 1.5E-01 | blood | | 7.3E-05 | 1.8E-01 | 2.1E-07 | 3.4E-03 | 4.0E-09 | NA | 1.9E-01 |
| Arsenic | 3.0E-04 | 3.0E-04 | 3.0E-05 | 8.49E+00 | 0.030 | 9.5E-01 | skin | developmental, cardiovascular system, nervous system | 1.1E-04 | 3.6E-01 | 9.1E-06 | 3.0E-02 | 6.0E-09 | 2.0E-04 | 3.9E-01 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.65E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 2.1E-01 | 3.0E-01 | 5.9E-04 | 8.5E-04 | 1.2E-05 | NA | 3.0E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 7.76E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 9.9E-03 | 7.1E-02 | 2.8E-05 | 5.0E-03 | 5.5E-07 | 1.1E-02 | 8.7E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 2.18E+00 | 0.001 | 1.0E+00 | blood | | 2.8E-05 | 4.3E-01 | 7.8E-08 | 1.2E-03 | 1.5E-09 | NA | 4.3E-01 |
| Vanadium | 7.0E-03 | 1.8E-04 | NA | 3.20E+01 | 0.001 | 2.6E-02 | kidney | | 4.1E-04 | 5.8E-02 | 1.1E-06 | 6.3E-03 | 2.3E-08 | NA | 6.5E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.5E+00 | | 4.7E-02 | | 1.2E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.6E+00** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 6.2E-01 |
| Total Gastrointestinal: | 3.0E-01 |
| Total Nervous System: | 2.1E-01 |
| Total Developmental: | 2.0E-04 |
| Total Kidney: | 6.5E-02 |
| Total Skin: | 3.9E-01 |
| Total Cardiovascular: | 2.0E-04 |

**APPENDIX Q**
**TABLE 8.23**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area G*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(\mu g/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 1.09E+04 | 1.0E-03 | 1.0E+00 | 1.7E-02 | NA | NA | NA | 3.3E-06 | NA | |
| Benzo(b)fluoranthene | B2 | 7.3E-01 | 7.3E-01 | 1.10E-04 | 8.19E-01 | 1.3E-01 | 1.0E+00 | 1.3E-06 | 9E-07 | 5.3E-07 | 4E-07 | 2.5E-10 | 3E-11 | 1E-06 |
| Iron | NA | NA | NA | NA | 1.85E+04 | 1.0E-03 | 1.0E+00 | 2.9E-02 | NA | NA | NA | 5.6E-06 | NA | |
| Manganese | D | NA | NA | NA | 9.02E+02 | 1.0E-03 | 4.0E-02 | 1.4E-03 | NA | NA | NA | 2.7E-07 | NA | |
| Thallium | D | NA | NA | NA | 5.19E+00 | 1.0E-03 | 1.0E+00 | 8.1E-06 | NA | NA | NA | 1.6E-09 | NA | |
| Vanadium | NA | NA | NA | NA | 3.72E+01 | 1.0E-03 | 2.6E-02 | 5.8E-05 | NA | NA | NA | 1.1E-08 | NA | |
| **ELCR Subtotals** | | | | | | | | | 9E-07 | | 4E-07 | | 3E-11 | |
| | | | | | | | | | | | | | **Estimated Total Risk =** | **1E-06** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
$\mu g/m^3$ = microgram per cubic meter
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.24**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area G*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 1.09E+04 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 1.5E-02 | 1.5E-02 | 6.0E-05 | 6.0E-05 | 7.7E-06 | 1.5E-03 | 1.7E-02 |
| Benzo(b)fluoranthene | NA | NA | NA | 8.19E-01 | 1.3E-01 | 1.0E+00 | | | 1.1E-06 | NA | NA | NA | 5.8E-10 | NA | |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.85E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.5E-02 | 3.6E-02 | 1.0E-04 | 1.4E-04 | 1.3E-05 | NA | 3.6E-02 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 9.02E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 1.2E-03 | 8.8E-03 | 4.9E-06 | 8.8E-04 | 6.4E-07 | 1.3E-02 | 2.2E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 5.19E+00 | 1.0E-03 | 1.0E+00 | blood | | 7.1E-06 | 1.1E-01 | 2.8E-08 | 4.4E-04 | 3.7E-09 | NA | 1.1E-01 |
| Vanadium | 7.0E-03 | 1.8E-04 | NA | 3.72E+01 | 1.0E-03 | 2.6E-02 | kidney | | 5.1E-05 | 7.3E-03 | 2.0E-07 | 1.1E-03 | 2.6E-08 | NA | 8.4E-03 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.8E-01 | | 2.6E-03 | | 1.4E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.9E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.1E-01 |
| Total Gastrointestinal: | 3.6E-02 |
| Total Nervous System: | 3.9E-02 |
| Total Kidney: | 8.4E-03 |

APPENDIX Q
TABLE 8.25
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area G*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC ($mg/m^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC ($mg/m^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 1.09E+04 | 0.001 | 1.0E+00 | nervous system | nervous system | 1.4E-01 | 1.4E-01 | 3.9E-04 | 3.9E-04 | 7.7E-06 | 1.5E-03 | 1.4E-01 |
| Benzo(b)fluoranthene | NA | NA | NA | 8.19E-01 | 0.130 | 1.0E+00 | | | 1.0E-05 | NA | NA | NA | 5.8E-10 | NA | |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.85E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 2.4E-01 | 3.4E-01 | 6.6E-04 | 9.4E-04 | 1.3E-05 | NA | 3.4E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 9.02E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 1.2E-02 | 8.2E-02 | 3.2E-05 | 5.8E-03 | 6.4E-07 | 1.3E-02 | 1.0E-01 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 5.19E+00 | 0.001 | 1.0E+00 | blood | | 6.6E-05 | 1.0E+00 | 1.9E-07 | 2.9E-03 | 3.7E-09 | NA | 1.0E+00 |
| Vanadium | 7.0E-03 | 1.8E-04 | NA | 3.72E+01 | 0.001 | 3% | kidney | | 4.8E-04 | 6.8E-02 | 1.3E-06 | 7.3E-03 | 2.6E-08 | NA | 7.5E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.6E+00 | | 1.7E-02 | | 1.4E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.7E+00** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.0E+00 |
| Total Gastrointestinal: | 3.4E-01 |
| Total Nervous System: | 2.4E-01 |
| Total Kidney: | 7.5E-02 |

**APPENDIX Q**
**TABLE 8.26**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area H*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(\mu g/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 8.01E+03 | 1.0E-03 | 1.0E+00 | 1.3E-02 | NA | NA | NA | 2.4E-06 | NA | |
| Arsenic | A | 1.5E+00 | 1.5E+00 | 4.30E-03 | 1.08E+01 | 3.0E-02 | 9.5E-01 | 1.7E-05 | 3E-05 | 1.6E-06 | 2E-06 | 3.3E-09 | 1E-08 | 3E-05 |
| Iron | NA | NA | NA | NA | 1.51E+04 | 1.0E-03 | 1.0E+00 | 2.4E-02 | NA | NA | NA | 4.6E-06 | NA | |
| Manganese | D | NA | NA | NA | 6.19E+02 | 1.0E-03 | 4.0E-02 | 9.7E-04 | NA | NA | NA | 1.9E-07 | NA | |
| Silver | D | NA | NA | NA | 6.80E+01 | 1.0E-03 | 4.0E-02 | 1.1E-04 | NA | NA | NA | 2.1E-08 | NA | |
| Thallium | D | NA | NA | NA | 4.52E+00 | 1.0E-03 | 1.0E+00 | 7.1E-06 | NA | NA | NA | 1.4E-09 | NA | |
| **ELCR Subtotals** | | | | | | | | | 3E-05 | | 2E-06 | | 1E-08 | |
| | | | | | | | | | | | | **Estimated Total Risk =** | | **3E-05** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
$\mu g/m^3$ = microgram per cubic meter
URF = Inhalation unit risk factor
WOE = weight of evidence

APPENDIX Q
TABLE 8.27
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area H*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.01E+03 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 1.1E-02 | 1.1E-02 | 4.4E-05 | 4.4E-05 | 5.6E-06 | 1.1E-03 | 1.2E-02 |
| Arsenic | 3.0E-04 | 3.0E-04 | 3.0E-05 | 1.08E+01 | 3.0E-02 | 9.5E-01 | skin | developmental, cardiovascular system, nervous system | 1.5E-05 | 4.9E-02 | 1.8E-06 | 5.9E-03 | 7.6E-09 | 2.5E-04 | 5.5E-02 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.51E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.1E-02 | 3.0E-02 | 8.3E-05 | 1.2E-04 | 1.1E-05 | NA | 3.0E-02 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 6.19E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 8.5E-04 | 6.1E-03 | 3.4E-06 | 6.0E-04 | 4.4E-07 | 8.7E-03 | 1.5E-02 |
| Silver | 5.0E-03 | 2.0E-04 | NA | 6.80E+01 | 1.0E-03 | 4.0E-02 | skin | | 9.3E-05 | 1.9E-02 | 3.7E-07 | 1.9E-03 | 4.8E-08 | NA | 2.0E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 4.52E+00 | 1.0E-03 | 1.0E+00 | blood | | 6.2E-06 | 9.5E-02 | 2.5E-08 | 3.8E-04 | 3.2E-09 | NA | 9.6E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | 2.1E-01 | | 8.9E-03 | | 1.0E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **2.3E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 9.6E-02 |
| Total Gastrointestinal: | 3.0E-02 |
| Total Nervous System: | 2.8E-02 |
| Total Developmental: | 2.5E-04 |
| Total Skin: | 2.0E-02 |
| Total Cardiovascular: | 2.5E-04 |

**APPENDIX Q**
**TABLE 8.28**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area H*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC ($mg/m^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC ($mg/m^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.01E+03 | 0.001 | 1.0E+00 | nervous system | nervous system | 1.0E-01 | 1.0E-01 | 2.9E-04 | 2.9E-04 | 5.6E-06 | 1.1E-03 | 1.0E-01 |
| Arsenic | 3.0E-04 | 3.0E-04 | 3.0E-05 | 1.08E+01 | 0.030 | 9.5E-01 | skin | developmental, cardiovascular system, nervous system | 1.4E-04 | 4.6E-01 | 1.2E-05 | 3.9E-02 | 7.6E-09 | 2.5E-04 | 5.0E-01 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.51E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 1.9E-01 | 2.8E-01 | 5.4E-04 | 7.7E-04 | 1.1E-05 | NA | 2.8E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 6.19E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 7.9E-03 | 5.7E-02 | 2.2E-05 | 4.0E-03 | 4.4E-07 | 8.7E-03 | 6.9E-02 |
| Silver | 5.0E-03 | 2.0E-04 | NA | 6.80E+01 | 0.001 | 4.0E-02 | skin | | 8.7E-04 | 1.7E-01 | 2.4E-06 | 1.2E-02 | 4.8E-08 | NA | 1.9E-01 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 4.52E+00 | 0.001 | 100% | blood | | 5.8E-05 | 8.9E-01 | 1.6E-07 | 2.5E-03 | 3.2E-09 | NA | 8.9E-01 |
| **Subtotal Hazard Indices** | | | | | | | | | | 2.0E+00 | | 5.8E-02 | | 1.0E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **2.0E+00** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 8.9E-01 |
| Total Gastrointestinal: | 2.8E-01 |
| Total Nervous System: | 1.7E-01 |
| Total Developmental: | 2.5E-04 |
| Total Skin: | 1.9E-01 |
| Total Cardiovascular: | 2.5E-04 |

**APPENDIX Q**
**TABLE 8.29**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area I*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(\mu g/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 8.81E+03 | 1.0E-03 | 1.0E+00 | 1.4E-02 | NA | NA | NA | 2.7E-06 | NA | NA |
| Iron | NA | NA | NA | NA | 1.65E+04 | 1.0E-03 | 1.0E+00 | 2.6E-02 | NA | NA | NA | 5.0E-06 | NA | NA |
| Manganese | D | NA | NA | NA | 9.21E+02 | 1.0E-03 | 4.0E-02 | 1.4E-03 | NA | NA | NA | 2.8E-07 | NA | NA |
| Thallium | D | NA | NA | NA | 5.78E+00 | 1.0E-03 | 1.0E+00 | 9.0E-06 | NA | NA | NA | 1.7E-09 | NA | NA |
| **ELCR Subtotals** | | | | | | | | | NA | | NA | | NA | |
| | | | | | | | | | | | | **Estimated Total Risk =** | | **NA** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
$\mu g/m^3$ = microgram per cubic meter
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.30**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area I*

| | | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | NA | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.81E+03 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 1.2E-02 | 1.2E-02 | 4.8E-05 | 4.8E-05 | 6.2E-06 | 1.2E-03 | 1.3E-02 |
| Iron | NA | 7.0E-01 | 7.0E-01 | NA | 1.65E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.3E-02 | 3.2E-02 | 9.0E-05 | 1.3E-04 | 1.2E-05 | NA | 3.2E-02 |
| Manganese | D | 1.4E-01 | 5.6E-03 | 5.0E-05 | 9.21E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 1.3E-03 | 9.0E-03 | 5.0E-06 | 9.0E-04 | 6.5E-07 | 1.3E-02 | 2.3E-02 |
| Thallium | D | 6.5E-05 | 6.5E-05 | NA | 5.78E+00 | 1.0E-03 | 1.0E+00 | blood | | 7.9E-06 | 1.2E-01 | 3.2E-08 | 4.9E-04 | 4.1E-09 | NA | 1.2E-01 |
| **Subtotal Hazard Indices** | | | | | | | | | | | 1.8E-01 | | 1.6E-03 | | 1.4E-02 | |
| | | | | | | | | | | | | | | | **Total HI =** | **1.9E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.2E-01 |
| Total Gastrointestinal: | 3.2E-02 |
| Total Nervous System: | 3.6E-02 |

**APPENDIX Q**
**TABLE 8.31**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area I*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.81E+03 | 0.001 | 1.0E+00 | nervous system | nervous system | 1.1E-01 | 1.1E-01 | 3.2E-04 | 3.2E-04 | 6.2E-06 | 1.2E-03 | 1.1E-01 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.65E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 2.1E-01 | 3.0E-01 | 5.9E-04 | 8.5E-04 | 1.2E-05 | NA | 3.0E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 9.21E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 1.2E-02 | 8.4E-02 | 3.3E-05 | 5.9E-03 | 6.5E-07 | 1.3E-02 | 1.0E-01 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 5.78E+00 | 0.001 | 1.0E+00 | blood | | 7.4E-05 | 1.1E+00 | 2.1E-07 | 3.2E-03 | 4.1E-09 | NA | 1.1E+00 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.6E+00 | | 1.0E-02 | | 1.4E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.7E+00** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.1E+00 |
| Total Gastrointestinal: | 3.0E-01 |
| Total Nervous System: | 2.2E-01 |

**APPENDIX Q**
**TABLE 8.32**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area J*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(\mu g/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 8.43E+03 | 1.0E-03 | 1.0E+00 | 1.3E-02 | NA | NA | NA | 2.5E-06 | NA | |
| Arsenic | A | 1.5E+00 | 1.5E+00 | 4.30E-03 | 1.29E+01 | 3.0E-02 | 9.5E-01 | 2.0E-05 | 3E-05 | 1.9E-06 | 3E-06 | 3.9E-09 | 2E-08 | 3E-05 |
| Benzo(b)fluoranthene | B2 | 7.3E-01 | 7.3E-01 | 1.10E-04 | 4.65E-01 | 1.3E-01 | 1.0E+00 | 7.3E-07 | 5E-07 | 3.0E-07 | 2E-07 | 1.4E-10 | 2E-11 | 7E-07 |
| Copper | NA | NA | NA | NA | 2.13E+02 | 1.0E-03 | 1.0E+00 | 3.3E-04 | NA | NA | NA | 6.4E-08 | NA | |
| Iron | NA | NA | NA | NA | 1.73E+04 | 1.0E-03 | 1.0E+00 | 2.7E-02 | NA | NA | NA | 5.2E-06 | NA | |
| Manganese | D | NA | NA | NA | 7.57E+02 | 1.0E-03 | 4.0E-02 | 1.2E-03 | NA | NA | NA | 1.8E-07 | NA | |
| Thallium | D | NA | NA | NA | 8.64E+00 | 1.0E-03 | 1.0E+00 | 1.3E-05 | NA | NA | NA | 2.1E-09 | NA | |
| **ELCR Subtotals** | | | | | | | | | 3E-05 | | 3E-06 | | 2E-08 | |
| | | | | | | | | | | | | **Estimated Total Risk =** | | **3E-05** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
$\mu g/m^3$ = microgram per cubic meter
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.33**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area J*

| | | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | NA | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.43E+03 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 1.2E-02 | 1.2E-02 | 4.6E-05 | 4.6E-05 | 5.9E-06 | 1.2E-03 | 1.3E-02 |
| Arsenic | A | 3.0E-04 | 3.0E-04 | 3.0E-05 | 1.29E+01 | 3.0E-02 | 9.5E-01 | skin | developmental, cardiovascular system, nervous system | 1.8E-05 | 5.9E-02 | 2.1E-06 | 7.1E-03 | 9.1E-09 | 3.0E-04 | 6.6E-02 |
| Benzo(b)fluoranthene | B2 | NA | NA | NA | 4.65E-01 | 1.3E-01 | 1.0E+00 | | | 6.4E-07 | NA | NA | NA | 3.3E-10 | NA | |
| Copper | NA | 4.0E-02 | 4.0E-02 | NA | 2.13E+02 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.9E-04 | 7.3E-03 | 1.2E-06 | 2.9E-05 | 1.5E-07 | NA | 7.3E-03 |
| Iron | NA | 7.0E-01 | 7.0E-01 | NA | 1.73E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.4E-02 | 3.4E-02 | 9.4E-05 | 1.3E-04 | 1.2E-05 | NA | 3.4E-02 |
| Manganese | D | 1.4E-01 | 5.6E-03 | 5.0E-05 | 7.57E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 1.0E-03 | 7.4E-03 | 4.1E-06 | 7.4E-04 | 5.3E-07 | 1.1E-02 | 1.9E-02 |
| Thallium | D | 6.5E-05 | 6.5E-05 | NA | 8.64E+00 | 1.0E-03 | 1.0E+00 | blood | | 1.2E-05 | 1.8E-01 | 4.7E-08 | 7.3E-04 | 6.1E-09 | NA | 1.8E-01 |
| **Subtotal Hazard Indices** | | | | | | | | | | | 3.0E-01 | | 8.7E-03 | | 1.2E-02 | |
| | | | | | | | | | | | | | | | **Total HI =** | **3.2E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.8E-01 |
| Total Gastrointestinal: | 4.1E-02 |
| Total Nervous System: | 3.2E-02 |
| Total Skin: | 6.6E-02 |
| Total Cardiovascular: | 3.0E-04 |
| Total Developmental: | 3.0E-04 |

**APPENDIX Q**
**TABLE 8.34**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area J*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.43E+03 | 0.001 | 1.0E+00 | nervous system | nervous system | 1.1E-01 | 1.1E-01 | 3.0E-04 | 3.0E-04 | 5.9E-06 | 1.2E-03 | 1.1E-01 |
| Arsenic | 3.0E-04 | 3.0E-04 | 3.0E-05 | 1.29E+01 | 0.030 | 9.5E-01 | skin | developmental, cardiovascular system, nervous system | 1.6E-04 | 5.5E-01 | 1.4E-05 | 4.6E-02 | 9.1E-09 | 3.0E-04 | 6.0E-01 |
| Benzo(b)fluoranthene | NA | NA | NA | 4.65E-01 | 0.130 | 1.0E+00 | | | 5.9E-06 | NA | NA | NA | 3.3E-10 | NA | |
| Copper | 4.0E-02 | 4.0E-02 | NA | 2.13E+02 | 0.001 | 1.0E+00 | gastrointestinal | | 2.7E-03 | 6.8E-02 | 7.6E-06 | 1.9E-04 | 1.5E-07 | NA | 6.8E-02 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.73E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 2.2E-01 | 3.2E-01 | 6.2E-04 | 8.8E-04 | 1.2E-05 | NA | 3.2E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 7.57E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 9.7E-03 | 6.9E-02 | 2.7E-05 | 4.8E-03 | 5.3E-07 | 1.1E-02 | 8.5E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 8.64E+00 | 0.001 | 1.0E+00 | blood | | 1.1E-04 | 1.7E+00 | 3.1E-07 | 4.8E-03 | 6.1E-09 | NA | 1.7E+00 |
| **Subtotal Hazard Indices** | | | | | | | | | | 2.8E+00 | | 5.7E-02 | | 1.2E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **2.9E+00** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.7E+00 |
| Total Gastrointestinal: | 3.8E-01 |
| Total Nervous System: | 1.9E-01 |
| Total Skin: | 6.0E-01 |
| Total Cardiovascular: | 3.0E-04 |
| Total Developmental: | 3.0E-04 |

**APPENDIX Q**
**TABLE 8.35**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area K*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(\mu g/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC ($mg/m^3$) | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 9.41E+03 | 1.0E-03 | 1.0E+00 | 1.5E-02 | NA | NA | NA | 2.8E-06 | NA | NA |
| Iron | NA | NA | NA | NA | 1.65E+04 | 1.0E-03 | 1.0E+00 | 2.6E-02 | NA | NA | NA | 5.0E-06 | NA | NA |
| Manganese | D | NA | NA | NA | 8.42E+02 | 1.0E-03 | 4.0E-02 | 1.3E-03 | NA | NA | NA | 2.5E-07 | NA | NA |
| Thallium | D | NA | NA | NA | 7.67E+00 | 1.0E-03 | 1.0E+00 | 1.2E-05 | NA | NA | NA | 2.3E-09 | NA | NA |
| Vanadium | NA | NA | NA | NA | 3.30E+01 | 1.0E-03 | 2.6E-02 | 5.2E-05 | NA | NA | NA | 1.0E-08 | NA | NA |
| **ELCR Subtotals** | | | | | | | | | NA | | NA | | NA | |
| | | | | | | | | | | | | **Estimated Total Risk =** | | **NA** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
$\mu g/m^3$ = microgram per cubic meter
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.36**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area K*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 9.41E+03 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 1.3E-02 | 1.3E-02 | 5.1E-05 | 5.1E-05 | 6.6E-06 | 1.3E-03 | 1.4E-02 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.65E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.3E-02 | 3.2E-02 | 9.0E-05 | 1.3E-04 | 1.2E-05 | NA | 3.2E-02 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 8.42E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 1.2E-03 | 8.2E-03 | 4.6E-06 | 8.2E-04 | 5.9E-07 | 1.2E-02 | 2.1E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 7.67E+00 | 1.0E-03 | 1.0E+00 | blood | | 1.1E-05 | 1.6E-01 | 4.2E-08 | 6.4E-04 | 5.4E-09 | NA | 1.6E-01 |
| Vanadium | 7.0E-03 | 1.8E-04 | NA | 3.30E+01 | 1.0E-03 | 2.6E-02 | kidney | | 4.5E-05 | 6.5E-03 | 1.8E-07 | 9.9E-04 | 2.3E-08 | NA | 7.4E-03 |
| **Subtotal Hazard Indices** | | | | | | | | | | 2.2E-01 | | 2.6E-03 | | 1.3E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **2.4E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.6E-01 |
| Total Gastrointestinal: | 3.2E-02 |
| Total Nervous System: | 3.5E-02 |
| Total Kidney: | 7.4E-03 |

**APPENDIX Q**
**TABLE 8.37**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area K*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC ($mg/m^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC ($mg/m^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 9.41E+03 | 0.001 | 1.0E+00 | nervous system | nervous system | 1.2E-01 | 1.2E-01 | 3.4E-04 | 3.4E-04 | 6.6E-06 | 1.3E-03 | 1.2E-01 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.65E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 2.1E-01 | 3.0E-01 | 5.9E-04 | 8.4E-04 | 1.2E-05 | NA | 3.0E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 8.42E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 1.1E-02 | 7.7E-02 | 3.0E-05 | 5.4E-03 | 5.9E-07 | 1.2E-02 | 9.4E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 7.67E+00 | 0.001 | 1.0E+00 | blood | | 9.8E-05 | 1.5E+00 | 2.7E-07 | 4.2E-03 | 5.4E-09 | NA | 1.5E+00 |
| Vanadium | 7.0E-03 | 1.8E-04 | NA | 3.30E+01 | 0.001 | 2.6E-02 | kidney | | 4.2E-04 | 6.0E-02 | 1.2E-06 | 6.5E-03 | 2.3E-08 | NA | 6.7E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | 2.1E+00 | | 1.7E-02 | | 1.3E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **2.1E+00** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 1.5E+00 |
| Total Gastrointestinal: | 3.0E-01 |
| Total Nervous System: | 2.2E-01 |
| Total Kidney: | 6.7E-02 |

**APPENDIX Q**
**TABLE 8.38**
Potential Excess Lifetime Cancer Risk from Soil (0-10 feet) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area L*

| | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(\mu g/m^3)^{-1}$ | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAD (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| Aluminum | NA | NA | NA | NA | 8.59E+03 | 1.0E-03 | 1.0E+00 | 1.3E-02 | NA | NA | NA | 2.6E-06 | NA | |
| cis-1,2-Dichloroethene | D | NA | NA | NA | 2.88E-01 | NA | 1.0E+00 | 4.5E-07 | NA | NA | NA | 5.8E-05 | NA | |
| Iron | NA | NA | NA | NA | 1.78E+04 | 1.0E-03 | 1.0E+00 | 2.8E-02 | NA | NA | NA | 5.4E-06 | NA | |
| Manganese | D | NA | NA | NA | 8.57E+02 | 1.0E-03 | 4.0E-02 | 1.3E-03 | NA | NA | NA | 2.6E-07 | NA | |
| Selenium | D | NA | NA | NA | 6.42E+00 | 1.0E-03 | 1.0E+00 | 1.0E-05 | NA | NA | NA | 1.9E-09 | NA | |
| Tetrachloroethene | NA | 5.4E-01 | 5.4E-01 | 5.90E-06 | 2.60E+00 | NA | 1.0E+00 | 4.1E-06 | 2E-06 | 1.3E-05 | 7E-06 | 6.0E-04 | 4E-06 | 1E-05 |
| Thallium | D | NA | NA | NA | 2.36E+00 | 1.0E-03 | 1.0E+00 | 3.7E-06 | NA | NA | NA | 7.1E-10 | NA | |
| Trichloroethene | NA | 1.3E-02 | 1.3E-02 | 2.00E-06 | 3.79E-01 | NA | 1.0E+00 | 5.9E-07 | 8E-09 | 1.9E-06 | 2E-08 | 6.8E-05 | 1E-07 | 2E-07 |
| Vanadium | NA | NA | NA | NA | 3.99E+01 | 1.0E-03 | 2.6E-02 | 6.2E-05 | NA | NA | NA | 1.2E-08 | NA | |
| **ELCR Subtotals** | | | | | | | | | 2E-06 | | 7E-06 | | 4E-06 | |
| | | | | | | | | | | | | **Estimated Total Risk =** | | 1E-05 |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
$\mu g/m^3$ = microgram per cubic meter
URF = Inhalation unit risk factor
WOE = weight of evidence

**APPENDIX Q**
**TABLE 8.39**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Adult Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area L*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.59E+03 | 1.0E-03 | 1.0E+00 | nervous system | nervous system | 1.2E-02 | 1.2E-02 | 4.7E-05 | 4.7E-05 | 6.1E-06 | 1.2E-03 | 1.3E-02 |
| cis-1,2-Dichloroethene | 1.0E-02 | 1.0E-02 | NA | 2.88E-01 | NA | 1.0E+00 | blood | | 3.9E-07 | 3.9E-05 | 1.6E-06 | 1.6E-04 | 1.4E-04 | NA | 2.0E-04 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.78E+04 | 1.0E-03 | 1.0E+00 | gastrointestinal | | 2.4E-02 | 3.5E-02 | 9.8E-05 | 1.4E-04 | 1.3E-05 | NA | 3.5E-02 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 8.57E+02 | 1.0E-03 | 4.0E-02 | nervous system | nervous system | 1.2E-03 | 8.4E-03 | 4.7E-06 | 8.4E-04 | 6.0E-07 | 1.2E-02 | 2.1E-02 |
| Selenium | 5.0E-03 | 5.0E-03 | NA | 6.42E+00 | 1.0E-03 | 1.0E+00 | whole body | | 8.8E-06 | 1.8E-03 | 3.5E-08 | 7.0E-06 | 4.5E-09 | NA | 1.8E-03 |
| Tetrachloroethene | 1.0E-02 | 1.0E-02 | 2.7E-01 | 2.60E+00 | NA | 1.0E+00 | liver | nervous system | 3.6E-06 | 3.6E-04 | 1.4E-05 | 1.4E-03 | 1.4E-03 | 5.2E-03 | 6.9E-03 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 2.36E+00 | 1.0E-03 | 1.0E+00 | blood | | 3.2E-06 | 5.0E-02 | 1.3E-08 | 2.0E-04 | 1.7E-09 | NA | 5.0E-02 |
| Trichloroethene | NA | NA | 6.0E-01 | 3.79E-01 | NA | 1.0E+00 | | nervous system, eyes | 5.2E-07 | NA | NA | NA | 1.6E-04 | 2.7E-04 | 2.7E-04 |
| Vanadium | 7.0E-03 | 1.8E-04 | NA | 3.99E+01 | 1.0E-03 | 2.6E-02 | kidney | | 5.5E-05 | 7.8E-03 | 2.2E-07 | 1.2E-03 | 2.8E-08 | NA | 9.0E-03 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.1E-01 | | 4.0E-03 | | 1.9E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.4E-01** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 5.0E-02 |
| Total Gastrointestinal: | 3.5E-02 |
| Total Nervous System: | 4.0E-02 |
| Total Whole Body: | 1.8E-03 |
| Total Kidney: | 9.0E-03 |
| Total Liver: | 1.8E-03 |
| Total Eyes: | 2.7E-04 |

**APPENDIX Q**
**TABLE 8.40**
Potential Noncarcinogenic Risk from Soil (0-10 feet) - Child Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri - Area L*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Soil EPC (mg/kg) | $ABS_d$ | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAD (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| Aluminum | 1.0E+00 | 1.0E+00 | 5.0E-03 | 8.59E+03 | 0.001 | 1.0E+00 | nervous system | nervous system | 1.1E-01 | 1.1E-01 | 3.1E-04 | 3.1E-04 | 6.1E-06 | 1.2E-03 | 1.1E-01 |
| cis-1,2-Dichloroethene | 1.0E-02 | 1.0E-02 | NA | 2.88E-01 | NA | 1.0E+00 | blood | | 3.7E-06 | 3.7E-04 | 1.0E-05 | 1.0E-03 | 1.4E-04 | NA | 1.4E-03 |
| Iron | 7.0E-01 | 7.0E-01 | NA | 1.78E+04 | 0.001 | 1.0E+00 | gastrointestinal | | 2.3E-01 | 3.3E-01 | 6.4E-04 | 9.1E-04 | 1.3E-05 | NA | 3.3E-01 |
| Manganese | 1.4E-01 | 5.6E-03 | 5.0E-05 | 8.57E+02 | 0.001 | 4.0E-02 | nervous system | nervous system | 1.1E-02 | 7.8E-02 | 3.1E-05 | 5.5E-03 | 6.0E-07 | 1.2E-02 | 9.6E-02 |
| Selenium | 5.0E-03 | 5.0E-03 | NA | 6.42E+00 | 0.001 | 1.0E+00 | whole body | | 8.2E-05 | 1.6E-02 | 2.3E-07 | 4.6E-05 | 4.5E-09 | NA | 1.6E-02 |
| Tetrachloroethene | 1.0E-02 | 1.0E-02 | 2.7E-01 | 2.60E+00 | NA | 1.0E+00 | liver | nervous system | 3.3E-05 | 3.3E-03 | 9.3E-05 | 9.3E-03 | 1.4E-03 | 5.2E-03 | 1.8E-02 |
| Thallium | 6.5E-05 | 6.5E-05 | NA | 2.36E+00 | 0.001 | 1.0E+00 | blood | | 3.0E-05 | 4.6E-01 | 8.4E-08 | 1.3E-03 | 1.7E-09 | NA | 4.7E-01 |
| Trichloroethene | NA | NA | 6.0E-01 | 3.79E-01 | NA | 1.0E+00 | | nervous system, eyes | 4.8E-06 | NA | NA | NA | 1.6E-04 | 2.7E-04 | 2.7E-04 |
| Vanadium | 7.0E-03 | 1.8E-04 | NA | 3.99E+01 | 0.001 | 2.6E-02 | kidney | | 5.1E-04 | 7.3E-02 | 1.4E-06 | 7.9E-03 | 2.8E-08 | NA | 8.1E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | 1.1E+00 | | 2.6E-02 | | 1.9E-02 | |
| | | | | | | | | | | | | | | **Total HI =** | **1.1E+00** |

$ABS_d$ = dermal absorption factor
$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
DAC = daily average concentration
DAD = dermally absorbed dose
EPC = exposure point concentration
HI = Hazard Index
HQ = Hazard Quotient
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter
RfC = reference concentration
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose

| | |
|---|---|
| Total Blood: | 4.7E-01 |
| Total Gastrointestinal: | 3.3E-01 |
| Total Nervous System: | 2.1E-01 |
| Total Whole Body: | 1.6E-02 |
| Total Kidney: | 8.1E-02 |
| Total Liver: | 1.3E-02 |
| Total Eyes: | 2.7E-04 |

# Risk Assessment Guidance for Superfund: Table 9

APPENDIX Q
TABLE 9.1
Potential Excess Lifetime Cancer Risk from Groundwater (Downgradient of Building 220) - Construction Worker RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(\mu g/m^3)^{-1}$ | Groundwater EPC (mg/L) | Ambient Air EPC $(mg/m^3)$ | DAevent $(mg/cm^2\text{-}event)$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| 1,1,1,2-Tetrachloroethane | C | 2.6E-02 | 2.6E-02 | 7.4E-06 | 1.60E-02 | 5.43E-04 | 9.35E-07 | 1.00E+00 | 4.24E-09 | 1.10E-10 | 5.23E-08 | 3.87E-10 | 4.97E-10 |
| 1,1,2,2-Tetrachloroethane | C | 2.0E-01 | 2.0E-01 | 5.8E-05 | 5.80E-04 | 1.97E-05 | 1.52E-08 | 1.00E+00 | 6.89E-11 | 1.38E-11 | 1.89E-09 | 1.10E-10 | 1.24E-10 |
| 1,1,2-Trichloroethane | C | 5.7E-02 | 5.7E-02 | 1.6E-05 | 2.30E-03 | 8.81E-05 | 4.70E-08 | 1.00E+00 | 2.13E-10 | 1.21E-11 | 8.48E-09 | 1.36E-10 | 1.48E-10 |
| 1,2-Dichloroethane (EDC) | B2 | 9.1E-02 | 9.1E-02 | 2.6E-05 | 1.89E-01 | 7.87E-03 | 2.18E-06 | 1.00E+00 | 9.89E-09 | 9.00E-10 | 7.58E-07 | 1.97E-08 | 2.06E-08 |
| Benzene | A | 5.5E-02 | 5.5E-02 | 7.8E-06 | 4.00E-03 | 1.69E-04 | 1.50E-07 | 1.00E+00 | 6.79E-10 | 3.74E-11 | 1.63E-08 | 1.27E-10 | 1.64E-10 |
| Carbon tetrachloride | B2 | 1.3E-01 | 1.3E-01 | 1.5E-05 | 4.16E+00 | 1.64E-01 | 2.39E-04 | 1.00E+00 | 1.09E-06 | 1.41E-07 | 1.58E-05 | 2.37E-07 | 3.78E-07 |
| Chloroform | B1 | 3.1E-02 | 3.1E-02 | 2.3E-05 | 7.90E-01 | 3.38E-02 | 1.60E-05 | 1.00E+00 | 7.26E-08 | 2.25E-09 | 3.25E-06 | 7.47E-08 | 7.70E-08 |
| cis-1,2-Dichloroethene | D | NA | NA | NA | 2.73E-01 | 1.26E-02 | 5.65E-06 | 1.00E+00 | 2.56E-08 | NA | 1.22E-06 | NA | NA |
| Naphthalene | C | NA | NA | 3.4E-05 | 1.01E-02 | 3.37E-04 | 1.41E-06 | 1.00E+00 | 6.41E-09 | NA | 3.24E-08 | 1.10E-09 | 1.10E-09 |
| Tetrachloroethene | NA | 5.4E-01 | 5.4E-01 | 5.9E-06 | 3.49E+01 | 1.31E+00 | 4.34E-03 | 1.00E+00 | 1.97E-05 | 1.06E-05 | 1.26E-04 | 7.46E-07 | 1.14E-05 |
| trans-1,2-Dichloroethene | NA | NA | NA | NA | 1.20E-02 | 5.77E-04 | 3.35E-07 | 1.00E+00 | 1.52E-09 | NA | 5.56E-08 | NA | NA |
| Trichloroethene | NA | 1.3E-02 | 1.3E-02 | 2.0E-06 | 1.15E+00 | 4.61E-02 | 4.16E-05 | 1.00E+00 | 1.89E-07 | 2.46E-09 | 4.44E-06 | 8.88E-09 | 1.13E-08 |
| Vinyl chloride | A | 7.2E-01 | 7.2E-01 | 4.4E-06 | 3.20E-04 | 3.40E-06 | 4.39E-09 | 1.00E+00 | 1.99E-11 | 1.44E-11 | 3.28E-10 | 1.44E-12 | 1.58E-11 |
| **Estimated Subtotal** | | | | | | | | | | 1.08E-05 | | 1.09E-06 | |
| | | | | | | | | | | | **Estimated Total Risk =** | | **1.19E-05** |

[a]Cancer WOE Classifications:
Group B (B1, B2): Probable human carcinogen

$ABS_{gi}$ = gastrointestinal absorption factor
COPC = Chemical of Potential Concern
CDI = chronic daily intake (mg/kg-day)
ELCR = excess lifetime cancer risk
EPC = exposure point concentration (mg/L)
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
URF = Inhalation unit risk factor
WOE = weight of evidence
DAevent = Absorbed dose per event
DAC = daily average concentration
$mg/m^3$ = microgram per cubic meter
$mg/m^3$ = milligrams per cubic meter
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day

APPENDIX Q

TABLE 9.2

Potential Noncarcinogenic Risk from Groundwater (Downgradient of Building 220) - Construction Worker RME Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Groundwater EPC (mg/L) | Ambient Air EPC (mg/m$^3$) | DAevent (mg/cm$^2$-event) | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| 1,1,1,2-Tetrachloroethane | 3.0E-02 | 3.0E-02 | NA | 1.60E-02 | 5.43E-04 | 9.35E-07 | 1.00E+00 | kidney, liver | | 3.62E-06 | 1.21E-04 | 4.45E-05 | NA | 1.21E-04 |
| 1,1,2,2-Tetrachloroethane | 4.0E-03 | 4.0E-03 | NA | 5.80E-04 | 1.97E-05 | 1.52E-08 | 1.00E+00 | liver | | 5.87E-08 | 1.47E-05 | 1.61E-06 | NA | 1.47E-05 |
| 1,1,2-Trichloroethane | 4.0E-03 | 4.0E-03 | NA | 2.30E-03 | 8.81E-05 | 4.70E-08 | 1.00E+00 | blood | | 1.82E-07 | 4.54E-05 | 7.22E-06 | NA | 4.54E-05 |
| 1,2-Dichloroethane (EDC) | 2.0E-02 | 2.0E-02 | 2.4E+00 | 1.89E-01 | 7.87E-03 | 2.18E-06 | 1.00E+00 | kidney, liver | kidney, liver | 8.42E-06 | 4.21E-04 | 6.45E-04 | 2.69E-04 | 6.90E-04 |
| Benzene | 4.0E-03 | 4.0E-03 | 3.0E-02 | 4.00E-03 | 1.69E-04 | 1.50E-07 | 1.00E+00 | blood | blood | 5.79E-07 | 1.45E-04 | 1.39E-05 | 4.62E-04 | 6.06E-04 |
| Carbon tetrachloride | 7.0E-04 | 7.0E-04 | 1.9E-01 | 4.16E+00 | 1.64E-01 | 2.39E-04 | 1.00E+00 | liver | liver | 9.26E-04 | 1.32E+00 | 1.35E-02 | 7.09E-02 | 1.39E+00 |
| Chloroform | 1.0E-02 | 1.0E-02 | 9.8E-02 | 7.90E-01 | 3.38E-02 | 1.60E-05 | 1.00E+00 | liver | liver | 6.19E-05 | 6.19E-03 | 2.77E-03 | 2.82E-02 | 3.44E-02 |
| cis-1,2-Dichloroethene | 1.0E-02 | 1.0E-02 | NA | 2.73E-01 | 1.26E-02 | 5.65E-06 | 1.00E+00 | blood | | 2.18E-05 | 2.18E-03 | 1.04E-03 | NA | 2.18E-03 |
| Naphthalene | 2.0E-02 | 2.0E-02 | 3.0E-03 | 1.01E-02 | 3.37E-04 | 1.41E-06 | 1.00E+00 | whole body | respiratory | 5.46E-06 | 2.73E-04 | 2.76E-05 | 9.20E-03 | 9.48E-03 |
| Tetrachloroethene | 1.0E-02 | 1.0E-02 | 2.7E-01 | 3.49E+01 | 1.31E+00 | 4.34E-03 | 1.00E+00 | liver | nervous system | 1.68E-02 | 1.68E+00 | 1.08E-01 | 3.99E-01 | 2.08E+00 |
| trans-1,2-Dichloroethene | 2.0E-02 | 2.0E-02 | 6.0E-02 | 1.20E-02 | 5.77E-04 | 3.35E-07 | 1.00E+00 | kidney | kidney | 1.30E-06 | 6.48E-05 | 4.74E-05 | 7.89E-04 | 8.54E-04 |
| Trichloroethene | NA | NA | 6.0E-01 | 1.15E+00 | 4.61E-02 | 4.16E-05 | 1.00E+00 | | nervous system, eyes | 1.61E-04 | NA | 3.78E-03 | 6.36E-03 | 6.36E-03 |
| Vinyl chloride | 3.0E-03 | 3.0E-03 | 1.0E-01 | 3.20E-04 | 3.40E-06 | 4.39E-09 | 1.00E+00 | liver | liver | 1.70E-08 | 5.66E-06 | 2.79E-07 | 2.79E-06 | 8.45E-06 |
| **Subtotal Hazard Indices** | | | | | | | | | | | 3.01E+00 | | 5.15E-01 | |
| | | | | | | | | | | | | | **Total HI =** | **3.53E+00** |

$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
COPC = Chemical of Potential Concern
DAC = daily average concentration
EPC = exposure point concentration (mg/L)
HI = Hazard Index
HQ = hazard quotient
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose
RfC = reference concentration
DAevent = Absorbed dose per event

mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter

| | |
|---|---|
| Total Kidney: | 1.7E-03 |
| Total Liver: | 3.1E+00 |
| Total Blood: | 2.8E-03 |
| Total Nervous System: | 4.1E-01 |
| Total Eyes: | 6.4E-03 |
| Total Whole Body: | 2.7E-04 |
| Total Respiratory: | 9.2E-03 |

**APPENDIX Q**
**TABLE 9.1 AND 9.2 SUPPLEMENT A**
Calculation of DAevent - Construction Worker RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical of Potential Concern | Surface Water Concentration (CW) (µg/L) | Permeability Coefficient (Kp) (cm/hr) | B (dimensionless) | Lag Time ($t_{event}$) (hr) | t* (hr) | Fraction Absorbed Water (FA) (dimensionless) | Duration of Event ($t_{event}$) (hr) | $DA_{event}$ (mg/cm$^2$-event) | Eq |
|---|---|---|---|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 1.60E+01 | 1.6E-02 | 7.8E-02 | 9.2E-01 | 2.2E+00 | 1.0E+00 | 2.0 | 9.4E-07 | 2 |
| 1,1,2,2-Tetrachloroethane | 5.80E-01 | 6.9E-03 | 3.5E-02 | 9.3E-01 | 2.2E+00 | 1.0E+00 | 2.0 | 1.5E-08 | 2 |
| 1,1,2-Trichloroethane | 2.30E+00 | 6.4E-03 | 2.9E-02 | 6.0E-01 | 1.4E+00 | 1.0E+00 | 2.0 | 4.7E-08 | 3 |
| 1,2-Dichloroethane (EDC) | 1.89E+02 | 4.2E-03 | 1.6E-02 | 3.8E-01 | 9.2E-01 | 1.0E+00 | 2.0 | 2.2E-06 | 3 |
| Benzene | 4.00E+00 | 1.5E-02 | 5.1E-02 | 2.9E-01 | 7.0E-01 | 1.0E+00 | 2.0 | 1.5E-07 | 3 |
| Carbon tetrachloride | 4.16E+03 | 1.6E-02 | 7.8E-02 | 7.8E-01 | 1.9E+00 | 1.0E+00 | 2.0 | 2.4E-04 | 3 |
| Chloroform | 7.90E+02 | 6.8E-03 | 2.9E-02 | 5.0E-01 | 1.2E+00 | 1.0E+00 | 2.0 | 1.6E-05 | 3 |
| cis-1,2-Dichloroethene | 2.73E+02 | 7.7E-03 | 2.9E-02 | 3.7E-01 | 8.8E-01 | 1.0E+00 | 2.0 | 5.7E-06 | 3 |
| Naphthalene | 1.01E+01 | 4.7E-02 | 2.0E-01 | 5.6E-01 | 1.3E+00 | 1.0E+00 | 2.0 | 1.4E-06 | 3 |
| Tetrachloroethene | 3.49E+04 | 3.3E-02 | 1.7E-01 | 9.1E-01 | 2.2E+00 | 1.0E+00 | 2.0 | 4.3E-03 | 2 |
| trans-1,2-Dichloroethene | 1.20E+01 | 1.0E-02 | 3.9E-02 | 3.7E-01 | 8.8E-01 | 1.0E+00 | 2.0 | 3.4E-07 | 3 |
| Trichloroethene | 1.15E+03 | 1.2E-02 | 5.1E-02 | 5.8E-01 | 1.4E+00 | 1.0E+00 | 2.0 | 4.2E-05 | 3 |
| Vinyl chloride | 3.20E-01 | 5.6E-03 | 1.7E-02 | 2.4E-01 | 5.7E-01 | 1.0E+00 | 2.0 | 4.4E-09 | 3 |

**Inorganics: DAevent (mg/cm$^2$-event) =**

$DA_{event}$ = Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm$^3$ (Eq 1)

**Organics: DAevent (mg/cm$^2$-event) =**

$DA_{event}$ = $t_{event}$<t*: $DA_{event}$ (mg/cm$^2$-event) =
2 x FA x Kp x Cw x (sqrt((6 x τ x $t_{event}$) / (3.1415))) x CF1 x CF2 (Eq 2)

$t_{event}$>t*: $DA_{event}$ (mg/cm$^2$-event) =
FA x Kp x CW x ( $t_{event}$/(1+B) + 2 x τ x ((1 + 3B + 3B$^2$)/(1+B)$^2$)) xCF1 x CF2 (Eq 3)

Notes:
NA - Not applicable
Permeability constants from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final)*. EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

APPENDIX Q
TABLE 9.1 AND 9.2 SUPPLEMENT B
Calculation of Constituent Concentrations in Air from Standing Water - Construction Worker RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area - St. Louis, Missouri*

| Chemical | Concentration in Water (mg/L) | Concentration in Water (g/m³) $C_L$ | Dimensionless Henry's Law Constant (H') $K_{aw}$ | Diffusion coefficient in air (cm²/s) $D_a$ | Diffusion coefficient in water (cm²/s) $D_w$ | Schmidt Number $Sc_g$ | Effective diameter of source (m) $d_e$ | Liquid-phase mass transfer coef (m/s) $k_L$ | $k_G$ (m/s) | 1/K | K (m/s) | E (g/s) | Concentration in Air (mg/m³) $C_{air}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 1.60E-02 | 1.60E-02 | 1 41E-02 | 7 10E-02 | 7 90E-06 | 2.12E+00 | 1 13E+01 | 2 65E-06 | 2.23E-03 | 4 09E+05 | 2 44E-06 | 3.91E-06 | 5.43E-04 |
| 1,1,2,2-Tetrachloroethane | 5.80E-04 | 5 80E-04 | 1 41E-02 | 7 10E-02 | 7 90E-06 | 2.12E+00 | 1 13E+01 | 2 65E-06 | 2 23E-03 | 4 09E+05 | 2 44E-06 | 1 42E-07 | 1.97E-05 |
| 1,1,2-Trichloroethane | 2.30E-03 | 2 30E-03 | 3.74E-02 | 7 80E-02 | 8 80E-06 | 1.93E+00 | 1 13E+01 | 2.85E-06 | 2 37E-03 | 3 63E+05 | 2.76E-06 | 6.34E-07 | 8 81E-05 |
| 1,2-Dichloroethane (EDC) | 1 89E-01 | 1 89E-01 | 4.01E-02 | 1 04E-01 | 9 90E-06 | 1 45E+00 | 1 13E+01 | 3.08E-06 | 2.88E-03 | 3.34E+05 | 3 00E-06 | 5 67E-05 | 7 87E-03 |
| Benzene | 4 00E-03 | 4 00E-03 | 2 28E-01 | 8 80E-02 | 9.80E-06 | 1 71E+00 | 1 13E+01 | 3.06E-06 | 2.57E-03 | 3 29E+05 | 3.04E-06 | 1 22E-06 | 1.89E-04 |
| Carbon tetrachloride | 4 16E+00 | 4.16E+00 | 1 25E+00 | 7 80E-02 | 8 80E-06 | 1.93E+00 | 1 13E+01 | 2 85E-06 | 2.37E-03 | 3.52E+05 | 2.84E-06 | 1 18E-03 | 1.84E-01 |
| Chloroform | 7.90E-01 | 7 90E-01 | 1 50E-01 | 1 04E-01 | 1 00E-05 | 1 45E+00 | 1 13E+01 | 3.10E-06 | 2 88E-03 | 3 25E+05 | 3 08E-06 | 2 43E-04 | 3.38E-02 |
| cis-1,2-Dichloroethene | 2 73E-01 | 2 73E-01 | 1.67E-01 | 7.36E-02 | 1 13E-05 | 2.05E+00 | 1 13E+01 | 3.36E-06 | 2.28E-03 | 3.00E+05 | 3.33E-06 | 9 09E-05 | 1 26E-02 |
| Naphthalene | 1 01E-02 | 1 01E-02 | 1 98E-02 | 5 90E-02 | 7.50E-06 | 2.56E+00 | 1 13E+01 | 2.56E-06 | 1.97E-03 | 4.17E+05 | 2 40E-06 | 2.42E-06 | 3 37E-04 |
| Tetrachloroethene | 3.49E+01 | 3 49E+01 | 7 54E-01 | 7 20E-02 | 8.20E-06 | 2 09E+00 | 1.13E+01 | 2 71E-06 | 2.25E-03 | 3.69E+05 | 2.71E-06 | 9.46E-03 | 1.31E+00 |
| trans-1,2-Dichloroethene | 1 20E-02 | 1 20E-02 | 3.85E-01 | 7.07E-02 | 1 19E-05 | 2 13E+00 | 1 13E+01 | 3 48E-06 | 2.22E-03 | 2 89E+05 | 3.46E-06 | 4.16E-06 | 5 77E-04 |
| Trichloroethene | 1 15E+00 | 1.15E+00 | 4 22E-01 | 7.90E-02 | 9 10E-06 | 1.91E+00 | 1.13E+01 | 2.91E-06 | 2 39E-03 | 3.45E+05 | 2 90E-06 | 3.32E-04 | 4 61E-02 |
| Vinyl chloride | 3 20E-04 | 3.20E-04 | 1 11E+00 | 1 06E-01 | 1 23E-06 | 1 42E+00 | 1 13E+01 | 7 66E-07 | 2 92E-03 | 1 31E+06 | 7 66E-07 | 2 45E-08 | 3 40E-06 |

| | |
|---|---|
| Concentration in Air ($C_{air}$) = (mg/m³) | $1000 * E/H * V_{wind} * L$ |
| Emissions from Liquid surface (E) = (g/s) | $K * A * C_L$ |
| Overall Mass Transfer Coefficient (K) = (m/s) | $1/K = 1/k_L + 1/k_G * K_{aw}$ |
| Liquid-phase Mass Transfer Coefficient ($k_L$) = (m/s) | $2.78E-06 * (D_w/D_{ether})^{2/3}$ |
| Gas-phase Mass Transfer Coefficient ($k_G$) = (m/g) | $4.82E-03 * U^{0.78} * Sc_G^{-0.67} * d_e^{-0.11}$ |
| Effective Diameter of Source ($d_e$) = (m) | $(4 * A / \pi)^{0.5}$ |
| Schmidt Number Calculation ($Sc_G$) = | $u_G/\rho_G * D_a$ |

| Parameters | | Values |
|---|---|---|
| $C_L$ | Concentration in liquid phase (g/m³) | chemical specific |
| K | overall mass transfer coefficient (m/s) | calculated |
| $k_L$ | liquid-phase mass transfer coefficient (m/s) | calculated |
| $k_G$ | gas-phase mass transfer coefficient (m/s) | calculated |
| $K_{aw}$ | Equilibrium constant (Henry's Law constant) | chemical specific |
| $D_{ether}$ | Diffusion coefficient of ether in water (cm²/s) | 8 50E-06 |
| $D_w$ | Diffusion coefficient in water (cm²/s) | chemical specific |
| U | Windspeed (m/s) | 1 |
| A | Area of the source (m²) | 100 |
| $u_G$ | viscosity of air (g/cm-s) | 1 81E-04 |
| $\rho_G$ | density of air (g/cm³) | 1 20E-03 |
| $D_a$ | Diffusion coefficient in air (cm²/s) | chemical specific |
| H | Height of breathing zone (m) | 2 |
| Vwind | Average wind speed in breathing zone (m/s) | 2 25 |
| L | Length of breathing zone perpendicular to wind (m) | 1.6 |

**Source of the calculation used to determine concentrations in air from standing water:**
U.S. Environmental Protection Agency. 1994. Air Emissions and Models for Waste and Wastewater
*Office of Air Quality Planning and Standards. Research Triangle Park, NC. USEPA,*
EPA/453/R-94/080A.
Chemical and physical properties of volatile COPCs obtained from Region 9 Preliminary Remediation Goal Table

APPENDIX Q
TABLE 9.3
Potential Excess Lifetime Cancer Risk from Groundwater (Off-site) - Construction Worker RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(\mu g/m^3)^{-1}$ | Groundwater EPC (mg/L) | Ambient Air EPC $(mg/m^3)$ | DAevent $(mg/cm^2\text{-}event)$ | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| 1,2-Dichloroethane (EDC) | B2 | 9.1E-02 | 9.1E-02 | 2.6E-05 | 5.29E-02 | 2.20E-03 | 6.10E-07 | 1.00E+00 | 2.77E-09 | 2.52E-10 | 2.12E-07 | 5.52E-09 | 5.77E-09 |
| cis-1,2-Dichloroethene | D | NA | NA | NA | 2.70E-02 | 1.25E-03 | 5.59E-07 | 1.00E+00 | 2.54E-09 | NA | 1.20E-07 | NA | NA |
| Manganese | D | NA | NA | NA | 2.01E+00 | NA | 4.02E-06 | 4.00E-02 | 1.82E-08 | NA | NA | NA | NA |
| Tetrachloroethene | NA | 5.4E-01 | 5.4E-01 | 5.9E-06 | 3.35E+00 | 1.26E-01 | 4.17E-04 | 1.00E+00 | 1.89E-06 | 1.02E-06 | 1.22E-05 | 7.17E-08 | 1.09E-06 |
| Trichloroethene | NA | 1.3E-02 | 1.3E-02 | 2.0E-06 | 4.55E-02 | 1.83E-03 | 1.65E-06 | 1.00E+00 | 7.51E-09 | 9.76E-11 | 1.77E-07 | 3.53E-10 | 4.51E-10 |
| Chloroform | B1 | 3.1E-02 | 3.1E-02 | 2.3E-05 | 3.50E-04 | 1.50E-05 | 7.09E-09 | 1.00E+00 | 3.22E-11 | 9.98E-13 | 1.44E-09 | 3.31E-11 | 3.41E-11 |
| **Estimated Subtotal** | | | | | | | | | | 1.02E-06 | | 7.76E-08 | |
| | | | | | | | | | | | **Estimated Total Risk =** | | **1.10E-06** |

[a]Cancer WOE Classifications:
Group B (B1, B2): Probable human carcinogen

$ABS_{gi}$ = gastrointestinal absorption factor
COPC = Chemical of Potential Concern
CDI = chronic daily intake (mg/kg-day)
ELCR = excess lifetime cancer risk
EPC = exposure point concentration (mg/L)
$SF_o$ = oral slope factor
URF = Inhalation unit risk factor
WOE = weight of evidence
DAevent = Absorbed dose per event
DAC = daily average concentration
$\mu g/m^3$ = microgram per cubic meter
$mg/m^3$ = milligrams per cubic meter
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day

**APPENDIX Q**

**TABLE 9.4**

Potential Noncarcinogenic Risk from Groundwater (Off-site) - Construction Worker RME Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Groundwater EPC (mg/L) | Ambient Air EPC (mg/m$^3$) | DAevent (mg/cm$^2$-event) | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| 1,2-Dichloroethane (EDC) | 2.0E-02 | 2.0E-02 | 2.4E+00 | 5.29E-02 | 2.20E-03 | 6.10E-07 | 1.00E+00 | kidney, liver | kidney, liver | 2.36E-06 | 1.18E-04 | 1.81E-04 | 7.53E-05 | 1.93E-04 |
| cis-1,2-Dichloroethene | 1.0E-02 | 1.0E-02 | NA | 2.70E-02 | 1.25E-03 | 5.59E-07 | 1.00E+00 | blood | | 2.16E-06 | 2.16E-04 | 1.02E-04 | NA | 2.16E-04 |
| Manganese | 2.4E-02 | 9.6E-04 | 5.0E-05 | 2.01E+00 | NA | 4.02E-06 | 4.00E-02 | nervous system | nervous system | 1.55E-05 | 1.62E-02 | NA | NA | 1.62E-02 |
| Tetrachloroethene | 1.0E-02 | 1.0E-02 | 2.7E-01 | 3.35E+00 | 1.26E-01 | 4.17E-04 | 1.00E+00 | liver | nervous system | 1.61E-03 | 1.61E-01 | 1.04E-02 | 3.83E-02 | 2.00E-01 |
| Trichloroethene | NA | NA | 6.0E-01 | 4.55E-02 | 1.83E-03 | 1.65E-06 | 1.00E+00 | | nervous system, eyes | 6.40E-06 | NA | 1.50E-04 | 2.53E-04 | 2.53E-04 |
| Chloroform | 1.0E-02 | 1.0E-02 | 9.8E-02 | 3.50E-04 | 1.50E-05 | 7.09E-09 | 1.00E+00 | liver | liver | 2.74E-08 | 2.74E-06 | 1.23E-06 | 1.25E-05 | 1.53E-05 |
| **Subtotal Hazard Indices** | | | | | | | | | | | 1.78E-01 | | 3.87E-02 | |
| | | | | | | | | | | | | | **Total HI =** | **2.16E-01** |

$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
COPC = Chemical of Potential Concern
DAC = daily average concentration
EPC = exposure point concentration (mg/L)
HI = Hazard Index
HQ = hazard quotient
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose
RfC = reference concentration
DAevent = Absorbed dose per event

mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter

| | |
|---|---|
| Total Kidney: | 1.9E-04 |
| Total Liver: | 1.6E-01 |
| Total Blood: | 2.2E-04 |
| Total Nervous System: | 5.5E-02 |
| Total Eyes: | 2.5E-04 |

**APPENDIX Q**
**TABLE 9.3 AND 9.4 SUPPLEMENT A**
Calculation of DAevent - Construction Worker RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical of Potential Concern | Surface Water Concentration (CW) (mg/L) | Permeability Coefficient (Kp) (cm/hr) | B (dimensionless) | Lag Time ($t_{event}$) (hr) | t* (hr) | Fraction Absorbed Water (FA) (dimensionless) | Duration of Event (tevent) (hr) | DAevent (mg/cm$^2$-event) | Eq |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dichloroethane | 5.29E+01 | 4.2E-03 | 1.6E-02 | 3.8E-01 | 9.2E-01 | 1.0E+00 | 2.0 | 6.1E-07 | 3 |
| cis-1,2-Dichloroethene | 2.70E+01 | 7.7E-03 | 2.9E-02 | 3.7E-01 | 8.8E-01 | 1.0E+00 | 2.0 | 5.6E-07 | 3 |
| Manganese | 2.01E+03 | 1.0E-03 | NA | NA | NA | NA | 2.0 | 4.0E-06 | 1 |
| Tetrachlorethylene | 3.35E+03 | 3.3E-02 | 1.7E-01 | 9.1E-01 | 2.2E+00 | 1.0E+00 | 2.0 | 4.2E-04 | 2 |
| Trichloroethylene | 4.55E+01 | 1.2E-02 | 5.1E-02 | 5.8E-01 | 1.4E+00 | 1.0E+00 | 2.0 | 1.7E-06 | 3 |
| Chloroform | 3.50E-01 | 6.8E-03 | 2.9E-02 | 5.0E-01 | 1.2E+00 | 1.0E+00 | 2.0 | 7.1E-09 | 3 |

**Inorganics: DAevent (mg/cm2-event) =**

$DA_{event}$ = Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm$^3$ (Eq 1)

**Organics: DAevent (mg/cm2-event) =**

$DA_{event}$ = $t_{event}$<t*: $DA_{event}$ (mg/cm$^2$-event) =

2 x FA x Kp x Cw x (sqrt((6 x $\tau$ x $t_{event}$) / (3.1415))) x CF1 x CF2 (Eq 2)

$t_{event}$>t*: $DA_{event}$ (mg/cm$^2$-event) =

FA x Kp x CW x ( $t_{event}$/(1+B) + 2 x $\tau$ x ((1 + 3B + 3B$^2$)/(1+B)$^2$)) xCF1 x CF2 (Eq 3)

Notes:
NA - Not applicable
Permeability constants from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final)*. EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

**APPENDIX Q**
**TABLE 9.3 AND 9.4 SUPPLEMENT B**
Calculation of Constituent Concentrations in Air from Standing Water - Construction Worker RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical | Concentration in Water (mg/L) | Concentration in Water ($g/m^3$) $C_L$ | Dimensionless Henry's Law Constant (H') $K_{eq}$ | Diffusion coefficient in air ($cm^2/s$) $D_a$ | Diffusion coefficient in water ($cm^2/s$) $D_w$ | Schmidt Number $Sc_g$ | Effective diameter of source (m) $d_e$ | Liquid-phase mass transfer coef (m/s) $k_L$ | $k_G$ (m/s) | 1/K | K (m/s) | E (g/s) | Concentration in Air ($mg/m^3$) $C_{air}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dichloroethane | 5.29E-02 | 5.29E-02 | 4.01E-02 | 1.04E-01 | 9.90E-06 | 1.45E+00 | 1.13E+01 | 3.08E-06 | 2.88E-03 | 3.34E+05 | 3.00E-06 | 1.59E-05 | 2.20E-03 |
| cis-1,2-Dichloroethene | 2.70E-02 | 2.70E-02 | 1.67E-01 | 7.36E-02 | 1.13E-05 | 2.05E+00 | 1.13E+01 | 3.36E-06 | 2.28E-03 | 3.00E+05 | 3.33E-06 | 8.99E-06 | 1.25E-03 |
| Tetrachloroethene | 3.35E+00 | 3.35E+00 | 7.54E-01 | 7.20E-02 | 8.20E-06 | 2.09E+00 | 1.13E+01 | 2.71E-06 | 2.25E-03 | 3.69E+05 | 2.71E-06 | 9.09E-04 | 1.26E-01 |
| Trichloroethene | 4.55E-02 | 4.55E-02 | 4.22E-01 | 7.90E-02 | 9.10E-06 | 1.91E+00 | 1.13E+01 | 2.91E-06 | 2.39E-03 | 3.45E+05 | 2.90E-06 | 1.32E-05 | 1.83E-03 |
| Chloroform | 3.50E-04 | 3.50E-04 | 1.50E-01 | 1.04E-01 | 1.00E-05 | 1.45E+00 | 1.13E+01 | 3.10E-06 | 2.88E-03 | 3.25E+05 | 3.08E-06 | 1.08E-07 | 1.50E-05 |

| | |
|---|---|
| **Concentration in Air ($C_{air}$) = ($mg/m^3$)** | **$1000 * E/H * V_{wind} * L$** |
| **Emissions from Liquid surface (E) = (g/s)** | **$K * A * C_L$** |
| **Overall Mas Transfer Coefficient (K) = (m/s)** | **$1/K = 1/k_L + 1/k_G * K_{eq}$** |
| **Liquid-phase Mass Transfer Coefficient ($k_L$) = (m/s)** | **$2.78E-06 * (D_w/D_{ether})^{2/3}$** |
| **Gas-phase Mass Transfer Coefficient ($k_G$) = (m/g)** | **$4.82E-03 * U^{0.78} * Sc_G^{-0.67} * d_e^{-0.11}$** |
| **Effective Diameter of Source ($d_e$) = (m)** | **$(4 * A / \pi)^{0.5}$** |
| **Schmidt Number Calculation ($Sc_G$) =** | **$u_G/p_G * D_a$** |

| Parameters | | Values |
|---|---|---|
| $C_L$ | Concentration in liquid phase ($g/m^3$) | chemical specific |
| K | overall mass transfer coefficient (m/s) | calculated |
| $k_L$ | liquid-phase mass transfer coefficient (m/s) | calculated |
| $k_G$ | gas-phase mass transfer coefficient (m/s) | calculated |
| $K_{eq}$ | Equilibrium constant (Henry's Law constant) | chemical specific |
| $D_{ether}$ | Diffusion coefficient of ether in water ($cm^2/s$) | 8.50E-06 |
| $D_w$ | Diffusion coefficient in water ($cm^2/s$) | chemical specific |
| U | Windspeed (m/s) | 1 |
| A | Area of the source ($m^2$) | 100 |
| $u_G$ | viscosity of air (g/cm-s) | 1.81E-04 |
| $p_G$ | density of air ($g/cm^3$) | 1.20E-03 |
| $D_a$ | Diffusion coefficient in air ($cm^2/s$) | chemical specific |
| H | Height of breathing zone (m) | 2 |
| Vwind | Average wind speed in breathing zone (m/s) | 2.25 |
| L | Length of breathing zone perpendicular to wind (m) | 1.6 |

**Source of the calculation used to determine concentrations in air from standing water:**
U.S. Environmental Protection Agency. 1994. Air Emissions and Models for Waste and Wastewater. Office of Air Quality Planning and Standards. Research Triangle Park, NC. USEPA, EPA/453/R-94/080A.
Chemical and physical properties of volatile COPCs obtained from Region 9 Preliminary Remediation Goal Table

**APPENDIX Q**
**TABLE 9.5**
Potential Excess Lifetime Cancer Risk from Groundwater (On-site Excluding Downgradient of Building 220) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(mg/m^3)^{-1}$ | Groundwater EPC (mg/L) | Bathroom Air EPC $(mg/m^3)$ | DAevent_adj (mg-year/kg-event) | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | CDI (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| 1,2-Dichloroethane (EDC) | B2 | 9.1E-02 | 9.1E-02 | 2.6E-05 | 4.40E-03 | 3.64E-02 | 2.34E-04 | 1.00E+00 | 6.57E-05 | 5.98E-06 | 3.21E-06 | 2.92E-07 | 1.50E-02 | 3.89E-04 | 3.95E-04 |
| Carbon tetrachloride | B2 | 1.3E-01 | 1.3E-01 | 1.5E-05 | 3.80E-04 | 3.14E-03 | 1.11E-04 | 1.00E+00 | 5.67E-06 | 7.38E-07 | 1.52E-06 | 1.97E-07 | 1.29E-03 | 1.94E-05 | 2.03E-05 |
| **Estimated Subtotal** | | | | | | | | | | 6.72E-06 | | 4.89E-07 | | 4.08E-04 | |
| | | | | | | | | | | | | | | **Estimated Total Risk =** | **4.16E-04** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable
Group E: No evidence of carcinogenicity

$ABS_{gi}$ = gastrointestinal absorption factor
COPC = Chemical of Potential Concern
CDI = chronic daily intake (mg/kg-day)
ELCR = excess lifetime cancer risk
EPC = exposure point concentration (mg/L)
$SF_d$ = dermal slope factor
$SF_o$ = oral slope factor
URF = Inhalation unit risk factor
WOE = weight of evidence
DAevent = Absorbed dose per event
DAC = daily average concentration
$mg/m^3$ = microgram per cubic meter
$mg/m^3$ = milligrams per cubic meter
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day

**APPENDIX Q**
**TABLE 9.5 SUPPLEMENT A**
Calculation of DAevent
Residential Adult/Child Age Adjusted Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical | EPC (µµg/L) | DA Adult ($mg/cm^2$-event) | DA Child ($mg/cm^2$-event) | DA_Age Adjusted (mg/cm2-event) |
|---|---|---|---|---|
| 1,2-Dichloroethane (EDC) | 4.40E+00 | 2.40E-08 | 3.25E-08 | 2.34E-04 |
| Carbon tetrachloride | 3.80E-01 | 1.15E-08 | 1.51E-08 | 1.11E-04 |
| **Age-Adjusted DAevent (mg-year/event-kg) =** | | | | |
| DAevent-agr = (DAevent-$_a$ x $SA_a$ x $ED_a$) / $BW_a$ + (DAevent-$_c$ x $SA_c$ x $ED_c$) / $BW_c$ | | | | |
| **Where:** | SAa | 18,000 cm2 | SAc | 6,600 cm2 |
| | EDa | 24 years | EDc | 6 years |
| | BWa | 70 kg | BWc | 15 kg |

Note: The calculation of DAevent for a residential adult is presented in Table 9.12 Supplement A and the calculation of DAevent for a child is presented in Table 9.13 Supplement A.

**APPENDIX Q**

**TABLE 9.6**

Potential Noncarcinogenic Risk from Groundwater (On-site Excluding Downgradient of Building 220) - Adult Resident RME Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC (mg/m$^3$) | Groundwater EPC (mg/L) | Bathroom Air EPC (mg/m$^3$) | DAevent (mg/cm$^2$-event) | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | CDI (mg/kg-day) | HQ | DAC (mg/m$^3$) | HQ | Total HI |
| 1,2-Dichloroethane (EDC) | 2.0E-02 | 2.0E-02 | 2.4E+00 | 4.40E-03 | 3.64E-02 | 2.40E-08 | 1.00E+00 | kidney, liver | kidney, liver | 1.21E-04 | 6.03E-03 | 5.93E-06 | 2.96E-04 | 3.49E-02 | 1.45E-02 | **2.09E-02** |
| Carbon tetrachloride | 7.0E-04 | 7.0E-04 | 1.9E-01 | 3.80E-04 | 3.14E-03 | 1.15E-08 | 1.00E+00 | liver | liver | 1.04E-05 | 1.49E-02 | 2.84E-06 | 4.05E-03 | 3.01E-03 | 1.59E-02 | 3.48E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | | 2.09E-02 | | 4.35E-03 | | 3.04E-02 | |
| | | | | | | | | | | | | | | | **Total HI =** | 5.57E-02 |

$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
COPC = Chemical of Potential Concern
DAC = daily average concentration
EPC = exposure point concentration (mg/L)
HI = Hazard Index
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose
RfC = reference concentration
DAevent = Absorbed dose per event

mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
mg/m$^3$ = milligrams per cubic meter

Total Kidney: 2.1E-02
Total Liver: 5.6E-02

**APPENDIX Q**
**TABLE 9.6 SUPPLEMENT A**
Calculation of $DA_{event}$
Residential Adult Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical of Potential Concern | Groundwater Concentration (CW) (µg/L) | Permeability Coefficient (Kp) (cm/hr) | B (dimensionless) | Lag Time ($t_{event}$) (hr) | t* (hr) | Fraction Absorbed Water (FA) (dimensionless) | Duration of Event ($t_{event}$) (hr) | DAevent (mg/cm$^2$-event) | Eq |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dichloroethane | 4.40E+00 | 4.2E-03 | 1.6E-02 | 3.8E-01 | 9.2E-01 | 1.0E+00 | 0.58 | 2.4E-08 | 2 |
| Carbon tetrachloride | 3.80E-01 | 1.6E-02 | 7.8E-02 | 7.8E-01 | 1.9E+00 | 1.0E+00 | 0.58 | 1.1E-08 | 2 |

**Inorganics: DAevent (mg/cm2-event) =**

$DA_{event}$ = Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm$^3$ (Eq 1)

**Organics: DAevent (mg/cm2-event) =**

$DA_{event}$ = $t_{event}$<t*: $DA_{event}$ (mg/cm$^2$-event) =
2 x FA x Kp x Cw x (sqrt((6 x t x $t_{event}$) / (3.1415))) x CF1 x CF2 (Eq 2)

$t_{event}$>t*: $DA_{event}$ (mg/cm$^2$-event) =
FA x Kp x CW x ( $t_{event}$/(1+B) + 2 x t x ((1 + 3B + 3B$^2$)/(1+B)$^2$)) xCF1 x CF (Eq 3)

Notes:
NA - Not applicable
Permeability constants from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final)*. EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

**APPENDIX Q**

**TABLE 9.6 SUPPLEMENT B**

Bathroom Air Exposure Concentrations from Upper Alluvial Aquifer Groundwater, Andelman Model, as Modified by Schaum
Residential Adult Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical | Exposure Point Concentration Cwo (mg/l) | $C_{amax}$ (mg/m$^3$) | $C_a$ (mg/m$^3$) |
|---|---|---|---|
| 1,2-Dichloroethane (EDC) | 4.4E-03 | 4.6E-02 | 3.6E-02 |
| Carbon tetrachloride | 3.8E-04 | 4.0E-03 | 3.1E-03 |

| Variables | Units | Exposure Assumptions |
|---|---|---|
| Ca = concentration of chemical in air | mg/m$^3$ | Solved by Eq 1 |
| $C_{amax}$ = maximum concentration of chemical | mg/m$^3$ | Solved by Eq 2 |
| $t_1$ = time in shower | hr | 2.5E-01 |
| $t_2$ = time in bathroom after shower | hr | 3.3E-01 |
| f = fraction volatilized for chemical | unitless | **9.0E-01** |
| $F_w$ = shower water flow rate | L/hr | 7.5E+02 |
| $V_a$ = bathroom volume | m$^3$ | 1.6E+01 |

Equation 1: $C_a = ((C_{amax}/2) * t_1 + C_{amax} \cdot t_2) / (t_1 + t_2)$

Equation 2: $C_{amax} = (C_w * f * F_w * t_1) / V_a$

Source of equations and assumptions: Schaum, J., K. Hoang, R. Kinerson, J. Moya, and R.G.M. Wang. 1994. "Estimating Dermal and Inhalation Exposure to Volatile Chemicals in Domestic Water." In: *Water Contamination and Health* . R.G.M. Wang (ed.). Marcel Dekker, Inc. New York.

**APPENDIX Q**

**TABLE 9.7**

Potential Noncarcinogenic Risk from Groundwater (On-site Excluding Downgradient of Building 220) - Child Resident RME Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC ($mg/m^3$) | Groundwater EPC (mg/L) | Bathroom Air EPC ($mg/m^3$) | DAevent ($mg/cm^2$-event) | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | CDI (mg/kg-day) | HQ | DAC ($mg/m^3$) | HQ | Total HI |
| 1,2-Dichloroethane (EDC) | 2.00E-02 | 2.00E-02 | 2.40E+00 | 4.40E-03 | 6.47E-02 | 3.25E-08 | 1.00E+00 | kidney, liver | kidney, liver | 2.81E-04 | 1.41E-02 | 1.37E-05 | 6.86E-04 | 6.21E-02 | 2.59E-02 | 4.06E-02 |
| Carbon tetrachloride | 7.00E-04 | 7.00E-04 | 1.90E-01 | 3.80E-04 | 5.59E-03 | 1.51E-08 | 1.00E+00 | liver | liver | 2.43E-05 | 3.47E-02 | 6.37E-06 | 9.10E-03 | 5.36E-03 | 2.82E-02 | 7.20E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | | 4.88E-02 | | 9.79E-03 | | 5.41E-02 | |
| | | | | | | | | | | | | | | | **Total HI =** | 1.13E-01 |

$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
COPC = Chemical of Potential Concern
DAC = daily average concentration
EPC = exposure point concentration (mg/L)
HI = Hazard Index
HQ = hazard quotient
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose
RfC = reference concentration
DAevent = Absorbed dose per event

mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter

Total Kidney: 4.1E-02
Total Liver: 1.1E-01

**APPENDIX Q**
**TABLE 9.7 SUPPLEMENT A**
Calculation of $DA_{event}$
Residential Child Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical of Potential Concern | Groundwater Concentration (CW) (µg/L) | Permeability Coefficient (Kp) (cm/hr) | B (dimensionless) | Lag Time ($t_{event}$) (hr) | t* (hr) | Fraction Absorbed Water (FA) (dimensionless) | Duration of Event (tevent) (hr) | DAevent (mg/cm$^2$-event) | Eq |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dichloroethane | 4.40E+00 | 4.2E-03 | 1.6E-02 | 3.8E-01 | 9.2E-01 | 1.0E+00 | 1.00 | 3.3E-08 | 3 |
| Carbon tetrachloride | 3.80E-01 | 1.6E-02 | 7.8E-02 | 7.8E-01 | 1.9E+00 | 1.0E+00 | 1.00 | 1.5E-08 | 2 |

**Inorganics: DAevent (mg/cm2-event) =**

$DA_{event}$ = Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm$^3$ (Eq 1)

**Organics: DAevent (mg/cm2-event) =**

$DA_{event}$ = $t_{event}$<t*: $DA_{event}$ (mg/cm$^2$-event) =
2 x FA x Kp x Cw x (sqrt((6 x t x $t_{event}$) / (3.1415))) x CF1 x CF2 (Eq 2)

$t_{event}$>t*: $DA_{event}$ (mg/cm$^2$-event) =
FA x Kp x CW x ( $t_{event}$/(1+B) + 2 x t x ((1 + 3B + 3B$^2$)/(1+B)$^2$)) xCF1 x CF2 (Eq 3)

Notes:
NA - Not applicable
Permeability constants from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final)*. EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

**APPENDIX Q**

**TABLE 9.7 SUPPLEMENT B**

Bathroom Air Exposure Concentrations from Upper Alluvial Aquifer Groundwater, Andelman Model, as Modified by Schaum
Residential Child Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical | Exposure Point Concentration Cwo (mg/l) | $C_{amax}$ (mg/m$^3$) | $C_a$ (mg/m$^3$) |
|---|---|---|---|
| 1,2-Dichloroethane (EDC) | 4.4E-03 | 8.4E-02 | 6.5E-02 |
| Carbon tetrachloride | 3.8E-04 | 7.2E-03 | 5.6E-03 |

| Variables | Units | Exposure Assumptions |
|---|---|---|
| Ca = concentration of chemical in air | mg/m$^3$ | Solved by Eq 1 |
| $C_{amax}$ = maximum concentration of chemical | mg/m$^3$ | Solved by Eq 2 |
| $t_1$ = time in bath | hr | 4.5E-01 |
| $t_2$ = time in bathroom after bath | hr | 5.5E-01 |
| f = fraction volatilized for chemical | unitless | **9.0E-01** |
| $F_w$ = tap water flow rate | L/hr | 7.5E+02 |
| $V_a$ = bathroom volume | m$^3$ | 1.6E+01 |

| | | |
|---|---|---|
| Equation 1: | $C_a$ = | $((C_{amax}/2) * t_1 + C_{amax} \cdot t_2) / (t_1 + t_2)$ |
| Equation 2: | $C_{amax}$ = | $(C_w * f * F_w * t_1) / V_a$ |

Equations and assumptions from Water Consumption and Health: Integration of Exposure Assessment, Toxicology, and Risk Assessment, edited by Rhoda G.M. Wang. Macel Dekker, Inc., New York. 1994.
Exposure to Volatiles in Domestic Water, Schaum et al., Pages

APPENDIX Q
TABLE 9.8
Potential Excess Lifetime Cancer Risk from Groundwater (Downgradient of Building 220) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ $(mg/kg\text{-}day)^{-1}$ | $SF_d$ $(mg/kg\text{-}day)^{-1}$ | URF $(mg/m^3)^{-1}$ | Groundwater EPC (mg/L) | Bathroom Air EPC $(mg/m^3)$ | DAevent_adj (mg-year/kg-event) | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | CDI (mg/kg-day) | ELCR | DAC $(mg/m^3)$ | ELCR | Total ELCR |
| 1,1,1,2-Tetrachloroethane | C | 2.6E-02 | 2.6E-02 | 7.4E-06 | 1.60E-02 | 1.32E-01 | 5.62E-03 | 1.00E+00 | 2.39E-04 | 6.21E-06 | 7.70E-05 | 2.00E-06 | 5.44E-02 | 4.03E-04 | 4.11E-04 |
| 1,1,2,2-Tetrachloroethane | C | 2.0E-01 | 2.0E-01 | 5.8E-05 | 5.80E-04 | 4.80E-03 | 9.01E-05 | 1.00E+00 | 8.66E-06 | 1.73E-06 | 1.23E-06 | 2.47E-07 | 1.97E-03 | 1.14E-04 | 1.16E-04 |
| 1,1,2-Trichloroethane | C | 5.7E-02 | 5.7E-02 | 1.6E-05 | 2.30E-03 | 1.90E-02 | 2.32E-04 | 1.00E+00 | 3.43E-05 | 1.96E-06 | 3.18E-06 | 1.81E-07 | 7.82E-03 | 1.25E-04 | 1.27E-04 |
| 1,2-Dichloroethane (EDC) | B2 | 9.1E-02 | 9.1E-02 | 2.6E-05 | 4.63E-02 | 3.83E-01 | 2.46E-03 | 1.00E+00 | 6.91E-04 | 6.29E-05 | 3.38E-05 | 3.07E-06 | 1.57E-01 | 4.09E-03 | 4.16E-03 |
| Benzene | A | 5.5E-02 | 5.5E-02 | 7.8E-06 | 4.00E-03 | 3.31E-02 | 6.63E-04 | 1.00E+00 | 5.97E-05 | 3.28E-06 | 9.08E-06 | 5.00E-07 | 1.36E-02 | 1.06E-04 | 1.10E-04 |
| Carbon tetrachloride | B2 | 1.3E-01 | 1.3E-01 | 1.5E-05 | 2.92E+00 | 2.42E+01 | 8.51E-01 | 1.00E+00 | 4.36E-02 | 5.67E-03 | 1.17E-02 | 1.52E-03 | 9.93E+00 | 1.38E-01 | 1.46E-01 |
| Chloroform | B1 | 3.1E-02 | 3.1E-02 | 2.3E-05 | 1.13E-01 | 9.34E-01 | 1.10E-02 | 1.00E+00 | 1.69E-03 | 5.23E-05 | 1.51E-04 | 4.69E-06 | 3.84E-01 | 8.83E-03 | 8.89E-03 |
| cis-1,2-Dichloroethene | D | NA | NA | NA | 6.47E-02 | 5.35E-01 | 6.17E-03 | 1.00E+00 | 9.66E-04 | NA | 8.45E-05 | NA | 2.20E-01 | NA | NA |
| Manganese | D | NA | NA | NA | 2.83E-01 | NA | 1.76E-03 | 4.00E-02 | 4.23E-03 | NA | 2.41E-05 | NA | NA | NA | NA |
| Naphthalene | C | NA | NA | 3.4E-05 | 1.01E-02 | 8.36E-02 | 7.13E-03 | 1.00E+00 | 1.51E-04 | NA | 9.77E-05 | NA | 3.43E-02 | 1.17E-03 | 1.17E-03 |
| Tetrachloroethene | NA | 5.4E-01 | 5.4E-01 | 5.9E-06 | 2.57E+01 | 2.13E+02 | 1.66E+01 | 1.00E+00 | 3.84E-01 | 1.87E-01 | 2.28E-01 | 1.16E-01 | 8.75E+01 | 4.03E-01 | 7.06E-01 |
| trans-1,2-Dichloroethene | NA | NA | NA | NA | 1.20E-02 | 9.93E-02 | 1.55E-03 | 1.00E+00 | 1.79E-04 | NA | 2.12E-05 | NA | 4.08E-02 | NA | NA |
| Trichloroethene | NA | 1.3E-02 | 1.3E-02 | 2.0E-06 | 3.99E-01 | 3.30E+00 | 7.19E-02 | 1.00E+00 | 5.96E-03 | 7.75E-05 | 9.84E-04 | 1.28E-05 | 1.36E+00 | 2.72E-03 | 2.81E-03 |
| Vinyl chloride | A | 7.2E-01 | 7.2E-01 | 4.4E-06 | 3.20E-04 | 2.65E-03 | 1.86E-05 | 1.00E+00 | 4.78E-06 | 3.44E-06 | 2.55E-07 | 1.84E-07 | 1.09E-03 | 4.79E-06 | 8.41E-06 |
| **Estimated Subtotal** | | | | | | | | | | **1.93E-01** | | **1.17E-01** | | **5.59E-01** | |
| | | | | | | | | | | | | | **Estimated Total Risk =** | | **8.70E-01** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable
Group E: No evidence of carcinogenicity

$ABS_{gi}$ = gastrointestinal absorption factor
COPC = Chemical of Potential Concern
CDI = chronic daily intake (mg/kg-day)
ELCR = excess lifetime cancer risk
EPC = exposure point concentration (mg/L)
$SF_o$ = oral slope factor
URF = Inhalation unit risk factor
WOE = weight of evidence
DAevent = Absorbed dose per event
DAC = daily average concentration
$\mu g/m^3$ = microgram per cubic meter
$mg/m^3$ = milligrams per cubic meter
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day

**APPENDIX Q**
**TABLE 9.8 SUPPLEMENT A**
Calculation of DAevent
Residential Adult/Child Age Adjusted Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical | EPC (mg/L) | DA Adult (mg/cm2-event) | DA Child (mg/cm2-event) | DA_agr (mg/cm2-event) |
|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 1.60E+01 | 6.28E-07 | 6.61E-07 | 5.62E-03 |
| 1,1,2,2-Tetrachloroethane | 5.80E-01 | 1.00E-08 | 1.07E-08 | 9.01E-05 |
| 1,1,2-Trichloroethane | 2.30E+00 | 2.41E-08 | 3.16E-08 | 2.32E-04 |
| 1,2-Dichloroethane (EDC) | 4.63E+01 | 2.53E-07 | 3.42E-07 | 2.46E-03 |
| Benzene | 4.00E+00 | 6.76E-08 | 9.31E-08 | 6.63E-04 |
| Carbon tetrachloride | 2.92E+03 | 8.83E-05 | 1.16E-04 | 8.51E-01 |
| Chloroform | 1.13E+02 | 1.14E-06 | 1.50E-06 | 1.10E-02 |
| cis-1,2-Dichloroethene | 6.47E+01 | 6.33E-07 | 8.57E-07 | 6.17E-03 |
| Manganese | 2.83E+02 | 1.64E-07 | 2.83E-07 | 1.76E-03 |
| Naphthalene | 1.01E+01 | 7.40E-07 | 9.72E-07 | 7.13E-03 |
| Tetrachloroethene | 2.57E+04 | 1.72E-03 | 2.26E-03 | 1.66E+01 |
| trans-1,2-Dichloroethene | 1.20E+01 | 1.59E-07 | 2.15E-07 | 1.55E-03 |
| Trichloroethene | 3.99E+02 | 7.46E-06 | 9.79E-06 | 7.19E-02 |
| Vinyl chloride | 3.20E-01 | 1.89E-09 | 2.63E-09 | 1.86E-05 |

| **Age-Adjusted DAevent (mg-year/event-kg) =** | | | | |
|---|---|---|---|---|
| DAevent-agr = $(DAevent\text{-}_a \times SA_a \times ED_a) / BW_a + (DAevent\text{-}_c \times SA_c \times ED_c) / BW_c$ | | | | |
| **Where:** | SAa | 18,000 cm2 | SAc | 6,600 cm2 |
| | EDa | 24 years | EDc | 6 years |
| | BWa | 70 kg | BWc | 15 kg |

**APPENDIX Q**

**TABLE 9.9**

Potential Noncarcinogenic Risk from Groundwater (Downgradient of Building 220) - Adult Resident RME Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC ($mg/m^3$) | Groundwater EPC (mg/L) | Bathroom Air EPC ($mg/m^3$) | DAevent ($mg/cm^2$-event) | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | CDI (mg/kg-day) | HQ | DAC ($mg/m^3$) | HQ | Total HI |
| 1,1,1,2-Tetrachloroethane | 3.0E-02 | 3.0E-02 | NA | 1.60E-02 | 1.32E-01 | 6.28E-07 | 1.00E+00 | kidney, liver | | 4.38E-04 | 1.46E-02 | 1.55E-04 | 5.16E-03 | 1.27E-01 | NA | 1.98E-02 |
| 1,1,2,2-Tetrachloroethane | 4.0E-03 | 4.0E-03 | NA | 5.80E-04 | 4.80E-03 | 1.00E-08 | 1.00E+00 | liver | | 1.59E-05 | 3.97E-03 | 2.47E-06 | 6.17E-04 | 4.60E-03 | NA | 4.59E-03 |
| 1,1,2-Trichloroethane | 4.0E-03 | 4.0E-03 | NA | 2.30E-03 | 1.90E-02 | 2.41E-08 | 1.00E+00 | blood | | 6.30E-05 | 1.58E-02 | 5.93E-06 | 1.48E-03 | 1.82E-02 | NA | 1.72E-02 |
| 1,2-Dichloroethane (EDC) | 2.0E-02 | 2.0E-02 | 2.4E+00 | 4.63E-02 | 3.83E-01 | 2.53E-07 | 1.00E+00 | kidney, liver | kidney, liver | 1.27E-03 | 6.34E-02 | 6.24E-05 | 3.12E-03 | 3.67E-01 | 1.53E-01 | 2.20E-01 |
| Benzene | 4.0E-03 | 4.0E-03 | 3.0E-02 | 4.00E-03 | 3.31E-02 | 6.76E-08 | 1.00E+00 | blood | blood | 1.10E-04 | 2.74E-02 | 1.67E-05 | 4.17E-03 | 3.17E-02 | 1.06E+00 | 1.09E+00 |
| Carbon tetrachloride | 7.0E-04 | 7.0E-04 | 1.9E-01 | 2.92E+00 | 2.42E+01 | 8.83E-05 | 1.00E+00 | liver | liver | 8.00E-02 | 1.14E+02 | 2.18E-02 | 3.11E+01 | 2.32E+01 | 1.22E+02 | 2.67E+02 |
| Chloroform | 1.0E-02 | 1.0E-02 | 9.8E-02 | 1.13E-01 | 9.34E-01 | 1.14E-06 | 1.00E+00 | liver | liver | 3.09E-03 | 3.09E-01 | 2.82E-04 | 2.82E-02 | 8.96E-01 | 9.14E+00 | 9.48E+00 |
| cis-1,2-Dichloroethene | 1.0E-02 | 1.0E-02 | NA | 6.47E-02 | 5.35E-01 | 6.33E-07 | 1.00E+00 | blood | | 1.77E-03 | 1.77E-01 | 1.56E-04 | 1.56E-02 | 5.13E-01 | NA | 1.93E-01 |
| Manganese | 2.4E-02 | 9.6E-04 | 5.0E-05 | 2.83E-01 | NA | 1.64E-07 | 4.00E-02 | nervous system | nervous system | 7.75E-03 | 3.23E-01 | 4.05E-05 | 4.22E-02 | NA | NA | 3.65E-01 |
| Naphthalene | 2.0E-02 | 2.0E-02 | 3.0E-03 | 1.01E-02 | 8.36E-02 | 7.40E-07 | 1.00E+00 | whole body | respiratory | 2.77E-04 | 1.38E-02 | 1.83E-04 | 9.13E-03 | 8.01E-02 | 2.67E+01 | 2.67E+01 |
| Tetrachloroethene | 1.0E-02 | 1.0E-02 | 2.7E-01 | 2.57E+01 | 2.13E+02 | 1.72E-03 | 1.00E+00 | liver | nervous system | 7.05E-01 | 7.05E+01 | 4.25E-01 | 4.25E+01 | 2.04E+02 | 7.56E+02 | 8.69E+02 |
| trans-1,2-Dichloroethene | 2.0E-02 | 2.0E-02 | 6.0E-02 | 1.20E-02 | 9.93E-02 | 1.59E-07 | 1.00E+00 | kidney | kidney | 3.29E-04 | 1.64E-02 | 3.92E-05 | 1.96E-03 | 9.52E-02 | 1.59E+00 | 1.61E+00 |
| Trichloroethene | NA | NA | 6.0E-01 | 3.99E-01 | 3.30E+00 | 7.46E-06 | 1.00E+00 | | nervous system, eyes | 1.09E-02 | NA | 1.84E-03 | NA | 3.17E+00 | 5.32E+00 | 5.32E+00 |
| Vinyl chloride | 3.0E-03 | 3.0E-03 | 1.0E-01 | 3.20E-04 | 2.65E-03 | 1.89E-09 | 1.00E+00 | liver | liver | 8.77E-06 | 2.92E-03 | 4.66E-07 | 1.55E-04 | 2.54E-03 | 2.54E-02 | 2.85E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | | 1.86E+02 | | 7.37E+01 | | 9.22E+02 | |
| | | | | | | | | | | | | | | | **Total HI =** | 1.18E+03 |

$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
COPC = Chemical of Potential Concern
DAC = daily average concentration
EPC = exposure point concentration (mg/L)
HI = Hazard Index
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose
RfC = reference concentration
DAevent = Absorbed dose per event

mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter

| | |
|---|---|
| Total Kidney: | 1.8E+00 |
| Total Liver: | 3.9E+02 |
| Total Blood: | 1.3E+00 |
| Total Nervous System: | 7.6E+02 |
| Total Whole Body: | 2.3E-02 |
| Total Respiratory: | 2.7E+01 |
| Total Eyes: | 5.3E+00 |

**APPENDIX Q**
**TABLE 9.9 SUPPLEMENT A**
Calculation of DAevent
Residential Adult Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical of Potential Concern | Groundwater Concentration (CW) (µg/L) | Permeability Coefficient (Kp) (cm/hr) | B (dimensionless) | Lag Time ($t_{event}$) (hr) | t* (hr) | Fraction Absorbed Water (FA) (dimensionless) | Duration of Event (tevent) (hr) | DAevent (mg/cm$^2$-event) | Eq |
|---|---|---|---|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 1.60E+01 | 1.6E-02 | 7.8E-02 | 9.2E-01 | 2.2E+00 | 1.0E+00 | 0.58 | 6.3E-07 | 2 |
| 1,1,2,2-Tetrachloroethane | 5.80E-01 | 6.9E-03 | 3.5E-02 | 9.3E-01 | 2.2E+00 | 1.0E+00 | 0.58 | 1.0E-08 | 2 |
| 1,1,2-Trichloroethane | 2.30E+00 | 6.4E-03 | 2.9E-02 | 6.0E-01 | 1.4E+00 | 1.0E+00 | 0.58 | 2.4E-08 | 2 |
| 1,2-Dichloroethane | 4.63E+01 | 4.2E-03 | 1.6E-02 | 3.8E-01 | 9.2E-01 | 1.0E+00 | 0.58 | 2.5E-07 | 2 |
| Benzene | 4.00E+00 | 1.5E-02 | 5.1E-02 | 2.9E-01 | 7.0E-01 | 1.0E+00 | 0.58 | 6.8E-08 | 2 |
| Carbon tetrachloride | 2.92E+03 | 1.6E-02 | 7.8E-02 | 7.8E-01 | 1.9E+00 | 1.0E+00 | 0.58 | 8.8E-05 | 2 |
| Chloroform | 1.13E+02 | 6.8E-03 | 2.9E-02 | 5.0E-01 | 1.2E+00 | 1.0E+00 | 0.58 | 1.1E-06 | 2 |
| cis-1,2-Dichloroethene | 6.47E+01 | 7.7E-03 | 2.9E-02 | 3.7E-01 | 8.8E-01 | 1.0E+00 | 0.58 | 6.3E-07 | 2 |
| Manganese | 2.83E+02 | 1.0E-03 | NA | NA | NA | NA | 0 58 | 1.6E-07 | 1 |
| Naphthalene | 1.01E+01 | 4.7E-02 | 2.0E-01 | 5.6E-01 | 1.3E+00 | 1.0E+00 | 0.58 | 7.4E-07 | 2 |
| Tetrachlorethylene | 2.57E+04 | 3.3E-02 | 1.7E-01 | 9.1E-01 | 2.2E+00 | 1.0E+00 | 0.58 | 1.7E-03 | 2 |
| trans-1,2-Dichloroethene | 1.20E+01 | 1.0E-02 | 3.9E-02 | 3.7E-01 | 8.8E-01 | 1.0E+00 | 0.58 | 1.6E-07 | 2 |
| Trichloroethylene | 3.99E+02 | 1.2E-02 | 5.1E-02 | 5.8E-01 | 1.4E+00 | 1.0E+00 | 0.58 | 7.5E-06 | 2 |
| Vinyl chloride | 3.20E-01 | 5.6E-03 | 1.7E-02 | 2.4E-01 | 5.7E-01 | 1 0E+00 | 0.58 | 1.9E-09 | 3 |

**Inorganics: DAevent (mg/cm2-event) =**

$DA_{event}$ = Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm$^3$ (Eq 1)

**Organics: DAevent (mg/cm2-event) =**

$DA_{event}$ = $t_{event}$<t*: $DA_{event}$ (mg/cm$^2$-event) =

2 x FA x Kp x Cw x (sqrt((6 x t x $t_{event}$) / (3.1415))) x CF1 x CF2 (Eq 2)

$t_{event}$>t*: $DA_{event}$ (mg/cm$^2$-event) =

FA x Kp x CW x ( $t_{event}$/(1+B) + 2 x t x ((1 + 3B + 3B$^2$)/(1+B)$^2$)) xCF1 x CF2 (Eq 3)

Notes:
NA - Not applicable
Permeability constants from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005 The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

**APPENDIX Q**

**TABLE 9.9 SUPPLEMENT B**

Bathroom Air Exposure Concentrations from Upper Alluvial Aquifer Groundwater, Andelman Model, as Modified by Schaum
Residential Adult Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical | Exposure Point Concentration Cwo (mg/l) | $C_{amax}$ (mg/m$^3$) | $C_a$ (mg/m$^3$) |
|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 1.6E-02 | 1.7E-01 | 1.3E-01 |
| 1,1,2,2-Tetrachloroethane | 5.8E-04 | 6.1E-03 | 4.8E-03 |
| 1,1,2-Trichloroethane | 2.3E-03 | 2.4E-02 | 1.9E-02 |
| 1,2-Dichloroethane (EDC) | 4.6E-02 | 4.9E-01 | 3.8E-01 |
| Benzene | 4.0E-03 | 4.2E-02 | 3.3E-02 |
| Carbon tetrachloride | 2.9E+00 | 3.1E+01 | 2.4E+01 |
| Chloroform | 1.1E-01 | 1.2E+00 | 9.3E-01 |
| cis-1,2-Dichloroethene | 6.5E-02 | 6.8E-01 | 5.4E-01 |
| Manganese | 2.8E-01 | 3.0E+00 | 2.3E+00 |
| Naphthalene | 1.0E-02 | 1.1E-01 | 8.4E-02 |
| Tetrachloroethene | 2.6E+01 | 2.7E+02 | 2.1E+02 |
| trans-1,2-Dichloroethene | 1.2E-02 | 1.3E-01 | 9.9E-02 |
| Trichloroethene | 4.0E-01 | 4.2E+00 | 3.3E+00 |
| Vinyl chloride | 3.2E-04 | 3.4E-03 | 2.6E-03 |

| Variables | Units | Exposure Assumptions |
|---|---|---|
| Ca = concentration of chemical in air | mg/m$^3$ | Solved by Eq 1 |
| $C_{amax}$ = maximum concentration of chemical | mg/m$^3$ | Solved by Eq 2 |
| $t_1$ = time in shower | hr | 2.5E-01 |
| $t_2$ = time in bathroom after shower | hr | 3.3E-01 |
| f = fraction volatilized for chemical | unitless | **9.0E-01** |
| $F_w$ = shower water flow rate | L/hr | 7.5E+02 |
| $V_a$ = bathroom volume | m$^3$ | 1.6E+01 |

Equation 1: $C_a = ((C_{amax}/2) * t_1 + C_{amax} \cdot t_2) / (t_1 + t_2)$

Equation 2: $C_{amax} = (C_w * f * F_w * t_1) / V_a$

Source of equations and assumptions: Schaum, J., K. Hoang, R. Kinerson, J. Moya, and R.G.M. Wang. 1994. "Estimating Dermal and Inhalation Exposure to Volatile Chemicals in Domestic Water." In: *Water Contamination and Health* . R.G.M. Wang (ed.). Marcel Dekker, Inc. New York.

**APPENDIX Q**

**TABLE 9.10**

Potential Noncarcinogenic Risk from Groundwater (Downgradient of Building 220) - Child Resident RME Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC ($mg/m^3$) | Groundwater EPC (mg/L) | Bathroom Air EPC ($mg/m^3$) | DAevent ($mg/cm^2$-event) | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | CDI (mg/kg-day) | HQ | DAC ($mg/m^3$) | HQ | Total HI |
| 1,1,1,2-Tetrachloroethane | 3.00E-02 | 3.00E-02 | NA | 1.60E-02 | 2.35E-01 | 6.61E-07 | 1.00E+00 | kidney, liver | | 1.02E-03 | 3.41E-02 | 2.79E-04 | 9.30E-03 | 2.26E-01 | NA | 4.34E-02 |
| 1,1,2,2-Tetrachloroethane | 4.00E-03 | 4.00E-03 | NA | 5.80E-04 | 8.53E-03 | 1.07E-08 | 1.00E+00 | liver | | 3.71E-05 | 9.27E-03 | 4.53E-06 | 1.13E-03 | 8.18E-03 | NA | 1.04E-02 |
| 1,1,2-Trichloroethane | 4.00E-03 | 4.00E-03 | NA | 2.30E-03 | 3.38E-02 | 3.16E-08 | 1.00E+00 | blood | | 1.47E-04 | 3.68E-02 | 1.33E-05 | 3.33E-03 | 3.24E-02 | NA | 4.01E-02 |
| 1,2-Dichloroethane (EDC) | 2.00E-02 | 2.00E-02 | 2.40E+00 | 4.63E-02 | 6.81E-01 | 3.42E-07 | 1.00E+00 | kidney, liver | kidney, liver | 2.96E-03 | 1.48E-01 | 1.44E-04 | 7.22E-03 | 6.53E-01 | 2.72E-01 | 4.27E-01 |
| Benzene | 4.00E-03 | 4.00E-03 | 3.00E-02 | 4.00E-03 | 5.89E-02 | 9.31E-08 | 1.00E+00 | blood | blood | 2.56E-04 | 6.39E-02 | 3.93E-05 | 9.82E-03 | 5.64E-02 | 1.88E+00 | 1.95E+00 |
| Carbon tetrachloride | 7.00E-04 | 7.00E-04 | 1.90E-01 | 2.92E+00 | 4.29E+01 | 1.16E-04 | 1.00E+00 | liver | liver | 1.87E-01 | 2.67E+02 | 4.89E-02 | 6.99E+01 | 4.12E+01 | 2.17E+02 | 5.53E+02 |
| Chloroform | 1.00E-02 | 1.00E-02 | 9.80E-02 | 1.13E-01 | 1.66E+00 | 1.50E-06 | 1.00E+00 | liver | liver | 7.22E-03 | 7.22E-01 | 6.34E-04 | 6.34E-02 | 1.59E+00 | 1.63E+01 | 1.70E+01 |
| cis-1,2-Dichloroethene | 1.00E-02 | 1.00E-02 | NA | 6.47E-02 | 9.52E-01 | 8.57E-07 | 1.00E+00 | blood | | 4.14E-03 | 4.14E-01 | 3.62E-04 | 3.62E-02 | 9.13E-01 | NA | 4.50E-01 |
| Manganese | 2.40E-02 | 9.60E-04 | 5.00E-05 | 2.83E-01 | NA | 2.83E-07 | 4.00E-02 | nervous system | nervous system | 1.81E-02 | 7.54E-01 | 1.19E-04 | 1.24E-01 | NA | NA | 8.78E-01 |
| Naphthalene | 2.00E-02 | 2.00E-02 | 3.00E-03 | 1.01E-02 | 1.49E-01 | 9.72E-07 | 1.00E+00 | whole body | respiratory | 6.46E-04 | 3.23E-02 | 4.10E-04 | 2.05E-02 | 1.42E-01 | 4.75E+01 | 4.76E+01 |
| Tetrachloroethene | 1.00E-02 | 1.00E-02 | 2.70E-01 | 2.57E+01 | 3.79E+02 | 2.26E-03 | 1.00E+00 | liver | nervous system | 1.65E+00 | 1.65E+02 | 9.55E-01 | 9.55E+01 | 3.63E+02 | 1.34E+03 | 1.60E+03 |
| trans-1,2-Dichloroethene | 2.00E-02 | 2.00E-02 | 6.00E-02 | 1.20E-02 | 1.77E-01 | 2.15E-07 | 1.00E+00 | kidney | kidney | 7.67E-04 | 3.84E-02 | 9.08E-05 | 4.54E-03 | 1.69E-01 | 2.82E+00 | 2.86E+00 |
| Trichloroethene | NA | NA | 5.95E-01 | 3.99E-01 | 5.87E+00 | 9.79E-06 | 1.00E+00 | | nervous system, eyes | 2.55E-02 | NA | 4.13E-03 | NA | 5.63E+00 | 9.47E+00 | 9.47E+00 |
| Vinyl chloride | 3.00E-03 | 3.00E-03 | 1.00E-01 | 3.20E-04 | 4.71E-03 | 2.63E-09 | 1.00E+00 | liver | liver | 2.05E-05 | 6.82E-03 | 1.11E-06 | 3.70E-04 | 4.51E-03 | 4.51E-02 | 5.23E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | | 4.33E+02 | | 1.66E+02 | | 1.64E+03 | |
| | | | | | | | | | | | | | | | **Total HI =** | 2.24E+03 |

$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
COPC = Chemical of Potential Concern
DAC = daily average concentration
EPC = exposure point concentration (mg/L)
HI = Hazard Index
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose
RfC = reference concentration
DAevent = Absorbed dose per event

mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter

| | |
|---|---|
| Total Kidney: | 3.3E+00 |
| Total Liver: | 8.3E+02 |
| Total Blood: | 2.4E+00 |
| Total Nervous System: | 1.4E+03 |
| Total Whole Body: | 5.3E-02 |
| Total Respiratory: | 4.7E+01 |
| Total Eyes: | 9.5E+00 |

**APPENDIX Q**

**TABLE 9.10 SUPPLEMENT B**

Bathroom Air Exposure Concentrations from Upper Alluvial Aquifer Groundwater, Andelman Model, as Modified by Schaum
Residential Child Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical | Exposure Point Concentration Cwo (mg/l) | $C_{amax}$ (mg/m$^3$) | $C_a$ (mg/m$^3$) |
|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 1.6E-02 | 3.0E-01 | 2.4E-01 |
| 1,1,2,2-Tetrachloroethane | 5.8E-04 | 1.1E-02 | 8.5E-03 |
| 1,1,2-Trichloroethane | 2.3E-03 | 4.4E-02 | 3.4E-02 |
| 1,2-Dichloroethane (EDC) | 4.6E-02 | 8.8E-01 | 6.8E-01 |
| Benzene | 4.0E-03 | 7.6E-02 | 5.9E-02 |
| Carbon tetrachloride | 2.9E+00 | 5.5E+01 | 4.3E+01 |
| Chloroform | 1.1E-01 | 2.1E+00 | 1.7E+00 |
| cis-1,2-Dichloroethene | 6.5E-02 | 1.2E+00 | 9.5E-01 |
| Naphthalene | 1.0E-02 | 1.9E-01 | 1.5E-01 |
| Tetrachloroethene | 2.6E+01 | 4.9E+02 | 3.8E+02 |
| trans-1,2-Dichloroethene | 1.2E-02 | 2.3E-01 | 1.8E-01 |
| Trichloroethene | 4.0E-01 | 7.6E+00 | 5.9E+00 |
| Vinyl chloride | 3.2E-04 | 6.1E-03 | 4.7E-03 |

| Variables | Units | Exposure Assumptions |
|---|---|---|
| Ca = concentration of chemical in air | mg/m$^3$ | Solved by Eq 1 |
| $C_{amax}$ = maximum concentration of chemical | mg/m$^3$ | Solved by Eq 2 |
| $t_1$ = time in bath | hr | 4.5E-01 |
| $t_2$ = time in bathroom after bath | hr | 5.5E-01 |
| f = fraction volatilized for chemical | unitless | **9.0E-01** |
| $F_w$ = tap water flow rate | L/hr | 7.5E+02 |
| $V_a$ = bathroom volume | m$^3$ | 1.6E+01 |

| | | |
|---|---|---|
| Equation 1: | $C_a$ = | $((C_{amax}/2) * t_1 + C_{amax} \cdot t_2) / (t_1 + t_2)$ |
| Equation 2: | $C_{amax}$ = | $(C_w * f * F_w * t_1) / V_a$ |

Source of equations and assumptions: Schaum, J., K. Hoang, R. Kinerson, J. Moya, and R.G.M. Wang. 1994. "Estimating Dermal and Inhalation Exposure to Volatile Chemicals in Domestic Water." In: *Water Contamination and Health*. R.G.M. Wang (ed.). Marcel Dekker, Inc. New York.

**APPENDIX Q**
**TABLE 9.10 SUPPLEMENT A**
Calculation of DAevent
Residential Child Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical of Potential Concern | Groundwater Concentration (CW) (mg/L) | Permeability Coefficient (Kp) (cm/hr) | B (dimensionless) | Lag Time ($t_{event}$) (hr) | t* (hr) | Fraction Absorbed Water (FA) (dimensionless) | Duration of Event (tevent) (hr) | DAevent (mg/cm$^2$-event) | Eq |
|---|---|---|---|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | 1.60E+01 | 1.6E-02 | 7.8E-02 | 9.2E-01 | 2.2E+00 | 1.0E+00 | 1.00 | 6.6E-07 | 2 |
| 1,1,2,2-Tetrachloroethane | 5.80E-01 | 6.9E-03 | 3.5E-02 | 9.3E-01 | 2.2E+00 | 1.0E+00 | 1.00 | 1.1E-08 | 2 |
| 1,1,2-Trichloroethane | 2.30E+00 | 6.4E-03 | 2.9E-02 | 6.0E-01 | 1.4E+00 | 1.0E+00 | 1.00 | 3.2E-08 | 2 |
| 1,2-Dichloroethane | 4.63E+01 | 4.2E-03 | 1.6E-02 | 3.8E-01 | 9.2E-01 | 1.0E+00 | 1.00 | 3.4E-07 | 3 |
| Benzene | 4.00E+00 | 1.5E-02 | 5.1E-02 | 2.9E-01 | 7.0E-01 | 1.0E+00 | 1.00 | 9.3E-08 | 3 |
| Carbon tetrachloride | 2.92E+03 | 1.6E-02 | 7.8E-02 | 7.8E-01 | 1.9E+00 | 1.0E+00 | 1.00 | 1.2E-04 | 2 |
| Chloroform | 1.13E+02 | 6.8E-03 | 2.9E-02 | 5.0E-01 | 1.2E+00 | 1.0E+00 | 1.00 | 1.5E-06 | 2 |
| cis-1,2-Dichloroethene | 6.47E+01 | 7.7E-03 | 2.9E-02 | 3.7E-01 | 8.8E-01 | 1.0E+00 | 1.00 | 8.6E-07 | 3 |
| Manganese | 2.83E+02 | 1.0E-03 | NA | NA | NA | NA | 1.00 | 2.8E-07 | 1 |
| Naphthalene | 1.01E+01 | 4.7E-02 | 2.0E-01 | 5.6E-01 | 1.3E+00 | 1.0E+00 | 1.00 | 9.7E-07 | 2 |
| Tetrachlorethylene | 2.57E+04 | 3.3E-02 | 1.7E-01 | 9.1E-01 | 2.2E+00 | 1.0E+00 | 1.00 | 2.3E-03 | 2 |
| trans-1,2-Dichloroethene | 1.20E+01 | 1.0E-02 | 3.9E-02 | 3.7E-01 | 8.8E-01 | 1.0E+00 | 1.00 | 2.2E-07 | 3 |
| Trichloroethylene | 3.99E+02 | 1.2E-02 | 5.1E-02 | 5.8E-01 | 1.4E+00 | 1.0E+00 | 1.00 | 9.8E-06 | 2 |
| Vinyl chloride | 3.20E-01 | 5.6E-03 | 1.7E-02 | 2.4E-01 | 5.7E-01 | 1.0E+00 | 1.00 | 2.6E-09 | 3 |

**Inorganics: DAevent (mg/cm2-event) =**

$DA_{event}$ = Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm$^3$ (Eq 1)

**Organics: DAevent (mg/cm2-event) =**

$DA_{event}$ = $t_{event}$<t*: $DA_{event}$ (mg/cm$^2$-event) =
2 x FA x Kp x Cw x (sqrt((6 x t x $_{event}$) / (3.1415))) x CF1 x CF2 (Eq 2)

$t_{event}$>t*: $DA_{event}$ (mg/cm$^2$-event) =
FA x Kp x CW x ( $t_{event}$/(1+B) + 2 x t x ((1 + 3B + 3B$^2$)/(1+B)$^2$)) xCF1 x CF2 (Eq 3)

Notes:
NA - Not applicable
Permeability constants from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final)*. EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

**APPENDIX Q**
**TABLE 9.11**
Potential Excess Lifetime Cancer Risk from Groundwater (Off-site) - Adult/Child (Age-Adjusted) Resident RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | WOE[a] | $SF_o$ (mg/kg-day)$^{-1}$ | $SF_d$ (mg/kg-day)$^{-1}$ | URF ($\mu g/m^3$)$^{-1}$ | Groundwater EPC (mg/L) | Bathroom Air EPC ($mg/m^3$) | DAevent_adj (mg-year/kg-event) | $ABS_{gi}$ | CDI (mg/kg-day) | ELCR | CDI (mg/kg-day) | ELCR | DAC ($mg/m^3$) | ELCR | Total ELCR |
| 1,2-Dichloroethane (EDC) | B2 | 9.1E-02 | 9.1E-02 | 2.6E-05 | 5.29E-02 | 4.38E-01 | 2.82E-03 | 1.00E+00 | 7.90E-04 | 7.19E-05 | 3.86E-05 | 3.51E-06 | 1.80E-01 | 4.68E-03 | 4.75E-03 |
| cis-1,2-Dichloroethene | D | NA | NA | NA | 2.70E-02 | 2.23E-01 | 2.57E-03 | 1.00E+00 | 4.03E-04 | NA | 3.53E-05 | NA | 9.18E-02 | NA | NA |
| Manganese | D | NA | NA | NA | 2.01E+00 | NA | 1.25E-02 | 4.00E-02 | 3.00E-02 | NA | 1.71E-04 | NA | NA | NA | NA |
| Tetrachloroethene | NA | 5.4E-01 | 5.4E-01 | 5.9E-06 | 3.35E+00 | 2.77E+01 | 2.17E+00 | 1.00E+00 | 5.01E-02 | 2.67E-02 | 2.97E-02 | 1.59E-02 | 1.14E+01 | 6.51E-02 | 1.08E-01 |
| Trichloroethene | NA | 1.3E-02 | 1.3E-02 | 2.0E-06 | 4.55E-02 | 3.77E-01 | 8.19E-03 | 1.00E+00 | 6.80E-04 | 8.83E-06 | 1.12E-04 | 1.46E-06 | 1.55E-01 | 3.09E-04 | 3.20E-04 |
| Chloroform | B1 | 3.1E-02 | 3.1E-02 | 2.3E-05 | 3.50E-04 | 2.90E-03 | 3.42E-05 | 1.00E+00 | 5.23E-06 | 1.62E-07 | 4.68E-07 | 1.45E-08 | 1.19E-03 | 2.74E-05 | 2.75E-05 |
| **Estimated Subtotal** | | | | | | | | | | 2.68E-02 | | 1.59E-02 | | 7.01E-02 | |
| | | | | | | | | | | | | | **Estimated Total Risk =** | | **1.13E-01** |

[a]Cancer WOE Classifications:
Group A: Human carcinogen
Group B (B1, B2): Probable human carcinogen
Group C: Possible human carcinogen
Group D: Not classifiable
Group E: No evidence of carcinogenicity

$ABS_{gi}$ = gastrointestinal absorption factor
COPC = Chemical of Potential Concern
CDI = chronic daily intake (mg/kg-day)
ELCR = excess lifetime cancer risk
EPC = exposure point concentration (mg/L)
$SF_o$ = oral slope factor
URF = Inhalation unit risk factor
WOE = weight of evidence
DAevent = Absorbed dose per event
DAC = daily average concentration
$\mu g/m^3$ = microgram per cubic meter
$mg/m^3$ = milligrams per cubic meter
mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day

**APPENDIX Q**
**TABLE 9.11 SUPPLEMENT A**
Calculation of DAevent
Residential Adult/Child Age Adjusted Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical | EPC (mg/L) | DA Adult ($mg/cm^2$-event) | DA Child ($mg/cm^2$-event) | DA_agr ($mg/cm^2$-event) |
|---|---|---|---|---|
| 1,2-Dichloroethane (EDC) | 5.29E+01 | 2.89E-07 | 3.91E-07 | 2.82E-03 |
| cis-1,2-Dichloroethene | 2.70E+01 | 2.64E-07 | 3.58E-07 | 2.57E-03 |
| Manganese | 2.01E+03 | 1.17E-06 | 2.01E-06 | 1.25E-02 |
| Tetrachloroethene | 3.35E+03 | 2.25E-04 | 2.95E-04 | 2.17E+00 |
| Trichloroethene | 4.55E+01 | 8.50E-07 | 1.12E-06 | 8.19E-03 |
| Chloroform | 3.50E-01 | 3.55E-09 | 4.66E-09 | 3.42E-05 |

**Age-Adjusted DAevent (mg-year/event-kg) =**
$DAevent\text{-}agr = (DAevent\text{-}_a \times SA_a \times ED_a) / BW_a + (DAevent\text{-}_c \times SA_c \times ED_c) / BW_c$

| | | | | |
|---|---|---|---|---|
| **Where:** | SAa | 18,000 $cm^2$ | SAc | 6,600 $cm^2$ |
| | EDa | 24 years | EDc | 6 years |
| | BWa | 70 kg | BWc | 15 kg |

**APPENDIX Q**

**TABLE 9.12**

Potential Noncarcinogenic Risk from Groundwater (Off-site)- Adult Resident RME Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC ($mg/m^3$) | Groundwater EPC (mg/L) | Bathroom Air EPC ($mg/m^3$) | DAevent ($mg/cm^2$-event) | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | CDI (mg/kg-day) | HQ | DAC ($mg/m^3$) | HQ | Total HI |
| 1,2-Dichloroethane (EDC) | 2.0E-02 | 2.0E-02 | 2.4E+00 | 5.29E-02 | 4.38E-01 | 2.89E-07 | 1.00E+00 | kidney, liver | kidney, liver | 1.45E-03 | 7.25E-02 | 7.13E-05 | 3.56E-03 | 4.20E-01 | 1.75E-01 | 2.51E-01 |
| cis-1,2-Dichloroethene | 1.0E-02 | 1.0E-02 | NA | 2.70E-02 | 2.23E-01 | 2.64E-07 | 1.00E+00 | blood | | 7.39E-04 | 7.39E-02 | 6.51E-05 | 6.51E-03 | 2.14E-01 | NA | 8.04E-02 |
| Manganese | 2.4E-02 | 9.6E-04 | 5.0E-05 | 2.01E+00 | NA | 1.17E-06 | 4.00E-02 | nervous system | nervous system | 5.51E-02 | 2.29E+00 | 2.87E-04 | 2.99E-01 | NA | NA | 2.59E+00 |
| Tetrachloroethene | 1.0E-02 | 1.0E-02 | 2.7E-01 | 3.35E+00 | 2.77E+01 | 2.25E-04 | 1.00E+00 | liver | nervous system | 9.19E-02 | 9.19E+00 | 5.54E-02 | 5.54E+00 | 2.66E+01 | 9.86E+01 | 1.13E+02 |
| Trichloroethene | NA | NA | 6.0E-01 | 4.55E-02 | 3.77E-01 | 8.50E-07 | 1.00E+00 | | nervous system, eyes | 1.25E-03 | NA | 2.10E-04 | NA | 3.61E-01 | 6.07E-01 | 6.07E-01 |
| Chloroform | 1.0E-02 | 1.0E-02 | 9.8E-02 | 3.50E-04 | 2.90E-03 | 3.55E-09 | 1.00E+00 | liver | liver | 9.59E-06 | 9.59E-04 | 8.75E-07 | 8.75E-05 | 2.78E-03 | 2.83E-02 | 2.94E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | | 1.16E+01 | | 5.85E+00 | | 9.94E+01 | |
| | | | | | | | | | | | | | | | **Total HI =** | **1.17E+02** |

$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
COPC = Chemical of Potential Concern
DAC = daily average concentration
EPC = exposure point concentration (mg/L)
HI = Hazard Index
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose
RfC = reference concentration
DAevent = Absorbed dose per event

mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter

| | |
|---|---|
| Total Kidney: | 2.5E-01 |
| Total Liver: | 1.5E+01 |
| Total Blood: | 8.0E-02 |
| Total Nervous System: | 1.0E+02 |
| Total Eyes: | 6.1E-01 |

**APPENDIX Q**
**TABLE 9.12 SUPPLEMENT A**
Calculation of DAevent
Residential Adult Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical of Potential Concern | Groundwater Concentration (CW) (µg/L) | Permeability Coefficient (Kp) (cm/hr) | B (dimensionless) | Lag Time ($\tau_{event}$) (hr) | t* (hr) | Fraction Absorbed Water (FA) (dimensionless) | Duration of Event (tevent) (hr) | DAevent (mg/cm$^2$-event) | Eq |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dichloroethane | 5.29E+01 | 4.2E-03 | 1.6E-02 | 3.8E-01 | 9.2E-01 | 1.0E+00 | 0.58 | 2.9E-07 | 2 |
| cis-1,2-Dichloroethene | 2.70E+01 | 7.7E-03 | 2.9E-02 | 3.7E-01 | 8.8E-01 | 1.0E+00 | 0.58 | 2.6E-07 | 2 |
| Manganese | 2.01E+03 | 1.0E-03 | NA | NA | NA | NA | 0.58 | 1.2E-06 | 1 |
| Tetrachlorethylene | 3.35E+03 | 3.3E-02 | 1.7E-01 | 9.1E-01 | 2.2E+00 | 1.0E+00 | 0.58 | 2.2E-04 | 2 |
| Trichloroethylene | 4.55E+01 | 1.2E-02 | 5.1E-02 | 5.8E-01 | 1.4E+00 | 1.0E+00 | 0.58 | 8.5E-07 | 2 |
| Chloroform | 3.50E-01 | 6.8E-03 | 2.9E-02 | 5.0E-01 | 1.2E+00 | 1.0E+00 | 0.58 | 3.5E-09 | 2 |

**Inorganics: DAevent (mg/cm2-event) =**

$DA_{event}$ = $Kp \times CW \times t_{event} \times 0.001$ mg/ug $\times 0.001$ l/cm$^3$ (Eq 1)

**Organics: DAevent (mg/cm2-event) =**

$DA_{event}$ = $t_{event}<t^*$: $DA_{event}$ (mg/cm$^2$-event) =

$2 \times FA \times Kp \times Cw \times (\mathrm{sqrt}((6 \times \tau \times t_{event}) / (3.1415))) \times CF1 \times CF2$ (Eq 2)

$t_{event}>t^*$: $DA_{event}$ (mg/cm$^2$-event) =

$FA \times Kp \times CW \times ( t_{event}/(1+B) + 2 \times \tau \times ((1 + 3B + 3B^2)/(1+B)^2)) \times CF1 \times CF2$ (Eq 3)

Notes:
NA - Not applicable
Permeability constants from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final)*. EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

**APPENDIX Q**

**TABLE 9.12 SUPPLEMENT B**

Bathroom Air Exposure Concentrations from Upper Alluvial Aquifer Groundwater, Andelman Model, as Modified by Schaum
Residential Adult Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical | Exposure Point Concentration Cwo (mg/l) | $C_{amax}$ (mg/m$^3$) | $C_a$ (mg/m$^3$) |
|---|---|---|---|
| 1,2-Dichloroethane (EDC) | 5.3E-02 | 5.6E-01 | 4.4E-01 |
| *cis-1,2-Dichloroethene* | 2.7E-02 | 2.8E-01 | 2.2E-01 |
| Manganese | 2.0E+00 | 2.1E+01 | 1.7E+01 |
| Tetrachloroethene | 3.4E+00 | 3.5E+01 | 2.8E+01 |
| Trichloroethene | 4.6E-02 | 4.8E-01 | 3.8E-01 |
| Chloroform | 3.5E-04 | 3.7E-03 | 2.9E-03 |

| Variables | Units | Exposure Assumptions |
|---|---|---|
| Ca = concentration of chemical in air | mg/m$^3$ | Solved by Eq 1 |
| $C_{amax}$ = maximum concentration of chemical | mg/m$^3$ | Solved by Eq 2 |
| $t_1$ = time in shower | hr | 2.5E-01 |
| $t_2$ = time in bathroom after shower | hr | 3.3E-01 |
| f = fraction volatilized for chemical | unitless | **9.0E-01** |
| $F_w$ = shower water flow rate | L/hr | 7.5E+02 |
| $V_a$ = bathroom volume | m$^3$ | 1.6E+01 |

Equation 1: $C_a = ((C_{amax}/2) * t_1 + C_{amax} \cdot t_2) / (t_1 + t_2)$

Equation 2: $C_{amax} = (C_w * f * F_w * t_1) / V_a$

Source of equations and assumptions: Schaum, J., K. Hoang, R. Kinerson, J. Moya, and R.G.M. Wang. 1994. "Estimating Dermal and Inhalation Exposure to Volatile Chemicals in Domestic Water." In: *Water Contamination and Health*. R.G.M. Wang (ed.). Marcel Dekker, Inc. New York.

**APPENDIX Q**

**TABLE 9.13**

Potential Noncarcinogenic Risk from Groundwater (Off-site) - Child Resident RME Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | | | | | | | | Ingestion | | Dermal | | Inhalation | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COPC | $RfD_o$ (mg/kg-day) | $RfD_d$ (mg/kg-day) | RfC ($mg/m^3$) | Groundwater EPC (mg/L) | Bathroom Air EPC ($mg/m^3$) | DAevent ($mg/cm^2$-event) | $ABS_{gi}$ | RfDo Target Organ | RfC Target Organ | CDI (mg/kg-day) | HQ | CDI (mg/kg-day) | HQ | DAC ($mg/m^3$) | HQ | Total HI |
| 1,2-Dichloroethane (EDC) | 2.00E-02 | 2.00E-02 | 2.40E+00 | 5.29E-02 | 7.79E-01 | 3.91E-07 | 1.00E+00 | kidney, liver | kidney, liver | 3.38E-03 | 1.69E-01 | 1.65E-04 | 8.25E-03 | 7.47E-01 | 3.11E-01 | 4.88E-01 |
| cis-1,2-Dichloroethene | 1.00E-02 | 1.00E-02 | NA | 2.70E-02 | 3.97E-01 | 3.58E-07 | 1.00E+00 | blood | | 1.73E-03 | 1.73E-01 | 1.51E-04 | 1.51E-02 | 3.81E-01 | NA | 1.88E-01 |
| Manganese | 2.40E-02 | 9.60E-04 | 5.00E-05 | 2.01E+00 | NA | 2.01E-06 | 4.00E-02 | nervous system | nervous system | 1.28E-01 | 5.35E+00 | 8.48E-04 | 8.83E-01 | NA | NA | 6.24E+00 |
| Tetrachloroethene | 1.00E-02 | 1.00E-02 | 2.70E-01 | 3.35E+00 | 4.93E+01 | 2.95E-04 | 1.00E+00 | liver | nervous system | 2.14E-01 | 2.14E+01 | 1.24E-01 | 1.24E+01 | 4.73E+01 | 1.75E+02 | 2.09E+02 |
| Trichloroethene | NA | NA | 5.95E-01 | 4.55E-02 | 6.70E-01 | 1.12E-06 | 1.00E+00 | | nervous system, eyes | 2.91E-03 | NA | 4.71E-04 | NA | 6.42E-01 | 1.08E+00 | 1.08E+00 |
| Chloroform | 1.00E-02 | 1.00E-02 | 9.80E-02 | 3.50E-04 | 5.15E-03 | 4.66E-09 | 1.00E+00 | liver | liver | 2.24E-05 | 2.24E-03 | 1.97E-06 | 1.97E-04 | 4.94E-03 | 5.04E-02 | 5.28E-02 |
| **Subtotal Hazard Indices** | | | | | | | | | | | 2.71E+01 | | 1.34E+01 | | 1.77E+02 | |
| | | | | | | | | | | | | | | | **Total HI =** | 2.17E+02 |

$ABS_{gi}$ = gastrointestinal absorption factor
CDI = chronic daily intake
COPC = Chemical of Potential Concern
DAC = daily average concentration
EPC = exposure point concentration (mg/L)
HI = Hazard Index
$RfD_d$ = dermal reference dose
$RfD_o$ = oral reference dose
RfC = reference concentration
DAevent = Absorbed dose per event

mg/L = milligrams per liter
mg/kg-day = milligrams per kilogram per day
$mg/m^3$ = milligrams per cubic meter

| | |
|---|---|
| Total Kidney: | 4.9E-01 |
| Total Liver: | 3.4E+01 |
| Total Blood: | 1.9E-01 |
| Total Nervous System: | 1.8E+02 |
| Total Eyes: | 1.1E+00 |

**APPENDIX Q**
**TABLE 9.13 SUPPLEMENT A**
Calculation of DAevent
Residential Child Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical of Potential Concern | Groundwater Concentration (CW) (µg/L) | Permeability Coefficient (Kp) (cm/hr) | B (dimensionless) | Lag Time ($t_{event}$) (hr) | t* (hr) | Fraction Absorbed Water (FA) (dimensionless) | Duration of Event (tevent) (hr) | DAevent (mg/cm$^2$-event) | Eq |
|---|---|---|---|---|---|---|---|---|---|
| 1,2-Dichloroethane | 5.29E+01 | 4.2E-03 | 1.6E-02 | 3.8E-01 | 9.2E-01 | 1.0E+00 | 1.0 | 3.9E-07 | 3 |
| cis-1,2-Dichloroethene | 2.70E+01 | 7.7E-03 | 2.9E-02 | 3.7E-01 | 8.8E-01 | 1.0E+00 | 1.0 | 3.6E-07 | 3 |
| Manganese | 2.01E+03 | 1.0E-03 | NA | NA | NA | NA | 1.0 | 2.0E-06 | 1 |
| Tetrachlorethylene | 3.35E+03 | 3.3E-02 | 1.7E-01 | 9.1E-01 | 2.2E+00 | 1.0E+00 | 1.0 | 3.0E-04 | 2 |
| Trichloroethylene | 4.55E+01 | 1.2E-02 | 5.1E-02 | 5.8E-01 | 1.4E+00 | 1.0E+00 | 1.0 | 1.1E-06 | 2 |
| Chloroform | 3.50E-01 | 6.8E-03 | 2.9E-02 | 5.0E-01 | 1.2E+00 | 1.0E+00 | 1.0 | 4.7E-09 | 2 |

**Inorganics: DAevent (mg/cm2-event) =**

$DA_{event}$ = Kp x CW x tevent x 0.001 mg/ug x 0.001 l/cm$^3$ (Eq 1)

**Organics: DAevent (mg/cm2-event) =**

$DA_{event}$ = $t_{event}$<t*: $DA_{event}$ (mg/cm$^2$-event) =

2 x FA x Kp x Cw x (sqrt((6 x t x $t_{event}$) / (3.1415))) x CF1 x CF2 (Eq 2)

$t_{event}$>t*: $DA_{event}$ (mg/cm$^2$-event) =

FA x Kp x CW x ( $t_{event}$/(1+B) + 2 x t x ((1 + 3B + 3B$^2$)/(1+B)$^2$)) xCF1 x CF2 (Eq 3)

Notes:
NA - Not applicable
Permeability constants from EPA 2004, *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document.
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state

**APPENDIX Q**

**TABLE 9.13 SUPPLEMENT B**

Bathroom Air Exposure Concentrations from Upper Alluvial Aquifer Groundwater, Andelman Model, as Modified by Schaum
Residential Child Scenario

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| Chemical | Exposure Point Concentration Cwo (mg/l) | $C_{amax}$ (mg/m$^3$) | $C_a$ (mg/m$^3$) |
|---|---|---|---|
| 1,2-Dichloroethane (EDC) | 5.3E-02 | 1.0E+00 | 7.8E-01 |
| cis-1,2-Dichloroethene | 2.7E-02 | 5.1E-01 | 4.0E-01 |
| Tetrachloroethene | 3.4E+00 | 6.4E+01 | 4.9E+01 |
| Trichloroethene | 4.6E-02 | 8.6E-01 | 6.7E-01 |
| Chloroform | 3.5E-04 | 6.6E-03 | 5.1E-03 |

| Variables | Units | Exposure Assumptions |
|---|---|---|
| Ca = concentration of chemical in air | mg/m$^3$ | Solved by Eq 1 |
| $C_{amax}$ = maximum concentration of che | mg/m$^3$ | Solved by Eq 2 |
| $t_1$ = time in bath | hr | 4.5E-01 |
| $t_2$ = time in bathroom after bath | hr | 5.5E-01 |
| f = fraction volatilized for chemical | unitless | **9.0E-01** |
| $F_w$ = tap water flow rate | L/hr | 7.5E+02 |
| $V_a$ = bathroom volume | m$^3$ | 1.6E+01 |

Equation 1: $C_a = ((C_{amax}/2) * t_1 + C_{amax} \cdot t_2) / (t_1 + t_2)$

Equation 2: $C_{amax} = (C_w * f * F_w * t_1) / V_a$

Source of equations and assumptions: Schaum, J., K. Hoang, R. Kinerson, J. Moya, and R.G.M. Wang. 1994. "Estimating Dermal and Inhalation Exposure to Volatile Chemicals in Domestic Water." In: *Water Contamination and Health*. R.G.M. Wang (ed.). Marcel Dekker, Inc. New York.

# Risk Assessment Guidance for Superfund: Table 10

APPENDIX Q
TABLE 10.1
Derivation of Particular Emission Factor for Particulate Emissions from Construction Activities
*St. Louis Ordnance Plant, Former Hanley Area - St. Louis, Missouri*

**PEF Equations:**

$$Q/C_{sa} = A \times \exp\left[\frac{(\ln A_c - B)^2}{C}\right]$$

**Equation E-15 (EPA, 2002)**

$$PEF'_{sc} = Q/C_{sa} \times \frac{1}{F_D} \times \frac{1}{< J'_T >}$$

**Equation E-26 (EPA, 2002)**

$$< J'_T > = \frac{M_{wind} + M_{excav} + M_{doz} + M_{grade} + M_{till}}{Ac \times T}$$

**Equation E-25 (EPA, 2002)**

$$F_D = 0.1852 + \frac{5.3537}{t_c} + \frac{-9.6318}{t_c^2}$$

**Equation E-16 (EPA, 2002)**

**PEF and Box Model Input Parameters**

| Parameter | Definition | Value | Units | Source |
|---|---|---|---|---|
| $Q/C_{Se}$ | inverse ratio of the geometric mean air concentration to the emission flux at the center of a square source | 12.80 | m | Eqn. E-15 |
| A | Constant | 2.4538 | unitless | default (Eqn. E-15) |
| B | Constant | 17.5660 | unitless | default (Eqn. E-15) |
| C | Constant | 189.0426 | unitless | default (Eqn. E-15) |
| $A_c$ | Areal extent of site contamination | 0.9 | acres | assumed |
| $PEF_{SC}$ | subchronic road particulate emission factor | 7.55E+07 | $m^3$/kg | Eqn. E-26 |
| $F_D$ | Dispersion correction factor | 0.186 | unitless | Eqn. E-16 |
| $t_c$ | duration of construction (1 year = 365 days x 24 hr/day) | 8,760 | hr | assumed |
| $<J'_T>$ | Total time-averaged PM10 unit emission flux for construction activities other than traffic on unpaved roads | 9.1.E-07 | g/m2-s | Eqn. E-25 |
| Mwind | Unit mass emitted from wind erosion | 1.6.E+04 | g | Eqn. E-20 [a] |
| Mexcav | Unit mass emitted from excavation soil | 1.5.E+03 | g | Eqn. E-21 [a] |
| Mdoz | Unit mass emitted from dozing operations | 1.3.E+02 | g | Eqn. E-22 [a] |
| Mgrade | Unit mass emitted from grading operations | 1.9.E+03 | g | Eqn. E-23 [a] |
| Mtill | Unit mass emitted from tilling operations | 4.5.E+03 | g | Eqn. E-24 [a] |
| Asurf | Areal extent of site with surface soil contamination | 0.9 | acre | Eqn. E-20 |
| Aexcav | Areal extent of excavation | 0.9 | acre | Eqn. E-21 |
| dexcav | Average depth of excavation | 1.0 | m | Eqn. E-21 |
| ∑VKT | Sum of dozing kilometers traveled | 4.43 | km | Eqn. E-22 [b] |
| ∑VKT | Sum of grading kilometers traveled | 4.43 | km | Eqn. E-23 [b] |
| Atill | Areal extent of tilling | 0.9 | acre | Eqn. E-24 |
| T | Total time over which construction occurs (1 yr x 250 days/yr x 8 hrs/day x 3600 s/hr) | 7 2.E+06 | s | assumed |

Source:
EPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, EPA Office of Solid Waste and Emergency Response. OSWER 9355.4-24. December.

[a] Default input parameters used to calculate emitted unit mass can be found in Appendix E of the EPA guidance document (2002).

[b] Assuming that the dozing and grading blades each have a length of 8 ft (2.44 m) and that one dozing or grading pass across the length of the site is equal to the square root of the site area (60 m)
∑VKT = (60 m/2.44 m) x 60 m x 3) / 1000 m/km = 4.43 km.

APPENDIX Q
TABLE 10.2
Derivation of Particular Emission Factor for Particulate Emissions from Unpaved Roads
*St Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**PEF Equations:**

$$Q/C_{Sr} = A \times \exp\left[\frac{(\ln A_{site} - B)^2}{C}\right]$$

**Equation 5-6 (EPA, 2002)**

$$PEF_{SC} = Q/C_{Sr} \times \frac{1}{F_D} \frac{T \times A_R}{556 \times (W/3)^{0.4} \times \left(\frac{365\ d/yr - p}{365\ d/yr}\right) \times \sum VKT}$$

**Equation 5-5 (EPA, 2002)**

$$F_D = 0.1852 + \frac{5.3537}{t_c} + \frac{-9.6318}{t_c^{\ 2}}$$

**Equation E-16 (EPA, 2002)**

**PEF and Box Model Input Parameters**

| Parameter | Definition | Value | Units | Source |
|---|---|---|---|---|
| $Q/C_{Sr}$ | inverse ratio of the geometric mean air concentration to the emission flux at the center of a square source | 20.8 | m | Eqn. 5-6 |
| A | Constant | 12.9351 | unitless | default (Eqn. 5-6) |
| B | Constant | 5.7383 | unitless | default (Eqn. 5-6) |
| C | Constant | 71.7711 | unitless | default (Eqn. 5-6) |
| $A_{site}$ | Areal extent of site contamination | 0.9 | acres | site-specific |
| $PEF_{SC}$ | subchronic road particulate emission factor | 8.42E+06 | $m^3$/kg | Eqn. 5-5 |
| $F_D$ | Dispersion correction factor | 0.186 | unitless | Eqn. E-16 |
| $t_c$ | duration of construction (1 year = 365 days x 24 hr/day) | 8,760 | hr | assumed |
| T | Total time over which construction occurs (1 yr x 250 days/yr x 8 hrs/day x 3,600 s/hr) | 7.2.E+06 | s | assumed |
| $A_R$ | surface area of contaminated road segment (square root of site surface contamination configured as a square x default width of road segment of 20 ft) | 367.90 | $m^2$ | calculated |
| W | mean weight of vehicle [(1 car @ 2 tons/car) + (2 trucks @ 20 tons/truck)] / 3 vehicles) | 14 | tons | assumed |
| p | number of days with at least 0.01 inches of precipitation (based on 10/2007 data) | 89 | days/yr | regional data |
| VKT | sum of fleet vehicle kilometers traveled during the exposure duration (assumed 3 vehicles x 0.060 km/day x 250 days) | 45.3 | km | assumed[a] |

Source:
EPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, EPA Office of Solid Waste and Emergency Response. OSWER 9355.4-24. December.

[a] Based on the small size (0.9 acre) of the exposure area, three vehicles were conservatively assumed to generate particulates in the vicinity of a hypothetical construction worker.

APPENDIX Q
TABLE 10.3
Derivation of Subchronic Volatilization Factor - Construction Scenario. Construction Worker
*St. Louis Ordnance Plant, Former Hanley Area, St Louis, Missouri*

| Chemical | Diffusivity In Air ($D_i$) ($cm^2/s$) | Henry's Law Constant ($H'$) (unitless) | Diffusivity In Water ($D_w$) ($cm^2/s$) | Soil Organic Carbon Partition Coeff. ($K_{oc}$) ($cm^3/g$) | Soil Water Partition Coeff. ($K_d = K_{oc} \times F_{oc}$) ($g/cm^3$) | Solubility In Water (S) (mg/L) | Apparent Diffusivity ($D_A$) ($cm^2/s$) | Volatilization Factor (VF) ($m^3/kg$) |
|---|---|---|---|---|---|---|---|---|
| cis-1,2-Dichloroethene | 8 80E-02 | 1 70E-01 | 1 10E-05 | 4 38E+01 | 2.63E-01 | 3.50E+03 | 2.02E-03 | 2.44E+02 |
| Tetrachloroethene | 5.00E-02 | 7 20E-01 | 9 50E-06 | 1 07E+02 | 6.41E-01 | 2 06E+02 | 2 19E-03 | 2 35E+02 |
| Trichloroethene | 6.90E-02 | 4 00E-01 | 1 00E-05 | 6 77E+01 | 4.06E-01 | 1.28E+03 | 2.53E-03 | 2 18E+02 |

$$Q/C_{sa} = A \times \exp\left[\frac{(\ln A_c - B)^2}{C}\right]$$

Equation 5-15 (EPA, 2002)

$$VF_{SC} = \left[\frac{(3.14 \times D_A \times T)^{1/2}}{2 \times \rho_b \times D_A}\right] \times 10^{-4}\left(m^2/cm^2\right) \times Q/C_{sa} \times \frac{1}{F_D}$$

Equation 5-14 (EPA, 2002)

$$D_A = \frac{\left(\theta_a^{10/3} \times D_i \times H' + \theta_w^{10/3} \times D_w\right)/n^2}{\rho_b \times K_d + \theta_w + \theta_a \times H'}$$

Equation 5-14 (EPA, 2002)

| Parameter | Definition | Value | Units | Source |
|---|---|---|---|---|
| $Q/C_{sa}$ | Inverse ratio of the geometric mean air concentration to the emission flux at the center of a square source | 12.80 | m | calculated |
| A | Constant | 2 4538 | unitless | default (Eqn E-15) |
| B | Constant | 17 5660 | unitless | default (Eqn. E-15) |
| C | Constant | 189.0426 | unitless | default (Eqn. E-15) |
| $A_c$ | Areal extent of site contamination | 0 9 | acres | assumed |
| T | Total time over which construction occurs (250 days x 8 hrs/day x 3600 s/hr) | 7 2E+06 | s | assumed |
| $\rho_b$ | Soil bulk density | 1 5 | $g/cm^3$ | default (Eqn 5-14) |
| $\theta_a$ | Air-filled soil porosity ($L_{air}/L_{soil}$) | 0.28 | $(L_{air}/L_{soil}) = n - \theta_w$ | calculated |
| n | Total soil porosity (Lpore/Lsoil) | 0 43 | $(Lpore/Lsoil) = 1 - (r_b/r_s)$ | calculated |
| $\theta_w$ | Water-filled soil porosity | 0 15 | Lwater/Lsoil | default (Eqn. 5-14) |
| $\rho_s$ | Soil particle density | 2.65 | $g/cm^3$ | default (Eqn 5-14) |
| $f_{oc}$ | Fraction organic carbon in soil | 0 006 | g/g | default (Eqn 5-14) |
| $F_D$ | Dispersion correction factor | 0 185 | unitless | default (Eqn. 5-14) |

**Note:**
Physical and chemical properties are obtained from EPA 2009.

**Source:**
EPA, 2002 Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, EPA Office of Solid Waste and Emergency Response OSWER 9355 4-24 December.
EPA, 2009 Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites. RSL Table Update. April 2009

**APPENDIX Q**
**TABLE 10.4**
Comparison of Potential Carcinogenic/Noncarcinogenic Risk from Soil (0-10 Feet): Construction Worker RME Scenario
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | Original Risk Estimates (based on PEF of 1.36E+09 in HHRA) | | | | | New Risk Estimates (based on constuction worker PEFs of 7.58E+06) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Soil EPC (mg/kg) | Air EPC ($mg/m^3$) | Carcinogenic | | Noncarcinogenic | | Air EPC (mg/m3) | Carcinogenic | | Noncarcinogenic | |
| COPC | | | DAC ($mg/m^3$) | ELCR | DAC ($mg/m^3$) | HQ | | DAC ($mg/m^3$) | ELCR | DAC ($mg/m^3$) | HQ |
| Arsenic | 9.7E+00 | 7.1E-09 | 7.0E-11 | 3.0E-10 | 4.9E-09 | 1.6E-04 | 1.3E-06 | 1.3E-08 | 5.4E-08 | 8.8E-07 | 2.9E-02 |
| Benzo(a)pyrene | 1.9E-01 | 1.4E-10 | 1.4E-12 | 1.5E-12 | 9.5E-11 | NA | 2.5E-08 | 2.4E-10 | 2.7E-10 | 1.7E-08 | NA |
| Tetrachloroethene | 2.6E+00 | 1.5E-03 | 1.4E-05 | 8.4E-08 | 1.0E-03 | 3.7E-03 | 1.1E-02 | 1.1E-04 | 6.4E-07 | 7.6E-03 | 2.8E-02 |
| Trichloroethene | 3.8E-01 | 1.7E-04 | 1.6E-06 | 3.2E-09 | 1.1E-04 | 1.9E-04 | 1.7E-03 | 1.7E-05 | 3.4E-08 | 1.2E-03 | 2.0E-03 |
| | | | **Total =** | 8.7E-08 | **Total =** | 4.0E-03 | | **Total =** | 7.3E-07 | **Total =** | 5.9E-02 |

Notes:
DAC = daily average concentration
ELCR = excess lifetime cancer risk
EPC = exposure point concentration
HQ = Hazard Quotient

APPENDIX Q
TABLE 10.5
Summary of Estimated Risks Associated with Inhalation Exposure Under Construction Worker Scenario - Exposure Units A through L: Onsite Subsurface Soil (0-10 Feet)
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

***On-site Subsurface Soil (0-10 feet)***

| | | | Toxicity Values | | | | Ambient Air EPC | | Noncarcinogenic | | Carcinogenic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Exposure Unit | COPC | Soil EPC (mg/kg) | RfC (mg/m$^3$) | URF (ug/m$^3$)$^{-1}$ | VF (kg/m$^3$) | Volatile (mg/m$^3$) | Particulate (mg/m$^3$) | Ambient Air EPC (Combined) (mg/m$^3$) | DAC (mg/m$^3$) | HQ | DAC (mg/m$^3$) | ELCR |
| A | Aluminum | 7.1E+03 | 5.0E-03 | NA | NA | NA | 9.43E-04 | 9.43E-04 | 6.5E-04 | 1.3E-01 | 9.2E-06 | NA |
| | Antimony | 2.8E+00 | NA | NA | NA | NA | 3.73E-07 | 3.73E-07 | 2.6E-07 | NA | 3.6E-09 | NA |
| | Iron | 1.6E+04 | NA | NA | NA | NA | 2.12E-03 | 2.12E-03 | 1.4E-03 | NA | 2.1E-05 | NA |
| | Manganese | 5.6E+02 | 5.0E-05 | NA | NA | NA | 7.36E-05 | 7.36E-05 | 5.0E-05 | 1.0E+00 | 7.2E-07 | NA |
| | Selenium | 1.2E+01 | NA | NA | NA | NA | 1.64E-06 | 1.64E-06 | 1 1E-06 | NA | 1.6E-08 | NA |
| | | | | | | | | | Total = | 1.1E+00 | Total = | 0 0E+00 |
| B | Aluminum | 8.6E+03 | 5.0E-03 | NA | NA | NA | 1.14E-03 | 1.14E-03 | 7.8E-04 | 1.6E-01 | 1.1E-05 | NA |
| | Antimony | 3.2E+00 | NA | NA | NA | NA | 4.16E-07 | 4.16E-07 | 2.8E-07 | NA | 4.1E-09 | NA |
| | Arsenic | 1.6E+01 | 3.0E-05 | 4.3E-03 | NA | NA | 2.11E-06 | 2.11E-06 | 1.4E-06 | 4.8E-02 | 2.1E-08 | 8.9E-08 |
| | Iron | 1.4E+04 | NA | NA | NA | NA | 1.89E-03 | 1.89E-03 | 1.3E-03 | NA | 1.9E-05 | NA |
| | Manganese | 5.9E+02 | 5.0E-05 | NA | NA | NA | 7.74E-05 | 7.74E-05 | 5.3E-05 | 1.1E+00 | 7.6E-07 | NA |
| | | | | | | | | | Total = | 1.3E+00 | Total = | 8 9E-08 |
| C | Aluminum | 8.3E+03 | 5.0E-03 | NA | NA | NA | 1.09E-03 | 1.09E-03 | 7.5E-04 | 1.5E-01 | 1.1E-05 | NA |
| | Antimony | 4.2E+00 | NA | NA | NA | NA | 5.60E-07 | 5.60E-07 | 3.8E-07 | NA | 5.5E-09 | NA |
| | Iron | 1.8E+04 | NA | NA | NA | NA | 2.33E-03 | 2.33E-03 | 1.6E-03 | NA | 2.3E-05 | NA |
| | Manganese | 6.1E+02 | 5.0E-05 | NA | NA | NA | 8.07E-05 | 8.07E-05 | 5.5E-05 | 1.1E+00 | 7 9E-07 | NA |
| | | | | | | | | | Total = | 1.3E+00 | Total = | 0.0E+00 |
| D | Aluminum | 1.2E+04 | 5.0E-03 | NA | NA | NA | 1.58E-03 | 1.58E-03 | 1.1E-03 | 2.2E-01 | 1.5E-05 | NA |
| | Iron | 1.8E+04 | NA | NA | NA | NA | 2.40E-03 | 2.40E-03 | 1.6E-03 | NA | 2.3E-05 | NA |
| | Manganese | 8.4E+02 | 5.0E-05 | NA | NA | NA | 1.11E-04 | 1.11E-04 | 7.6E-05 | 1.5E+00 | 1.1E-06 | NA |
| | Thallium | 4.7E+00 | NA | NA | NA | NA | 6.15E-07 | 6.15E-07 | 4.2E-07 | NA | 6.0E-09 | NA |
| | | | | | | | | | Total = | 1.7E+00 | Total = | 0.0E+00 |
| E | Aluminum | 9.0E+03 | 5.0E-03 | NA | NA | NA | 1.19E-03 | 1.19E-03 | 8.2E-04 | 1.6E-01 | 1.2E-05 | NA |
| | Antimony | 1.4E+01 | NA | NA | NA | NA | 1.86E-06 | 1.86E-06 | 1.3E-06 | NA | 1.8E-08 | NA |
| | Arsenic | 1.4E+01 | 3.0E-05 | 4.3E-03 | NA | NA | 1.81E-06 | 1.81E-06 | 1.2E-06 | 4.1E-02 | 1.8E-08 | 7.6E-08 |
| | Chromium | 4.1E+01 | NA | NA | NA | NA | 5.47E-06 | 5.47E-06 | 3.7E-06 | NA | 5.4E-08 | NA |
| | Iron | 1.7E+04 | NA | NA | NA | NA | 2.19E-03 | 2.19E-03 | 1.5E-03 | NA | 2.1E-05 | NA |
| | Manganese | 8.4E+02 | 5.0E-05 | NA | NA | NA | 1.11E-04 | 1.11E-04 | 7.6E-05 | 1.5E+00 | 1.1E-06 | NA |
| | Thallium | 5.1E+00 | NA | NA | NA | NA | 6.69E-07 | 6.69E-07 | 4.6E-07 | NA | 6.5E-09 | NA |
| | Vanadium | 3.5E+01 | NA | NA | NA | NA | 4.65E-06 | 4.65E-06 | 3.2E-06 | NA | 4.6E-08 | NA |
| | | | | | | | | | Total = | 1.7E+00 | Total = | 7.6E-08 |

**APPENDIX Q**
**TABLE 10.5**
Summary of Estimated Risks Associated with Inhalation Exposure Under Construction Worker Scenario - Exposure Units A through L: Onsite Subsurface Soil (0-10 Feet)
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

***On-site Subsurface Soil (0-10 feet)***

| | | | Toxicity Values | | | | Ambient Air EPC | | Noncarcinogenic | | Carcinogenic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Exposure Unit | COPC | Soil EPC (mg/kg) | RfC ($mg/m^3$) | URF $(ug/m^3)^{-1}$ | VF ($kg/m^3$) | Volatile ($mg/m^3$) | Particulate ($mg/m^3$) | Ambient Air EPC (Combined) ($mg/m^3$) | DAC ($mg/m^3$) | HQ | DAC ($mg/m^3$) | ELCR |
| F | Aluminum | 9.3E+03 | 5.0E-03 | NA | NA | NA | 1.23E-03 | 1.23E-03 | 8.4E-04 | 1.7E-01 | 1 2E-05 | NA |
| | Antimony | 5.7E+00 | NA | NA | NA | NA | 7.56E-07 | 7.56E-07 | 5.2E-07 | NA | 7.4E-09 | NA |
| | Arsenic | 8.5E+00 | 3.0E-05 | 4.3E-03 | NA | NA | 1.12E-06 | 1.12E-06 | 7.7E-07 | 2.6E-02 | 1.1E-08 | 4.7E-08 |
| | Iron | 1.7E+04 | NA | NA | NA | NA | 2.18E-03 | 2.18E-03 | 1.5E-03 | NA | 2.1E-05 | NA |
| | Manganese | 7.8E+02 | 5.0E-05 | NA | NA | NA | 1.02E-04 | 1.02E-04 | 7.0E-05 | 1.4E+00 | 1.0E-06 | NA |
| | Thallium | 2.2E+00 | NA | NA | NA | NA | 2.88E-07 | 2.88E-07 | 2.0E-07 | NA | 2.8E-09 | NA |
| | Vanadium | 3.2E+01 | NA | NA | NA | NA | 4.23E-06 | 4.23E-06 | 2.9E-06 | NA | 4.1E-08 | NA |
| | | | | | | | | | Total = | 1.6E+00 | Total = | 4.7E-08 |
| G | Aluminum | 1.1E+04 | 5.0E-03 | NA | NA | NA | 1.44E-03 | 1.44E-03 | 9.9E-04 | 2.0E-01 | 1.4E-05 | NA |
| | Benzo(b)fluoranthene | 8.2E-01 | NA | 1.1E-04 | NA | NA | 1.08E-07 | 1.08E-07 | 7.4E-08 | NA | 1.1E-09 | 1.2E-10 |
| | Iron | 1.8E+04 | NA | NA | NA | NA | 2.44E-03 | 2.44E-03 | 1.7E-03 | NA | 2.4E-05 | NA |
| | Manganese | 9.0E+02 | 5.0E-05 | NA | NA | NA | 1.19E-04 | 1.19E-04 | 8.2E-05 | 1.6E+00 | 1.2E-06 | NA |
| | Thallium | 5.2E+00 | NA | NA | NA | NA | 6.85E-07 | 6.85E-07 | 4.7E-07 | NA | 6.7E-09 | NA |
| | Vanadium | 3.7E+01 | NA | NA | NA | NA | 4.91E-06 | 4.91E-06 | 3.4E-06 | NA | 4.8E-08 | NA |
| | | | | | | | | | Total = | 1.8E+00 | Total = | 1.2E-10 |
| H | Aluminum | 8.0E+03 | 5.0E-03 | NA | NA | NA | 1.06E-03 | 1.06E-03 | 7.2E-04 | 1.4E-01 | 1.0E-05 | NA |
| | Arsenic | 1.1E+01 | 3.0E-05 | 4.3E-03 | NA | NA | 1.42E-06 | 1.42E-06 | 9.7E-07 | 3.2E-02 | 1.4E-08 | 6.0E-08 |
| | Iron | 1.5E+04 | NA | NA | NA | NA | 2.00E-03 | 2.00E-03 | 1.4E-03 | NA | 2.0E-05 | NA |
| | Manganese | 6.2E+02 | 5.0E-05 | NA | NA | NA | 8.18E-05 | 8.18E-05 | 5.6E-05 | 1.1E+00 | 8.0E-07 | NA |
| | Silver | 6.8E+01 | NA | NA | NA | NA | 8.98E-06 | 8.98E-06 | 6.2E-06 | NA | 8.8E-08 | NA |
| | Thallium | 4 5E+00 | NA | NA | NA | NA | 5.97E-07 | 5.97E-07 | 4.1E-07 | NA | 5.8E-09 | NA |
| | | | | | | | | | Total = | 1.3E+00 | Total = | 6 0E-08 |
| I | Aluminum | 8.8E+03 | 5.0E-03 | NA | NA | NA | 1.16E-03 | 1.16E-03 | 8.0E-04 | 1.6E-01 | 1.1E-05 | NA |
| | Iron | 1.7E+04 | NA | NA | NA | NA | 2.18E-03 | 2.18E-03 | 1.5E-03 | NA | 2.1E-05 | NA |
| | Manganese | 9.2E+02 | 5.0E-05 | NA | NA | NA | 1.22E-04 | 1.22E-04 | 8.3E-05 | 1.7E+00 | 1.2E-06 | NA |
| | Thallium | 5.8E+00 | NA | NA | NA | NA | 7.63E-07 | 7.63E-07 | 5.2E-07 | NA | 7.5E-09 | NA |
| | | | | | | | | | Total = | 1.8E+00 | Total = | 0.0E+00 |
| J | Aluminum | 8.4E+03 | 5.0E-03 | NA | NA | NA | 1.11E-03 | 1.11E-03 | 7.6E-04 | 1.5E-01 | 1.1E-05 | NA |
| | Arsenic | 1.3E+01 | 3.0E-05 | 4.3E-03 | NA | NA | 1.70E-06 | 1.70E-06 | 1.2E-06 | 3.9E-02 | 1.7E-08 | 7.2E-08 |
| | Benzo(b)fluoranthene | 4.7E-01 | NA | 1.1E-04 | NA | NA | 6.14E-08 | 6.14E-08 | 4.2E-08 | NA | 6.0E-10 | 6.6E-11 |
| | Copper | 2.1E+02 | NA | NA | NA | NA | 2.81E-05 | 2.81E-05 | 1.9E-05 | NA | 2.8E-07 | NA |
| | Iron | 1.7E+04 | NA | NA | NA | NA | 2.28E-03 | 2.28E-03 | 1.6E-03 | NA | 2.2E-05 | NA |
| | Manganese | 7.6E+02 | 5.0E-05 | NA | NA | NA | 9.99E-05 | 9.99E-05 | 6.8E-05 | 1.4E+00 | 9.8E-07 | NA |
| | Thallium | 8.6E+00 | NA | NA | NA | NA | 1.14E-06 | 1.14E-06 | 7.8E-07 | NA | 1.1E-08 | NA |
| | | | | | | | | | Total = | 1.6E+00 | Total = | 7.2E-08 |

APPENDIX Q
TABLE 10.5
Summary of Estimated Risks Associated with Inhalation Exposure Under Construction Worker Scenario - Exposure Units A through L: Onsite Subsurface Soil (0-10 Feet)
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

***On-site Subsurface Soil (0-10 feet)***

| | | | Toxicity Values | | | | Ambient Air EPC | | | Noncarcinogenic | | Carcinogenic | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Exposure Unit | COPC | Soil EPC (mg/kg) | RfC ($mg/m^3$) | URF $(ug/m^3)^{-1}$ | VF ($kg/m^3$) | Volatile ($mg/m^3$) | Particulate ($mg/m^3$) | Ambient Air EPC (Combined) ($mg/m^3$) | DAC ($mg/m^3$) | HQ | DAC ($mg/m^3$) | ELCR |
| | Aluminum | 9.4E+03 | 5.0E-03 | NA | NA | NA | 1.24E-03 | 1.24E-03 | 8.5E-04 | 1.7E-01 | 1.2E-05 | NA |
| | Iron | 1.6E+04 | NA | NA | NA | NA | 2.18E-03 | 2 18E-03 | 1.5E-03 | NA | 2.1E-05 | NA |
| K | Manganese | 8.4E+02 | 5.0E-05 | NA | NA | NA | 1.11E-04 | 1.11E-04 | 7.6E-05 | 1.5E+00 | 1.1E-06 | NA |
| | Thallium | 7.7E+00 | NA | NA | NA | NA | 1.01E-06 | 1.01E-06 | 6.9E-07 | NA | 9.9E-09 | NA |
| | Vanadium | 3.3E+01 | NA | NA | NA | NA | 4.35E-06 | 4.35E-06 | 3.0E-06 | NA | 4.3E-08 | NA |
| | | | | | | | | | Total = | 1.7E+00 | Total = | 0.0E+00 |
| | Aluminum | 8.6E+03 | 5.0E-03 | NA | NA | NA | 1.13E-03 | 1.13E-03 | 7.8E-04 | 1.6E-01 | 1.1E-05 | NA |
| | cis-1,2-Dichloroethene | 2.9E-01 | NA | NA | 2.44E+02 | 1.18E-03 | 3.80E-08 | 1.18E-03 | 8.1E-04 | NA | 1.2E-05 | NA |
| | Iron | 1.8E+04 | NA | NA | NA | NA | 2.36E-03 | 2.36E-03 | 1.6E-03 | NA | 2.3E-05 | NA |
| | Manganese | 8.6E+02 | 5.0E-05 | NA | NA | NA | 1.13E-04 | 1.13E-04 | 7.8E-05 | 1 6E+00 | 1.1E-06 | NA |
| L | Selenium | 6.4E+00 | NA | NA | NA | NA | 8.47E-07 | 8.47E-07 | 5.8E-07 | NA | 8.3E-09 | NA |
| | Tetrachloroethene | 2.6E+00 | 2.7E-01 | 5.9E-06 | 2.35E+02 | 1.11E-02 | 3.43E-07 | 1.11E-02 | 7.6E-03 | 2.8E-02 | 1.1E-04 | 6.4E-07 |
| | Thallium | 2.4E+00 | NA | NA | NA | NA | 3.12E-07 | 3.12E-07 | 2.1E-07 | NA | 3.0E-09 | NA |
| | Trichloroethene | 3.8E-01 | 6.0E-01 | 2.0E-06 | 2.18E+02 | 1.74E-03 | 5.01E-08 | 1.74E-03 | 1.2E-03 | 2.0E-03 | 1.7E-05 | 3.4E-08 |
| | Vanadium | 4.0E+01 | NA | NA | NA | NA | 5 27E-06 | 5.27E-06 | 3 6E-06 | NA | 5.2E-08 | NA |
| | | | | | | | | | Total = | 1.7E+00 | Total = | 6.7E-07 |

Notes:
COPC - chemical of potential concern
DAC - daily average concentration
EPC - exposure point concentration
HQ - hazard quotient
RfC - reference concentration
URF - unit risk factor
VF - volatilization factor

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit A

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**Summary Statistics for Raw Data Sets with NDs using Detected Data Only**

| | | | | Raw Statistics using Detected Observations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Num Ds** | **NumNDs** | **% NDs** | **Minimum** | **Maximum** | **Mean** | **Median** | **SD** | **MAD/0.675** | **Skewness** | **CV** |
| Aluminum (mg/kg) | 9 | 0 | 0.00% | 5,748.20 | 7,845 | 6,708.24 | 6,840 | 706.5763 | 529.28095 | -0.089277 | 0.1053295 |
| Antimony (mg/kg) | 3 | 5 | 62.50% | 1.2 | 5.293179 | 2.564393 | 1.2 | 2.363198 | 0 | 1.7320508 | 0.9215428 |
| Iron (mg/kg) | 9 | 0 | 0.00% | 10,700 | 21,855 | 13,971.44 | 13306 | 3,205.59 | 1,678.28 | 2.1436828 | 0.2294386 |
| Lead (mg/kg) | 10 | 0 | 0.00% | 28.345 | 1,022.90 | 236.0005 | 111.08 | 324.0846 | 77.242402 | 2.0711212 | 1.373237 |
| Manganese (mg/kg) | 9 | 0 | 0.00% | 440 | 601 | 526.49 | 518 | 49.74089 | 33.787991 | 0.0157938 | 0.0944764 |
| Selenium (mg/kg) | 1 | 4 | 80.00% | 12.4 | 12.4 | 12.4 | 12.4 | N/A | 0 | N/A | N/A |

| | | | |
|---|---|---|---|
| Adjusted Chi Square Value | 1107.0027 | 95% Jackknife UCL | 7,146.2 |
| | | 95% Standard Bootstrap UCL | 7073.3984 |
| Anderson-Darling Test Statistic | 0.4152635 | 95% Bootstrap-t UCL | 7,124.8 |
| Anderson-Darling 5% Critical Value | 0.71998 | 95% Hall's Bootstrap UCL | 7,087.0 |
| Kolmogorov-Smirnov Test Statistic | 0.2078738 | 95% Percentile Bootstrap UCL | 7,061.5 |
| Kolmogorov-Smirnov 5% Critical Value | 0.27879 | 95% BCA Bootstrap UCL | 7,052.9 |
| **Data appear Gamma Distributed at 5% Significance Level** | | 95% Chebyshev(Mean, Sd) UCL | 7,734.9 |
| | | 97.5% Chebyshev(Mean, Sd) UCL | 8179.1004 |
| **Assuming Gamma Distribution** | | 99% Chebyshev(Mean, Sd) UCL | 9,051.7 |
| 95% Approximate Gamma UCL | 7,183.2 | | |
| 95% Adjusted Gamma UCL | 7,288.8 | | |
| **Potential UCL to Use** | | Use 95% Student's-t UCL | 7,146.2 |

**Antimony (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 8 | Number of Detected Data | 3 |
| Number of Distinct Detected Data | 2 | Number of Non-Detect Data | 5 |
| | | Percent Non-Detects | 62.50% |

| **Raw Statistics** | | **Log-transformed Statistics** | |
|---|---|---|---|
| Minimum Detected | 1.2 | Minimum Detected | 0.1823216 |
| Maximum Detected | 5.293179 | Maximum Detected | 1.666419 |
| Mean of Detected | 2.564393 | Mean of Detected | 0.6770207 |
| SD of Detected | 2.363198 | SD of Detected | 0.8568441 |
| Minimum Non-Detect | 3.8 | Minimum Non-Detect | 1.3350011 |
| Maximum Non-Detect | 3.8 | Maximum Non-Detect | 1.3350011 |

**Warning: Data set has only 2 Distinct Detected Values.**
**This may not be adequate enough to compute meaningful and reliable test statistics and estimates.**
**The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).**

**Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.**

**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**
**Those methods will return a 'N/A' value on your output display!**

**It is necessary to have 4 or more Distinct Values for bootstrap methods.**
**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit A

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**UCL Statistics**

| **Normal Distribution Test with Detected Values Only** | | **Lognormal Distribution Test with Detected Values Only** | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.7499856 | Shapiro Wilk Test Statistic | 0.7499856 |
| 5% Shapiro Wilk Critical Value | 0.767 | 5% Shapiro Wilk Critical Value | 0.767 |
| **Data not Normal at 5% Significance Level** | | **Data not Lognormal at 5% Significance Level** | |
| | | | |
| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
| DL/2 Substitution Method | | DL/2 Substitution Method | |
| Mean | 2.1491474 | Mean | 0.6550414 |
| SD | 1.3091474 | SD | 0.4583639 |
| 95% DL/2 (t) UCL | 3.0260597 | 95% H-Stat (DL/2) UCL | 4.6598443 |
| | | | |
| Maximum Likelihood Estimate(MLE) Method | N/A | Log ROS Method | |
| **MLE method failed to converge properly** | | Mean in Log Scale | 0.3989669 |
| | | SD in Log Scale | 0.632964 |
| | | Mean in Original Scale | 1.8267602 |
| | | SD in Original Scale | 1.4864011 |
| | | 95% Percentile Bootstrap UCL | 2.7412911 |
| | | 95% BCA Bootstrap UCL | 3.1090758 |
| | | | |
| **Gamma Distribution Test with Detected Values Only** | | **Data Distribution Test with Detected Values Only** | |
| k star (bias corrected) | N/A | **Data do not follow a Discernable Distribution (0.05)** | |
| Theta Star | N/A | | |
| nu star | N/A | | |
| | | | |
| A-D Test Statistic | 0.6190292 | **Nonparametric Statistics** | |
| 5% A-D Critical Value | N/A | Kaplan-Meier (KM) Method | |
| K-S Test Statistic | N/A | Mean | 1.7116474 |
| 5% K-S Critical Value | N/A | SD | 1.3536917 |
| **Data not Gamma Distributed at 5% Significance Level** | | SE of Mean | 0.5861657 |
| | | 95% KM (t) UCL | 2.8221844 |
| **Assuming Gamma Distribution** | | 95% KM (z) UCL | 2.6758042 |
| Gamma ROS Statistics using Extrapolated Data | | 95% KM (jackknife) UCL | N/A |
| Minimum | N/A | 95% KM (bootstrap t) UCL | N/A |
| Maximum | N/A | 95% KM (BCA) UCL | N/A |
| Mean | N/A | 95% KM (Percentile Bootstrap) UCL | N/A |
| Median | N/A | 95% KM (Chebyshev) UCL | 4.2666845 |
| SD | N/A | 97.5% KM (Chebyshev) UCL | 5.372251 |
| k star | N/A | 99% KM (Chebyshev) UCL | 7.5439225 |
| Theta star | N/A | | |
| Nu star | N/A | **Potential UCLs to Use** | |
| AppChi2 | N/A | 95% KM (t) UCL | 2.8221844 |
| 95% Gamma Approximate UCL | N/A | 95% KM (% Bootstrap) UCL | N/A |
| 95% Adjusted Gamma UCL | N/A | | |

**Note: DL/2 is not a recommended method.**

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit A

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**Iron (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Observations | 9 | Number of Distinct Observations | 9 |

| **Raw Statistics** | | **Log-transformed Statistics** | |
|---|---|---|---|
| Minimum | 10,700 | Minimum of Log Data | 9.277999 |
| Maximum | 21,855 | Maximum of Log Data | 9.992185 |
| Mean | 13,971.44 | Mean of log Data | 9.5252649 |
| Median | 13,306 | SD of log Data | 0.200743 |
| SD | 3,205.6 | | |
| Coefficient of Variation | 0.2294386 | | |
| Skewness | 2.1436828 | | |

**Warning: There are only 9 Values in this data**

**Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions**

**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**

**Relevant UCL Statistics**

| **Normal Distribution Test** | | **Lognormal Distribution Test** | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.7673918 | Shapiro Wilk Test Statistic | 0.8533862 |
| Shapiro Wilk Critical Value | 0.829 | Shapiro Wilk Critical Value | 0.829 |
| **Data not Normal at 5% Significance Level** | | **Data appear Lognormal at 5% Significance Level** | |

| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
|---|---|---|---|
| 95% Student's-t UCL | 15,958.43 | 95% H-UCL | 16,008.59 |
| **95% UCLs (Adjusted for Skewness)** | | 95% Chebyshev (MVUE) UCL | 18,027.85 |
| 95% Adjusted-CLT UCL | 16,544.86 | 97.5% Chebyshev (MVUE) UCL | 19,792.89 |
| 95% Modified-t UCL | 16,085.68 | 99% Chebyshev (MVUE) UCL | 23,259.97 |

| **Gamma Distribution Test** | | **Data Distribution** | |
|---|---|---|---|
| k star (bias corrected) | 17.273292 | **Data appear Gamma Distributed at 5% Significance Level** | |
| Theta Star | 808.84666 | | |
| nu star | 310.91926 | | |
| Approximate Chi Square Value (.05) | 271.07014 | **Nonparametric Statistics** | |
| Adjusted Level of Significance | 0.02308 | 95% CLT UCL | 15,729.02 |
| Adjusted Chi Square Value | 263.20703 | 95% Jackknife UCL | 15,958.43 |
| | | 95% Standard Bootstrap UCL | 15,694.32 |
| Anderson-Darling Test Statistic | 0.6836912 | 95% Bootstrap-t UCL | 17,770.21 |
| Anderson-Darling 5% Critical Value | 0.720883 | 95% Hall's Bootstrap UCL | 23,572.92 |
| Kolmogorov-Smirnov Test Statistic | 0.2732144 | 95% Percentile Bootstrap UCL | 15,759.44 |
| Kolmogorov-Smirnov 5% Critical Value | 0.2788268 | 95% BCA Bootstrap UCL | 16,317.89 |

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit A

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| | | | |
|---|---|---|---|
| **Data appear Gamma Distributed at 5% Significance Level** | | 95% Chebyshev(Mean, Sd) UCL | 18,629.06 |
| | | 97.5% Chebyshev(Mean, Sd) UCL | 20,644.41 |
| **Assuming Gamma Distribution** | | 99% Chebyshev(Mean, Sd) UCL | 24,603.18 |
| 95% Approximate Gamma UCL | 16,025.34 | | |
| 95% Adjusted Gamma UCL | 16,504.09 | | |
| **Potential UCL to Use** | | Use 95% Approximate Gamma UCL | 16,025.34 |

**Lead (mg/kg)**

| | | | |
|---|---|---|---|
| **General Statistics** | | | |
| Number of Valid Observations | 10 | Number of Distinct Observations | 10 |
| **Raw Statistics** | | **Log-transformed Statistics** | |
| Minimum | 28.345 | Minimum of Log Data | 3.3444506 |
| Maximum | 1,022.90 | Maximum of Log Data | 6.930397 |
| Mean | 236.0005 | Mean of log Data | 4.8165606 |
| Median | 111.08 | SD of log Data | 1.129478 |
| SD | 324.08461 | | |
| Coefficient of Variation | 1.373237 | | |
| Skewness | 2.0711212 | | |
| **Relevant UCL Statistics** | | | |
| **Normal Distribution Test** | | **Lognormal Distribution Test** | |
| Shapiro Wilk Test Statistic | 0.6615147 | Shapiro Wilk Test Statistic | 0.926276 |
| Shapiro Wilk Critical Value | 0.842 | Shapiro Wilk Critical Value | 0.842 |
| **Data not Normal at 5% Significance Level** | | **Data appear Lognormal at 5% Significance Level** | |
| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
| 95% Student's-t UCL | 423.86626 | 95% H-UCL | 832.92451 |
| **95% UCLs (Adjusted for Skewness)** | | 95% Chebyshev (MVUE) UCL | 563.81276 |
| 95% Adjusted-CLT UCL | 476.29326 | 97.5% Chebyshev (MVUE) UCL | 715.38275 |
| 95% Modified-t UCL | 435.05323 | 99% Chebyshev (MVUE) UCL | 1,013.1 |
| **Gamma Distribution Test** | | **Data Distribution** | |
| k star (bias corrected) | 0.6986517 | **Data appear Lognormal at 5% Significance Level** | |
| Theta Star | 337.79423 | | |
| nu star | 13.973033 | | |
| Approximate Chi Square Value (.05) | 6.5528786 | **Nonparametric Statistics** | |
| Adjusted Level of Significance | 0.0267 | 95% CLT UCL | 404.57259 |
| Adjusted Chi Square Value | 5.6932252 | 95% Jackknife UCL | 423.86626 |
| | | 95% Standard Bootstrap UCL | 396.39126 |
| Anderson-Darling Test Statistic | 0.7572758 | 95% Bootstrap-t UCL | 1,236.2 |
| Anderson-Darling 5% Critical Value | 0.7516513 | 95% Hall's Bootstrap UCL | 1,445.4 |
| Kolmogorov-Smirnov Test Statistic | 0.2952614 | 95% Percentile Bootstrap UCL | 418.53 |

| | | | |
|---|---|---|---|
| Kolmogorov-Smirnov 5% Critical Value | 0.2746167 | 95% BCA Bootstrap UCL | 474.2505 |
| **Data not Gamma Distributed at 5% Significance Level** | | 95% Chebyshev(Mean, Sd) UCL | 682.72031 |
| | | 97.5% Chebyshev(Mean, Sd) UCL | 876.01633 |
| **Assuming Gamma Distribution** | | 99% Chebyshev(Mean, Sd) UCL | 1,255.71 |
| 95% Approximate Gamma UCL | 503.23576 | | |
| 95% Adjusted Gamma UCL | 579.22228 | | |
| **Potential UCL to Use** | | Use 95% Chebyshev (MVUE) UCL | 563.81276 |

**Manganese (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Observations | 9 | Number of Distinct Observations | 9 |
| **Raw Statistics** | | **Log-transformed Statistics** | |
| Minimum | 440 | Minimum of Log Data | 6.0867747 |
| Maximum | 601 | Maximum of Log Data | 6.3985949 |
| Mean | 526.49 | Mean of log Data | 6.2622272 |
| Median | 518 | SD of log Data | 0.0952286 |
| SD | 49.740888 | | |
| Coefficient of Variation | 0.0944764 | | |
| Skewness | 0.0157938 | | |

**Warning: There are only 9 Values in this data**
**Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions**

**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**

**Relevant UCL Statistics**

| | | | |
|---|---|---|---|
| **Normal Distribution Test** | | **Lognormal Distribution Test** | |
| Shapiro Wilk Test Statistic | 0.9418955 | Shapiro Wilk Test Statistic | 0.9419496 |
| Shapiro Wilk Critical Value | 0.829 | Shapiro Wilk Critical Value | 0.829 |
| **Data appear Normal at 5% Significance Level** | | **Data appear Lognormal at 5% Significance Level** | |
| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
| 95% Student's-t UCL | 557.32186 | 95% H-UCL | N/A |
| **95% UCLs (Adjusted for Skewness)** | | 95% Chebyshev (MVUE) UCL | 599.39522 |
| 95% Adjusted-CLT UCL | 553.85543 | 97.5% Chebyshev (MVUE) UCL | 630.93599 |
| 95% Modified-t UCL | 557.3364 | 99% Chebyshev (MVUE) UCL | 692.89171 |
| **Gamma Distribution Test** | | **Data Distribution** | |
| k star (bias corrected) | 83.410635 | **Data appear Normal at 5% Significance Level** | |
| Theta Star | 6.3120249 | | |

| | | | |
|---|---|---|---|
| nu star | 1,501.4 | | |
| Approximate Chi Square Value (.05) | 1,412.4 | **Nonparametric Statistics** | |
| Adjusted Level of Significance | 0.02308 | 95% CLT UCL | 553.76216 |
| Adjusted Chi Square Value | 1,394.1 | 95% Jackknife UCL | 557.32186 |
| | | 95% Standard Bootstrap UCL | 551.77876 |
| Anderson-Darling Test Statistic | 0.3350307 | 95% Bootstrap-t UCL | 561.67398 |
| Anderson-Darling 5% Critical Value | 0.71998 | 95% Hall's Bootstrap UCL | 568.67805 |
| Kolmogorov-Smirnov Test Statistic | 0.1672515 | 95% Percentile Bootstrap UCL | 552.39667 |
| Kolmogorov-Smirnov 5% Critical Value | 0.27879 | 95% BCA Bootstrap UCL | 552.89111 |
| **Data appear Gamma Distributed at 5% Significance Level** | | 95% Chebyshev(Mean, Sd) UCL | 598.76183 |
| | | 97.5% Chebyshev(Mean, Sd) UCL | 630.03392 |
| **Assuming Gamma Distribution** | | 99% Chebyshev(Mean, Sd) UCL | 691.46186 |
| 95% Approximate Gamma UCL | 559.65928 | | |
| 95% Adjusted Gamma UCL | 566.99917 | | |
| **Potential UCL to Use** | | Use 95% Student's-t UCL | 557.32186 |

**Selenium (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 5 | Number of Detected Data | 1 |
| Number of Distinct Detected Data | 1 | Number of Non-Detect Data | 4 |
| | | Percent Non-Detects | 80.00% |

**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**
**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**
**The data set for variable Selenium (mg/kg) was not processed!**

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit B

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**Summary Statistics for Raw Data Sets with NDs using Detected Data Only**

| | | | | Raw Statistics using Detected Observations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Num Ds** | **NumNDs** | **% NDs** | **Minimum** | **Maximum** | **Mean** | **Median** | **SD** | **MAD/0.675** | **Skewness** | **CV** |
| Aluminum (mg/kg) | 8 | 0 | 0.00% | 5,500 | 11,600 | 7,242.76 | 6,678.50 | 1,948.49 | 1,289.77 | 1.884802 | 0.269026 |
| Antimony (mg/kg) | 3 | 3 | 50.00% | 2.76 | 3.15 | 2.923333 | 2.86 | 0.202567 | 0.148258 | 1.2694107 | 0.0692931 |
| Arsenic (mg/kg) | 5 | 2 | 28.57% | 7.280546 | 18.9 | 13.99611 | 13.7 | 4.349166 | 4.1512231 | -0.857611 | 0.3107411 |
| Iron (mg/kg) | 8 | 0 | 0.00% | 10,659 | 17,630 | 12,833 | 12,221.50 | 2,263.89 | 1,313.57 | 1.5871075 | 0.1764113 |
| Lead (mg/kg) | 9 | 0 | 0.00% | 31 | 1,416 | 267.9742 | 74.4 | 444.7745 | 42.449222 | 2.6692624 | 1.659766 |
| Manganese (mg/kg) | 8 | 0 | 0.00% | 435.2 | 708 | 524.275 | 487 | 92.14262 | 57.67235 | 1.3016792 | 0.1757525 |

| | | | |
|---|---|---|---|
| | | 95% Standard Bootstrap UCL | 8,305.69 |
| Anderson-Darling Test Statistic | 0.497916 | 95% Bootstrap-t UCL | 9,568.73 |
| Anderson-Darling 5% Critical Value | 0.716106 | 95% Hall's Bootstrap UCL | 13,084.83 |
| Kolmogorov-Smirnov Test Statistic | 0.203633 | 95% Percentile Bootstrap UCL | 8,486.75 |
| Kolmogorov-Smirnov 5% Critical Value | 0.293904 | 95% BCA Bootstrap UCL | 8,834.13 |
| **Data appear Gamma Distributed at 5% Significance Level** | | 95% Chebyshev(Mean, Sd) UCL | 10,245.59 |
| | | 97.5% Chebyshev(Mean, Sd) UCL | 11,544.92 |
| **Assuming Gamma Distribution** | | 99% Chebyshev(Mean, Sd) UCL | 14,097.19 |
| 95% Approximate Gamma UCL | 8,645.40 | | |
| 95% Adjusted Gamma UCL | 9,051.89 | | |
| **Potential UCL to Use** | | Use 95% Approximate Gamma UCL | 8,645.40 |

**Antimony (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 6 | Number of Detected Data | 3 |
| Number of Distinct Detected Data | 3 | Number of Non-Detect Data | 3 |
| | | Percent Non-Detects | 50.00% |

| **Raw Statistics** | | **Log-transformed Statistics** | |
|---|---|---|---|
| Minimum Detected | 2.76 | Minimum Detected | 1.015231 |
| Maximum Detected | 3.15 | Maximum Detected | 1.147403 |
| Mean of Detected | 2.923333 | Mean of Detected | 1.071152 |
| SD of Detected | 0.202567 | SD of Detected | 0.068391 |
| Minimum Non-Detect | 3.8 | Minimum Non-Detect | 1.335001 |
| Maximum Non-Detect | 3.8 | Maximum Non-Detect | 1.335001 |

**Warning: There are only 3 Distinct Detected Values in this data set**
**The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.**
**Those methods will return a 'N/A' value on your output display!**

**It is necessary to have 4 or more Distinct Values for bootstrap methods.**
**It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.**

**UCL Statistics**

| **Normal Distribution Test with Detected Values Only** | | **Lognormal Distribution Test with Detected Values Only** | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.926668 | Shapiro Wilk Test Statistic | 0.933709 |
| 5% Shapiro Wilk Critical Value | 0.767 | 5% Shapiro Wilk Critical Value | 0.767 |
| **Data appear Normal at 5% Significance Level** | | **Data appear Lognormal at 5% Significance Level** | |

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit B

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**Assuming Normal Distribution**

| | |
|---|---|
| DL/2 Substitution Method | |
| Mean | 2.411667 |
| SD | 0.574958 |
| 95% DL/2 (t) UCL | 2.88465 |

| | |
|---|---|
| Maximum Likelihood Estimate(MLE) Method | N/A |

**MLE method failed to converge properly**

**Assuming Lognormal Distribution**

| | |
|---|---|
| DL/2 Substitution Method | |
| Mean | 0.856503 |
| SD | 0.239081 |
| 95% H-Stat (DL/2) UCL | 5.104422 |

| | |
|---|---|
| Log ROS Method | |
| Mean in Log Scale | 1.071152 |
| SD in Log Scale | 0.060149 |
| Mean in Original Scale | 2.923161 |
| SD in Original Scale | 0.176982 |
| 95% Percentile Bootstrap UCL | 3.035837 |
| 95% BCA Bootstrap UCL | 3.035837 |

**Gamma Distribution Test with Detected Values Only**

| | |
|---|---|
| k star (bias corrected) | N/A |
| Theta Star | N/A |
| nu star | N/A |
| A-D Test Statistic | 0.343108 |
| 5% A-D Critical Value | N/A |
| K-S Test Statistic | N/A |
| 5% K-S Critical Value | N/A |

**Data not Gamma Distributed at 5% Significance Level**

**Data Distribution Test with Detected Values Only**

**Data appear Normal at 5% Significance Level**

**Assuming Gamma Distribution**

| | |
|---|---|
| Gamma ROS Statistics using Extrapolated Data | |
| Minimum | N/A |
| Maximum | N/A |
| Mean | N/A |
| Median | N/A |
| SD | N/A |
| k star | N/A |
| Theta star | N/A |
| Nu star | N/A |
| AppChi2 | N/A |
| 95% Gamma Approximate UCL | N/A |
| 95% Adjusted Gamma UCL | N/A |

**Nonparametric Statistics**

| | |
|---|---|
| Kaplan-Meier (KM) Method | |
| Mean | 2.923333 |
| SD | 0.165395 |
| SE of Mean | 0.116952 |
| 95% KM (t) UCL | 3.158997 |
| 95% KM (z) UCL | 3.115702 |
| 95% KM (jackknife) UCL | 3.186814 |
| 95% KM (bootstrap t) UCL | 3.570468 |
| 95% KM (BCA) UCL | 3.15 |
| 95% KM (Percentile Bootstrap) UCL | 3.15 |
| 95% KM (Chebyshev) UCL | 3.433115 |
| 97.5% KM (Chebyshev) UCL | 3.653699 |
| 99% KM (Chebyshev) UCL | 4.086991 |

**Potential UCLs to Use**

| | |
|---|---|
| 95% KM (t) UCL | 3.158997 |
| 95% KM (Percentile Bootstrap) UCL | 3.15 |

**Warning: Recommended UCL exceeds the maximum observation**

**Note: DL/2 is not a recommended method.**

**APPENDIX R**
ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit B
*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**Arsenic (MG/KG)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 7 | Number of Detected Data | 5 |
| Number of Distinct Detected Data | 5 | Number of Non-Detect Data | 2 |
| | | Percent Non-Detects | 28.57% |

| **Raw Statistics** | | **Log-transformed Statistics** | |
|---|---|---|---|
| Minimum Detected | 7.280546 | Minimum Detected | 1.985206 |
| Maximum Detected | 18.9 | Maximum Detected | 2.939162 |
| Mean of Detected | 13.99611 | Mean of Detected | 2.591039 |
| SD of Detected | 4.349166 | SD of Detected | 0.3655 |
| Minimum Non-Detect | 1.376 | Minimum Non-Detect | 0.319181 |
| Maximum Non-Detect | 1.376 | Maximum Non-Detect | 0.319181 |

**Warning: There are only 5 Detected Values in this data**
**Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions**

**It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.**

**UCL Statistics**

| **Normal Distribution Test with Detected Values Only** | | **Lognormal Distribution Test with Detected Values Only** | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.937486 | Shapiro Wilk Test Statistic | 0.866964 |
| 5% Shapiro Wilk Critical Value | 0.762 | 5% Shapiro Wilk Critical Value | 0.762 |
| **Data appear Normal at 5% Significance Level** | | **Data appear Lognormal at 5% Significance Level** | |

| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
|---|---|---|---|
| DL/2 Substitution Method | | DL/2 Substitution Method | |
| Mean | 10.19379 | Mean | 1.743894 |
| SD | 7.40123 | SD | 1.477233 |
| 95% DL/2 (t) UCL | 15.62965 | 95% H-Stat (DL/2) UCL | 42.90173 |
| | | | |
| Maximum Likelihood Estimate(MLE) Method | | Log ROS Method | |
| Mean | 13.99927 | Mean in Log Scale | 2.339724 |
| SD | 3.890013 | SD in Log Scale | 0.527817 |
| 95% MLE (t) UCL | 16.8563 | Mean in Original Scale | 11.59183 |
| 95% MLE (Tiku) UCL | 17.37883 | SD in Original Scale | 5.443716 |
| | | 95% Percentile Bootstrap UCL | 14.76857 |
| | | 95% BCA Bootstrap UCL | 14.72572 |

| **Gamma Distribution Test with Detected Values Only** | | **Data Distribution Test with Detected Values Only** | |
|---|---|---|---|
| k star (bias corrected) | 4.388219 | **Data appear Normal at 5% Significance Level** | |
| Theta Star | 3.189473 | | |
| nu star | 43.88219 | | |
| | | | |
| A-D Test Statistic | 0.404383 | **Nonparametric Statistics** | |
| 5% A-D Critical Value | 0.678868 | Kaplan-Meier (KM) Method | |
| K-S Test Statistic | 0.678868 | Mean | 12.07738 |
| 5% K-S Critical Value | 0.357563 | SD | 4.473539 |
| **Data appear Gamma Distributed at 5% Significance Level** | | SE of Mean | 1.890415 |
| | | 95% KM (t) UCL | 15.75079 |
| **Assuming Gamma Distribution** | | 95% KM (z) UCL | 15.18683 |
| Gamma ROS Statistics using Extrapolated Data | | 95% KM (jackknife) UCL | 16.25557 |
| Minimum | 7.280546 | 95% KM (bootstrap t) UCL | 14.99314 |
| Maximum | 18.9 | 95% KM (BCA) UCL | 16.71429 |
| Mean | 12.81191 | 95% KM (Percentile Bootstrap) UCL | 16.01429 |
| Median | 13.6 | 95% KM (Chebyshev) UCL | 20.31751 |
| SD | 4.161916 | 97.5% KM (Chebyshev) UCL | 23.88302 |
| k star | 6.043795 | 99% KM (Chebyshev) UCL | 30.88677 |
| Theta star | 2.119845 | | |
| Nu star | 84.61314 | **Potential UCLs to Use** | |
| AppChi2 | 64.41154 | 95% KM (t) UCL | 15.75079 |
| 95% Gamma Approximate UCL | 16.83015 | 95% KM (Percentile Bootstrap) UCL | 16.01429 |
| 95% Adjusted Gamma UCL | 18.33836 | | |

**Note: DL/2 is not a recommended method.**

**Iron (mg/kg)**

| **General Statistics** | | | |
|---|---|---|---|
| Number of Valid Observations | 8 | Number of Distinct Observations | 8 |
| | | | |
| **Raw Statistics** | | **Log-transformed Statistics** | |
| Minimum | 10,659 | Minimum of Log Data | 9.27416 |
| Maximum | 17,630 | Maximum of Log Data | 9.777357 |
| Mean | 12,833 | Mean of log Data | 9.447541 |
| Median | 12,221.50 | SD of log Data | 0.162948 |
| SD | 2,263.89 | | |
| Coefficient of Variation | 0.176411 | | |
| Skewness | 1.587108 | | |

**Warning: There are only 8 Values in this data**
**Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions**

**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit B

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**Relevant UCL Statistics**

| **Normal Distribution Test** | | **Lognormal Distribution Test** | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.848158 | Shapiro Wilk Test Statistic | 0.893222 |
| Shapiro Wilk Critical Value | 0.818 | Shapiro Wilk Critical Value | 0.818 |
| **Data appear Normal at 5% Significance Level** | | **Data appear Lognormal at 5% Significance Level** | |

| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
|---|---|---|---|
| 95% Student's-t UCL | 14,349.43 | 95% H-UCL | 14,446.22 |
| **95% UCLs (Adjusted for Skewness)** | | 95% Chebyshev (MVUE) UCL | 16,049.54 |
| 95% Adjusted-CLT UCL | 14,629.45 | 97.5% Chebyshev (MVUE) UCL | 17,444.86 |
| 95% Modified-t UCL | 14,424.28 | 99% Chebyshev (MVUE) UCL | 20,185.67 |

| **Gamma Distribution Test** | | **Data Distribution** | |
|---|---|---|---|
| k star (bias corrected) | 25.7309 | **Data appear Normal at 5% Significance Level** | |
| Theta Star | 498.7389 | | |
| nu star | 411.6944 | | |
| Approximate Chi Square Value (.05) | 365.6598 | **Nonparametric Statistics** | |
| Adjusted Level of Significance | 0.01946 | 95% CLT UCL | 14,149.55 |
| Adjusted Chi Square Value | 354.6361 | 95% Jackknife UCL | 14,349.43 |
| | | 95% Standard Bootstrap UCL | 14,078.92 |
| Anderson-Darling Test Statistic | 0.475363 | 95% Bootstrap-t UCL | 16,211.89 |
| Anderson-Darling 5% Critical Value | 0.715195 | 95% Hall's Bootstrap UCL | 21,988.21 |
| Kolmogorov-Smirnov Test Statistic | 0.240391 | 95% Percentile Bootstrap UCL | 14,221.13 |
| Kolmogorov-Smirnov 5% Critical Value | 0.293545 | 95% BCA Bootstrap UCL | 14,671.50 |
| **Data appear Gamma Distributed at 5% Significance Level** | | 95% Chebyshev(Mean, Sd) UCL | 16,321.88 |
| | | 97.5% Chebyshev(Mean, Sd) UCL | 17,831.53 |
| **Assuming Gamma Distribution** | | 99% Chebyshev(Mean, Sd) UCL | 20,796.93 |
| 95% Approximate Gamma UCL | 14,448.61 | | |
| 95% Adjusted Gamma UCL | 14,897.73 | | |

| | | | |
|---|---|---|---|
| **Potential UCL to Use** | | Use 95% Student's-t UCL | 14,349.43 |

**Lead (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Observations | 9 | Number of Distinct Observations | 9 |

| **Raw Statistics** | | **Log-transformed Statistics** | |
|---|---|---|---|
| Minimum | 31 | Minimum of Log Data | 3.433987 |
| Maximum | 1,416 | Maximum of Log Data | 7.255591 |
| Mean | 267.9742 | Mean of log Data | 4.80302 |
| Median | 74.4 | SD of log Data | 1.199929 |
| SD | 444.7745 | | |
| Coefficient of Variation | 1.659766 | | |
| Skewness | 2.669262 | | |

**Warning: There are only 9 Values in this data**

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit B

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions**

**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**

**Relevant UCL Statistics**

| **Normal Distribution Test** | | **Lognormal Distribution Test** | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.578637 | Shapiro Wilk Test Statistic | 0.885785 |
| Shapiro Wilk Critical Value | 0.829 | Shapiro Wilk Critical Value | 0.829 |
| **Data not Normal at 5% Significance Level** | | **Data appear Lognormal at 5% Significance Level** | |
| | | | |
| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
| 95% Student's-t UCL | 543.6674 | 95% H-UCL | 1,202.81 |
| **95% UCLs (Adjusted for Skewness)** | | 95% Chebyshev (MVUE) UCL | 626.6865 |
| 95% Adjusted-CLT UCL | 652.7885 | 97.5% Chebyshev (MVUE) UCL | 801.3835 |
| 95% Modified-t UCL | 565.653 | 99% Chebyshev (MVUE) UCL | 1144.542 |
| | | | |
| **Gamma Distribution Test** | | **Data Distribution** | |
| k star (bias corrected) | 0.579832 | **Data appear Lognormal at 5% Significance Level** | |
| Theta Star | 462.1585 | | |
| nu star | 10.43697 | | |
| Approximate Chi Square Value (.05) | 4.216689 | **Nonparametric Statistics** | |
| Adjusted Level of Significance | 0.02308 | 95% CLT UCL | 511.8372 |
| Adjusted Chi Square Value | 3.423307 | 95% Jackknife UCL | 543.6674 |
| | | 95% Standard Bootstrap UCL | 503.1016 |
| Anderson-Darling Test Statistic | 0.910757 | 95% Bootstrap-t UCL | 1,564.28 |
| Anderson-Darling 5% Critical Value | 0.751184 | 95% Hall's Bootstrap UCL | 1,515.08 |
| Kolmogorov-Smirnov Test Statistic | 0.331364 | 95% Percentile Bootstrap UCL | 531.8187 |
| Kolmogorov-Smirnov 5% Critical Value | 0.289198 | 95% BCA Bootstrap UCL | 667.0111 |
| **Data not Gamma Distributed at 5% Significance Level** | | 95% Chebyshev(Mean, Sd) UCL | 914.2166 |
| | | 97.5% Chebyshev(Mean, Sd) UCL | 1,193.85 |
| **Assuming Gamma Distribution** | | 99% Chebyshev(Mean, Sd) UCL | 1,743.12 |
| 95% Approximate Gamma UCL | 663.2787 | | |
| 95% Adjusted Gamma UCL | 816.9994 | | |
| | | | |
| **Potential UCL to Use** | | Use 95% Chebyshev (MVUE) UCL | 626.6865 |

**Manganese (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Observations | 8 | Number of Distinct Observations | 8 |

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit B

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

| **Raw Statistics** | | **Log-transformed Statistics** | |
|---|---|---|---|
| Minimum | 435.2 | Minimum of Log Data | 6.075806 |
| Maximum | 708 | Maximum of Log Data | 6.562444 |
| Mean | 524.275 | Mean of log Data | 6.249618 |
| Median | 487 | SD of log Data | 0.164834 |
| SD | 92.14262 | | |
| Coefficient of Variation | 0.175753 | | |
| Skewness | 1.301679 | | |

**Warning: There are only 8 Values in this data**

**Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions**

**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**

**Relevant UCL Statistics**

| **Normal Distribution Test** | | **Lognormal Distribution Test** | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.864984 | Shapiro Wilk Test Statistic | 0.89567 |
| Shapiro Wilk Critical Value | 0.818 | Shapiro Wilk Critical Value | 0.818 |
| **Data appear Normal at 5% Significance Level** | | **Data appear Lognormal at 5% Significance Level** | |
| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
| 95% Student's-t UCL | 585.9953 | 95% H-UCL | 591.1364 |
| **95% UCLs (Adjusted for Skewness)** | | 95% Chebyshev (MVUE) UCL | 657.2808 |
| 95% Adjusted-CLT UCL | 593.8797 | 97.5% Chebyshev (MVUE) UCL | 714.952 |
| 95% Modified-t UCL | 588.4941 | 99% Chebyshev (MVUE) UCL | 828.2359 |

| **Gamma Distribution Test** | | **Data Distribution** | |
|---|---|---|---|
| k star (bias corrected) | 25.39259 | **Data appear Normal at 5% Significance Level** | |
| Theta Star | 20.64677 | | |
| nu star | 406.2815 | | |
| Approximate Chi Square Value (.05) | 360.5584 | **Nonparametric Statistics** | |
| Adjusted Level of Significance | 0.01946 | 95% CLT UCL | 577.86 |
| Adjusted Chi Square Value | 349.6141 | 95% Jackknife UCL | 585.9953 |
| | | 95% Standard Bootstrap UCL | 574.2227 |
| Anderson-Darling Test Statistic | 0.47506 | 95% Bootstrap-t UCL | 636.1731 |
| Anderson-Darling 5% Critical Value | 0.715222 | 95% Hall's Bootstrap UCL | 656.441 |
| Kolmogorov-Smirnov Test Statistic | 0.227095 | 95% Percentile Bootstrap UCL | 573.4 |
| Kolmogorov-Smirnov 5% Critical Value | 0.293553 | 95% BCA Bootstrap UCL | 587.75 |
| **Data appear Gamma Distributed at 5% Significance Level** | | 95% Chebyshev(Mean, Sd) UCL | 666.2763 |
| | | 97.5% Chebyshev(Mean, Sd) UCL | 727.7204 |
| **Assuming Gamma Distribution** | | 99% Chebyshev(Mean, Sd) UCL | 848.4154 |
| 95% Approximate Gamma UCL | 590.7593 | | |
| 95% Adjusted Gamma UCL | 609.2523 | | |

| **Potential UCL to Use** | Use 95% Student's-t UCL | 585.9953 |
|---|---|---|

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit C

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**General UCL Statistics for Data Sets with Non-Detects**

| **User Selected Options** | | |
|---|---|---|
| Full Precision | ON | |
| Confidence Coefficient | 95% | |
| Number of Bootstrap Operations | | 2,000 |

**Aluminum (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Observations | 4 | Number of Distinct Observations | 4 |

**Warning: This data set only has 4 observations!**
**Data set is too small to compute reliable and meaningful statistics and estimates!**
**The data set for variable Aluminum (mg/kg) was not processed!**

**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**
**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**

**Antimony (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Data | 2 | Number of Detected Data | 1 |
| Number of Distinct Detected Data | 1 | Number of Non-Detect Data | 1 |
| | | Percent Non-Detects | 50.00% |

**Warning: This data set only has 2 observations!**
**Data set is too small to compute reliable and meaningful statistics and estimates!**
**The data set for variable Antimony (mg/kg) was not processed!**

**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**
**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**

**Iron (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Observations | 4 | Number of Distinct Observations | 4 |

**Warning: This data set only has 4 observations!**
**Data set is too small to compute reliable and meaningful statistics and estimates!**
**The data set for variable Iron (mg/kg) was not processed!**

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit C

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**
**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**

**Manganese (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Observations | 4 | Number of Distinct Observations | 4 |

**Warning: This data set only has 4 observations!**
**Data set is too small to compute reliable and meaningful statistics and estimates!**
**The data set for variable Manganese (mg/kg) was not processed!**

**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**
**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit D

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**Summary Statistics for Raw Data Sets with NDs using Detected Data Only**

| | | | | Raw Statistics using Detected Observations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Num Ds** | **NumNDs** | **% NDs** | **Minimum** | **Maximum** | **Mean** | **Median** | **SD** | **MAD/0.675** | **Skewness** | **CV** |
| Aluminum (mg/kg) | 6 | 0 | 0.00% | 6,987 | 12,900 | 9,170.43 | 7,841.80 | 2,741.98 | 1,219.13 | 0.8599339 | 0.2990028 |
| Iron (mg/kg) | 6 | 0 | 0.00% | 11,678 | 19,100 | 15,879.17 | 16,424 | 2,803.25 | 3,077.09 | -0.523952 | 0.1765362 |
| Manganese (mg/kg) | 6 | 0 | 0.00% | 306 | 1,040 | 628.6 | 606.3 | 254.11903 | 217.19792 | 0.6006249 | 0.4042619 |
| Thallium (mg/kg) | 3 | 0 | 0.00% | 2.74 | 4.66 | 3.6733333 | 3.62 | 0.9611105 | 1.3046701 | 0.2489422 | 0.2616453 |

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit D

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**General UCL Statistics for Data Sets with Non-Detects**

| **User Selected Options** | | |
|---|---|---|
| Full Precision | ON | |
| Confidence Coefficient | 95% | |
| Number of Bootstrap Operations | | 2,000 |

**Aluminum (mg/kg)**

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Observations | 6 | Number of Distinct Observations | 6 |

| **Raw Statistics** | | **Log-transformed Statistics** | |
|---|---|---|---|
| Minimum | 6,987 | Minimum of Log Data | 8.8518066 |
| Maximum | 12,900 | Maximum of Log Data | 9.4649826 |
| Mean | 9170.4333 | Mean of log Data | 9.0889918 |
| Median | 7841.8 | SD of log Data | 0.2831899 |
| SD | 2,741.98 | | |
| Coefficient of Variation | 0.2990028 | | |
| Skewness | 0.8599339 | | |

**Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!**

**It is suggested to collect at least 8 to 10 observations using these statistical methods!**
**If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**

**Warning: There are only 6 Values in this data**
**Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions**

**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**

**Relevant UCL Statistics**

| **Normal Distribution Test** | | **Lognormal Distribution Test** | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.7722045 | Shapiro Wilk Test Statistic | 0.7918765 |
| Shapiro Wilk Critical Value | 0.788 | Shapiro Wilk Critical Value | 0.788 |
| **Data not Normal at 5% Significance Level** | | **Data appear Lognormal at 5% Significance Level** | |

| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
|---|---|---|---|
| 95% Student's-t UCL | 11,426.10 | 95% H-UCL | 12,178.13 |
| **95% UCLs (Adjusted for Skewness)** | | 95% Chebyshev (MVUE) UCL | 13,770.55 |
| 95% Adjusted-CLT UCL | 11,431.61 | 97.5% Chebyshev (MVUE) UCL | 15,766.94 |
| 95% Modified-t UCL | 11,491.60 | 99% Chebyshev (MVUE) UCL | 19,688.45 |

| **Gamma Distribution Test** | | **Data Distribution** | |
|---|---|---|---|
| k star (bias corrected) | 7.388115 | **Data Follow Appr. Gamma Distribution at 5% Significance Level** | |
| Theta Star | 1,241.24 | | |
| nu star | 88.657379 | | |
| Approximate Chi Square Value (.05) | 67.949066 | **Nonparametric Statistics** | |
| Adjusted Level of Significance | 0.01222 | 95% CLT UCL | 11,011.70 |
| Adjusted Chi Square Value | 61.433922 | 95% Jackknife UCL | 11,426.10 |
| | | 95% Standard Bootstrap UCL | 10,887.07 |
| Anderson-Darling Test Statistic | 0.7192816 | 95% Bootstrap-t UCL | 18,977.16 |
| Anderson-Darling 5% Critical Value | 0.6977653 | 95% Hall's Bootstrap UCL | 24,959.71 |
| Kolmogorov-Smirnov Test Statistic | 0.2749839 | 95% Percentile Bootstrap UCL | 10,985.33 |
| Kolmogorov-Smirnov 5% Critical Value | 0.3321384 | 95% BCA Bootstrap UCL | 11,079.50 |
| **Data follow Appr. Gamma Distribution at 5% Significance Level** | | 95% Chebyshev(Mean, Sd) UCL | 14,049.83 |
| | | 97.5% Chebyshev(Mean, Sd) UCL | 16,161.15 |
| **Assuming Gamma Distribution** | | 99% Chebyshev(Mean, Sd) UCL | 20,308.43 |
| 95% Approximate Gamma UCL | 11,965.24 | | |
| 95% Adjusted Gamma UCL | 13,234.16 | | |
| **Potential UCL to Use** | | Use 95% Approximate Gamma UCL | 11,965.24 |

**Iron (mg/kg)**

| **General Statistics** | | | |
|---|---|---|---|
| Number of Valid Observations | 6 | Number of Distinct Observations | 6 |

| **Raw Statistics** | | **Log-transformed Statistics** | |
|---|---|---|---|
| Minimum | 11,678 | Minimum of Log Data | 9.365462 |
| Maximum | 19,100 | Maximum of Log Data | 9.8574436 |
| Mean | 15,879.17 | Mean of log Data | 9.6588949 |
| Median | 16,424 | SD of log Data | 0.1855474 |
| SD | 2,803.25 | | |
| Coefficient of Variation | 0.1765362 | | |
| Skewness | -0.523952 | | |

**Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!**

**It is suggested to collect at least 8 to 10 observations using these statistical methods!**
**If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**

**Warning: There are only 6 Values in this data**
**Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions**

**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit D

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**Relevant UCL Statistics**

| **Normal Distribution Test** | | **Lognormal Distribution Test** | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.9517419 | Shapiro Wilk Test Statistic | 0.9352178 |
| Shapiro Wilk Critical Value | 0.788 | Shapiro Wilk Critical Value | 0.788 |
| **Data appear Normal at 5% Significance Level** | | **Data appear Lognormal at 5% Significance Level** | |
| | | | |
| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
| 95% Student's-t UCL | 18,185.23 | 95% H-UCL | 18,884.87 |
| **95% UCLs (Adjusted for Skewness)** | | 95% Chebyshev (MVUE) UCL | 21,131.52 |
| 95% Adjusted-CLT UCL | 17,500.01 | 97.5% Chebyshev (MVUE) UCL | 23,401.14 |
| 95% Modified-t UCL | 18,144.43 | 99% Chebyshev (MVUE) UCL | 27,859.38 |
| | | | |
| **Gamma Distribution Test** | | **Data Distribution** | |
| k star (bias corrected) | 18.220721 | **Data appear Normal at 5% Significance Level** | |
| Theta Star | 871.48947 | | |
| nu star | 218.64866 | | |
| Approximate Chi Square Value (.05) | 185.42602 | **Nonparametric Statistics** | |
| Adjusted Level of Significance | 0.01222 | 95% CLT UCL | 17,761.57 |
| Adjusted Chi Square Value | 174.32411 | 95% Jackknife UCL | 18,185.23 |
| | | 95% Standard Bootstrap UCL | 17,596.38 |
| Anderson-Darling Test Statistic | 0.2790323 | 95% Bootstrap-t UCL | 17,741.32 |
| Anderson-Darling 5% Critical Value | 0.6969765 | 95% Hall's Bootstrap UCL | 17,402.26 |
| Kolmogorov-Smirnov Test Statistic | 0.2347145 | 95% Percentile Bootstrap UCL | 17,531 |
| Kolmogorov-Smirnov 5% Critical Value | 0.3317733 | 95% BCA Bootstrap UCL | 17,393.17 |
| **Data appear Gamma Distributed at 5% Significance Level** | | 95% Chebyshev(Mean, Sd) UCL | 20,867.58 |
| | | 97.5% Chebyshev(Mean, Sd) UCL | 23,026.07 |
| **Assuming Gamma Distribution** | | 99% Chebyshev(Mean, Sd) UCL | 27,266.01 |
| 95% Approximate Gamma UCL | 18,724.23 | | |
| 95% Adjusted Gamma UCL | 19,916.69 | | |
| | | | |
| **Potential UCL to Use** | | Use 95% Student's-t UCL | 18,185.23 |

**Manganese (mg/kg)**

| **General Statistics** | | | |
|---|---|---|---|
| Number of Valid Observations | 6 | Number of Distinct Observations | 6 |
| | | | |
| **Raw Statistics** | | **Log-transformed Statistics** | |
| Minimum | 306 | Minimum of Log Data | 5.7235851 |
| Maximum | 1,040 | Maximum of Log Data | 6.946976 |
| Mean | 628.6 | Mean of log Data | 6.3723727 |
| Median | 606.3 | SD of log Data | 0.4212758 |
| SD | 254.11903 | | |
| Coefficient of Variation | 0.4042619 | | |
| Skewness | 0.6006249 | | |

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit D

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**Warning: A sample size of 'n' = 6 may not adequate enough to compute meaningful and reliable test statistics and estimates!**

**It is suggested to collect at least 8 to 10 observations using these statistical methods!**
**If possible compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**

**Warning: There are only 6 Values in this data**
**Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions**

**The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.**

**Relevant UCL Statistics**

| **Normal Distribution Test** | | **Lognormal Distribution Test** | |
|---|---|---|---|
| Shapiro Wilk Test Statistic | 0.9806526 | Shapiro Wilk Test Statistic | 0.9936888 |
| Shapiro Wilk Critical Value | 0.788 | Shapiro Wilk Critical Value | 0.788 |
| **Data appear Normal at 5% Significance Level** | | **Data appear Lognormal at 5% Significance Level** | |

| **Assuming Normal Distribution** | | **Assuming Lognormal Distribution** | |
|---|---|---|---|
| 95% Student's-t UCL | 837.64849 | 95% H-UCL | 1,016.88 |
| **95% UCLs (Adjusted for Skewness)** | | 95% Chebyshev (MVUE) UCL | 1,101.78 |
| 95% Adjusted-CLT UCL | 826.4244 | 97.5% Chebyshev (MVUE) UCL | 1,305.96 |
| 95% Modified-t UCL | 841.88822 | 99% Chebyshev (MVUE) UCL | 1,707.04 |

| **Gamma Distribution Test** | | **Data Distribution** | |
|---|---|---|---|
| k star (bias corrected) | 3.70747 | **Data appear Normal at 5% Significance Level** | |
| Theta Star | 169.54959 | | |
| nu star | 44.48964 | | |
| Approximate Chi Square Value (.05) | 30.191136 | **Nonparametric Statistics** | |
| Adjusted Level of Significance | 0.01222 | 95% CLT UCL | 799.24313 |
| Adjusted Chi Square Value | 26.012515 | 95% Jackknife UCL | 837.64849 |
| | | 95% Standard Bootstrap UCL | 784.88694 |
| Anderson-Darling Test Statistic | 0.1413094 | 95% Bootstrap-t UCL | 902.24349 |
| Anderson-Darling 5% Critical Value | 0.6981728 | 95% Hall's Bootstrap UCL | 941.66284 |
| Kolmogorov-Smirnov Test Statistic | 0.1111346 | 95% Percentile Bootstrap UCL | 783.66667 |
| Kolmogorov-Smirnov 5% Critical Value | 0.3326541 | 95% BCA Bootstrap UCL | 798.83333 |
| **Data appear Gamma Distributed at 5% Significance Level** | | 95% Chebyshev(Mean, Sd) UCL | 1,080.81 |
| | | 97.5% Chebyshev(Mean, Sd) UCL | 1,276.48 |
| **Assuming Gamma Distribution** | | 99% Chebyshev(Mean, Sd) UCL | 1,660.84 |
| 95% Approximate Gamma UCL | 926.30459 | | |
| 95% Adjusted Gamma UCL | 1,075.11 | | |

| | | | |
|---|---|---|---|
| **Potential UCL to Use** | | Use 95% Student's-t UCL | 837.64849 |

**Thallium (mg/kg)**

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit D

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**General Statistics**

| | | | |
|---|---|---|---|
| Number of Valid Observations | 3 | Number of Distinct Observations | 3 |

**Warning: This data set only has 3 observations!**
**Data set is too small to compute reliable and meaningful statistics and estimates!**
**The data set for variable Thallium (mg/kg) was not processed!**

**It is suggested to collect at least 8 to 10 observations before using these statistical methods!**
**If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.**

**APPENDIX R**

ProUCL Output – On-Site Soil (0-10 ft bgs), Exposure Unit E

*St. Louis Ordnance Plant, Former Hanley Area, St. Louis, Missouri*

**Summary Statistics for Raw Data Sets with NDs using Detected Data Only**

| | | | | Raw Statistics using Detected Observations | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Num Ds** | **NumNDs** | **% NDs** | **Minimum** | **Maximum** | **Mean** | **Median** | **SD** | **MAD/0.675** | **Skewness** | **CV** |
| Aluminum (mg/kg) | 7 | 0 | 0.00% | 6,292 | 10,600 | 8,026.14 | 7,775 | 1,386.52 | 1,282.43 | 0.928603 | 0.17275 |
| Antimony (mg/kg) | 1 | 4 | 80.00% | 14.1 | 14.1 | 14.1 | 14.1 | N/A | 0 | N/A | N/A |
| Arsenic (MG/KG) | 7 | 0 | 0.00% | 5.12 | 16.5 | 10.412454 | 11 | 4.518998 | 5.189029 | -0.008032 | 0.433999 |
| Chromium (mg/kg) | 8 | 1 | 11.11% | 13 | 57.7 | 21.78425 | 17 | 14.75732 | 4.392884 | 2.645185 | 0.677431 |
| Iron (mg/kg) | 7 | 0 | 0.00% | 5,800 | 17,300 | 13810 | 14,793 | 3,833.40 | 2520.386 | -1.851035 | 0.277581 |
| Manganese (mg/kg) | 7 | 0 | 0.00% | 509 | 1060 | 688.65286 | 619 | 207.6768 | 108.2283 | 1.280718 | 0.30157 |
| Thallium (mg/kg) | 1 | 4 | 80.00% | 5.07 | 5.07 | 5.07 | 5.07 | N/A | 0 | N/A | N/A |
| Vanadium (mg/kg) | 6 | 0 | 0.00% | 20.3 | 44.1 | 27.003667 | 24.75 | 8.672877 | 3.500371 | 2.079426 | 0.321174 |