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February 9, 2012

Nevada Division of Environmental Protection
Bureau of Corrective Actions
901 S. Stewart Street, Suite 3005
Carson City, Nevada 89701-5249

**VIA:** Electronic Mail

**ATTN:** Jack Yates

**CC:** Cindi Byrns (Comstock), Joe McGinley (MGA), Carolyn McIntosh (Patton Boggs), David Friedman (NDEP), Jeff Collins (NDEP)

**RE: SAMPLING AND ANALYSIS PLAN FOR COMSTOCK MINING INC., AREAS WITHIN NDEP-DEFINED RISK ZONES OF THE CARSON RIVER MERCURY SITE, REQUEST TO INSTALL ADDITIONAL BORINGS FOR GEOTECHNICAL PURPOSES**

Dear Mr. Yates:

On behalf of Comstock Mining Inc. (Comstock), McGinley and Associates (MGA) is providing this request to install additional borings for geotechnical purposes. As an initial step, Comstock proposes to install four geotechnical borings at areas where environmental sampling has already been conducted.

Specifically, environmental sampling, per the NDEP-approved Sampling and Analysis Plan (SAP) was conducted at locations LP-08, LP-09, LP-10, and HM-07. Locations LP-08 – LP-10 were deep borings installed from the land surface to the interface with native geology in the Lucerne Pit. Location HM-07 was a shallow boring installed from 0-24" in an existing roadway. These locations and the related laboratory analytical data are provided on the attached Figure.

The analytical laboratory data for these locations and all other locations received to date are summarized on the attached Tables 1-3. The four locations of interest are highlighted in yellow.

For all samples at all locations the lead and mercury concentrations were below the NDEP Screening/Action Levels as shown on the attached Tables 2 and 3. The site-wide average concentration for lead and mercury are 26.24 mg/kg and 1.69 mg/kg, respectively. The site-wide maximum concentrations are 75.70 mg/kg and 29 mg/kg, respectively. The NDEP Screening/Action Levels are 400 mg/kg and 80 mg/kg respectively. For the five locations of interest the maximum concentrations are 42.3 mg/kg and 1.73 mg/kg, respectively.

Arsenic, however, exceeds the NDEP Screening/Action Level of 32 mg/kg at several locations, these locations are highlighted in green on the attached Table 1. The arsenic data and related summary statistics are summarized on Table 1. The site-wide average and maximum concentrations are 36.92

mg/kg and 120 mg/kg, respectively. For the four locations listed above, the maximum concentration is 120 mg/kg at location LP-10 at 30' below ground surface (bgs).

For the borings that are proposed to be installed, it is expected that the 0-6" bgs data will represent the highest likelihood of generating dust. For this depth increment the data at these four locations are 21.7, 28.2, 34.4 and 44.9 mg/kg. All of these are within the range of background concentrations cited within the NDEP's Screening Action Level for Arsenic in Surface Soil in the Carson River Basin document. This document notes that background concentrations of arsenic ranged as high as 73 mg/kg in the data collected. The NDEP's selected Screening/Action Level of 32 mg/Kg represented the 95$^{th}$ percentile of the data set.

As an additional line of evidence, MGA has conducted a quantitative health risk assessment (HRA) for the arsenic data. This HRA is attached as Attachment 1 and is summarized herein. The HRA shows that under the current scenario of a maximum concentration of 120 mg/Kg and the expected duration for the installation of these borings (20 days) that the off-site residents would not be adversely impacted. MGA has selected exposure parameters that are conservative, such as using the maximum concentration instead of a 95$^{th}$ percentile upper confidence limit. MGA has also run additional exposure scenarios assuming arsenic concentrations up to 300 mg/Kg and drilling for 24 hours per day, 350 days per year for 30 years. These scenarios also demonstrate no adverse effect for off-site residents and are presented in Attachment 1.

Additionally, MGA believes that the absence of concentrations above the pertinent NDEP Screening/Action Levels for the other contaminants of concern (COCs) is a strong line of evidence that this portion of the site is not impacted by historic mine or mill activities. The site history and conceptual site model (CSM) discussed in the NDEP's Carson River Mercury Superfund Site Long-Term Sampling and Response Plan (LTSRP) indicates that the COCs should occur together. Furthermore, the LTSRP notes that both lead and arsenic should have been concentrated in the wastes along with the mercury. It is MGA's belief that the presence of arsenic above the NDEP's Screening/Action Level with the absence of elevated levels of mercury and lead indicate that the arsenic values are representative of background conditions. This will be supported further once the background sample data is received from the laboratory.

The purpose of this request is to allow Comstock to install geotechnical borings. Regardless of the background data, the absence of elevated levels of mercury and lead indicate that the sole COC that may be present is arsenic. The quantitative HRA demonstrates that the drilling activities will not adversely affect off-site residents. Comstock will conduct drilling activities utilizing a core drill that operates under wet conditions. In addition, water trucks will be utilized to water the access roads and drilling locations. This methodology will allow Comstock to maintain adequate dust control.

McGinley and Associates, Inc. appreciates the opportunity to submit this request and we look forward to working with you on this project. Should you have any questions regarding this notification, please contact us at (702) 260-4961 or at brakvica@mcgin.com. If this request is acceptable to you, please advise us at brakvica@mcgin.com.

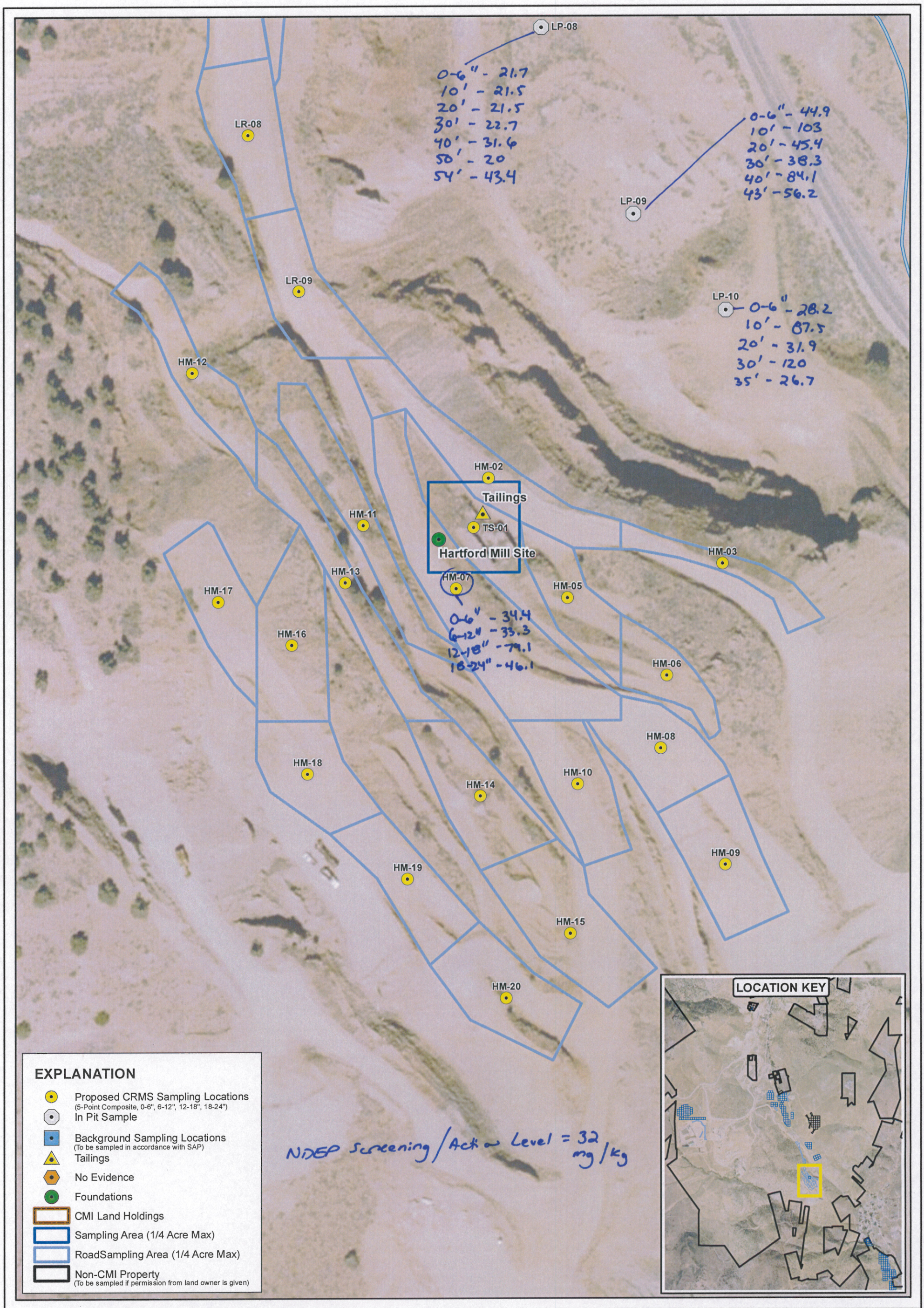
Respectfully submitted,
**McGinley and Associates, Inc.**

Brian A. Rakvica, P.E., C.E.M. #2260, Exp. Date 09/21/12
Senior Project Manager

Reviewed by:

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession, and to the best of my knowledge, comply with all applicable federal, state and local statutes, regulations and ordinances.

Joseph M. McGinley, C.E.M. #1036, Exp. Date 11/12
Principal

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COMSTOCK MINING INC
Revitalizing the Comstock

Comstock

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| DESIGN: - | DRAWN: BCH | REVIEWED: - |
| SCALE: 1 inch = 100 feet | DATE: 1/25/2012 | |
| FILE: CRMS_Sampling_Locations_20120109_BCH.mxd | | |

DRAWING TITLE:

**Hartford Mill Site**

ARSENIC DATA (mg/kg)

**Comstock Mining, Inc.**
**CRMS Sample & Analysis Plan**

ISSUED FOR: -

DRAWING NO. Figure 7

SRK JOB NO. 360000.020

REVISION NO. A

PATH: H:\Comstock Mining Inc\360000.020_Engineering Consulting\40_Drafting\task_020_SCP\CRMS_Sampling_Locations_20120109_BCH.mxd

**Table 1 - Summary of Arsenic Data**

| Sample | Date Collected | Units | Component | Result |
|---|---|---|---|---|
| COM001-SS-HM12-0-6" | 1/25/2012 | mg/Kg | Arsenic, Total | 20.2 |
| COM001-SS-HM12-12"-18" | 1/25/2012 | mg/Kg | Arsenic, Total | 17.8 |
| COM001-SS-HM12-18"-24" | 1/25/2012 | mg/Kg | Arsenic, Total | 19.7 |
| COM001-SS-HM12-6"-12" | 1/25/2012 | mg/Kg | Arsenic, Total | 33.3 |
| COM001-SS-HM6-0-6" | 1/27/2012 | mg/Kg | Arsenic, Total | 33.1 |
| COM001-SS-HM6-6-12" | 1/27/2012 | mg/Kg | Arsenic, Total | 24.8 |
| COM001-SS-HM6-12-18" | 1/27/2012 | mg/Kg | Arsenic, Total | 16.1 |
| COM001-SS-LR1-0-6" | 1/27/2012 | mg/Kg | Arsenic, Total | 40.2 |
| COM001-SS-LR1-6-12" | 1/27/2012 | mg/Kg | Arsenic, Total | 42 |
| COM001-SS-LR1-12-18" | 1/27/2012 | mg/Kg | Arsenic, Total | 37.6 |
| COM001-SS-LR1-18-24" | 1/27/2012 | mg/Kg | Arsenic, Total | 28.8 |
| COM001-SS-LR2-0-6" | 1/27/2012 | mg/Kg | Arsenic, Total | 33.1 |
| COM001-SS-LR2-6-12" | 1/27/2012 | mg/Kg | Arsenic, Total | 30.9 |
| COM001-SS-LR2-12-18" | 1/27/2012 | mg/Kg | Arsenic, Total | 34.8 |
| COM001-SS-LR2-18-24" | 1/27/2012 | mg/Kg | Arsenic, Total | 18.8 |
| COM001-SS-LR7-0-6" | 1/31/2012 | mg/Kg | Arsenic, Total | 30.3 |
| COM001-SS-LR7-6-12" | 1/31/2012 | mg/Kg | Arsenic, Total | 23.8 |
| COM001-SS-LR7-12-18" | 1/31/2012 | mg/Kg | Arsenic, Total | 27.6 |
| COM001-SS-LR7-18-24" | 1/31/2012 | mg/Kg | Arsenic, Total | 17.7 |
| COM001-SS-HM6-18-24" | 1/27/2012 | mg/Kg | Arsenic, Total | 18.2 |
| COM001-SS-HM15-0-6" | 1/25/2012 | mg/Kg | Arsenic, Total | 25.3 |
| COM001-SS-HM15-12-18" | 1/25/2012 | mg/Kg | Arsenic, Total | 19.9 |
| COM001-SS-HM15-18-24" | 1/25/2012 | mg/Kg | Arsenic, Total | 18.6 |
| COM001-SS-HM15-6-12" | 1/25/2012 | mg/Kg | Arsenic, Total | 23.7 |
| COM001-SS-HM-16-0-6" | 1/24/2012 | mg/Kg | Arsenic, Total | 49.3 |
| COM001-SS-HM-16-12-18" | 1/24/2012 | mg/Kg | Arsenic, Total | 40.7 |
| COM001-SS-HM-16-18-24" | 1/24/2012 | mg/Kg | Arsenic, Total | 52 |
| COM001-SS-HM-16-6-12" | 1/24/2012 | mg/Kg | Arsenic, Total | 63.7 |
| COM001-SS-HM-17-0-6" | 1/24/2012 | mg/Kg | Arsenic, Total | 38.7 |
| COM001-SS-HM-17-12"-18 | 1/24/2012 | mg/Kg | Arsenic, Total | 33.3 |
| COM001-SS-HM-17-18"-24 | 1/24/2012 | mg/Kg | Arsenic, Total | 37.7 |
| COM001-SS-HM-17-6"-12" | 1/24/2012 | mg/Kg | Arsenic, Total | 32.6 |
| COM001-SS-HM-18-0-6" | 1/24/2012 | mg/Kg | Arsenic, Total | 35 |
| COM001-SS-HM-18-12"-18 | 1/24/2012 | mg/Kg | Arsenic, Total | 36.5 |
| COM001-SS-HM-18-18"-24 | 1/24/2012 | mg/Kg | Arsenic, Total | 27.5 |
| COM001-SS-HM-18-6"-12" | 1/24/2012 | mg/Kg | Arsenic, Total | 39.2 |
| COM001-SS-HM-19-0-6" | 1/24/2012 | mg/Kg | Arsenic, Total | 28.1 |
| COM001-SS-HM-19-12-18" | 1/24/2012 | mg/Kg | Arsenic, Total | 31.7 |
| COM001-SS-HM-19-18-24" | 1/24/2012 | mg/Kg | Arsenic, Total | 29.6 |
| COM001-SS-HM-19-6-12" | 1/24/2012 | mg/Kg | Arsenic, Total | 27 |
| COM001-SS-HM20-0-6" | 1/24/2012 | mg/Kg | Arsenic, Total | 25 |
| COM001-SS-HM20-12"-18" | 1/24/2012 | mg/Kg | Arsenic, Total | 51.3 |
| COM001-SS-HM20-18"-24" | 1/24/2012 | mg/Kg | Arsenic, Total | 49 |
| COM001-SS-HM20-6"-12" | 1/24/2012 | mg/Kg | Arsenic, Total | 32.2 |
| COM001-SS-HM-7-0-6" | 1/25/2012 | mg/Kg | Arsenic, Total | 34.4 |
| COM001-SS-HM-7-6-12" | 1/25/2012 | mg/Kg | Arsenic, Total | 33.3 |
| COM001-SS-HM-7-12-18" | 1/25/2012 | mg/Kg | Arsenic, Total | 79.1 |
| COM001-SS-HM-7-18-24" | 1/25/2012 | mg/Kg | Arsenic, Total | 46.1 |
| COM001-SS-LP10-0-6" | 1/23/2012 | mg/Kg | Arsenic, Total | 28.2 |

**Table 1 - Summary of Arsenic Data**

| | | | | |
|---|---|---|---|---|
| COM001-SS-LP10-10' | 1/23/2012 | mg/Kg | Arsenic, Total | 87.5 |
| COM001-SS-LP10-20' | 1/23/2012 | mg/Kg | Arsenic, Total | 31.9 |
| COM001-SS-LP10-30' | 1/23/2012 | mg/Kg | Arsenic, Total | 120 |
| COM001-SS-LP10-35' | 1/24/2012 | mg/Kg | Arsenic, Total | 26.7 |
| COM001-SS-LP1-0-6" | 1/19/2012 | mg/Kg | Arsenic, Total | 42 |
| COM001-SS-LP1-10' | 1/19/2012 | mg/Kg | Arsenic, Total | 16 |
| COM001-SS-LP1-20' | 1/19/2012 | mg/Kg | Arsenic, Total | 28 |
| COM001-SS-LP1-30' | 1/19/2012 | mg/Kg | Arsenic, Total | 33 |
| COM001-SS-LP1b-35' | 1/19/2012 | mg/Kg | Arsenic, Total | 32 |
| COM001-SS-LP2-0-6" | 1/19/2012 | mg/Kg | Arsenic, Total | 23 |
| COM001-SS-LP2-10' | 1/19/2012 | mg/Kg | Arsenic, Total | 27 |
| COM001-SS-LP2-100' | 1/20/2012 | mg/Kg | Arsenic, Total | 59 |
| COM001-SS-LP2-20' | 1/19/2012 | mg/Kg | Arsenic, Total | 32 |
| COM001-SS-LP2-30' | 1/19/2012 | mg/Kg | Arsenic, Total | 82 |
| COM001-SS-LP2-40' | 1/19/2012 | mg/Kg | Arsenic, Total | 48 |
| COM001-SS-LP2-50' | 1/20/2012 | mg/Kg | Arsenic, Total | 40 |
| COM001-SS-LP2-60' | 1/20/2012 | mg/Kg | Arsenic, Total | 68 |
| COM001-SS-LP2-70' | 1/20/2012 | mg/Kg | Arsenic, Total | 21 |
| COM001-SS-LP2-90' | 1/20/2012 | mg/Kg | Arsenic, Total | 38 |
| COM001-SS-LP4-0-6" | 1/26/2012 | mg/Kg | Arsenic, Total | 46 |
| COM001-SS-LP4-10' | 1/26/2012 | mg/Kg | Arsenic, Total | 49.2 |
| COM001-SS-LP4-20' | 1/26/2012 | mg/Kg | Arsenic, Total | 44.5 |
| COM001-SS-LP4-30' | 1/26/2012 | mg/Kg | Arsenic, Total | 56.5 |
| COM001-SS-LP5-0-6" | 1/26/2012 | mg/Kg | Arsenic, Total | 49.1 |
| COM001-SS-LP5-10' | 1/26/2012 | mg/Kg | Arsenic, Total | 22 |
| COM001-SS-LP5-20'" | 1/26/2012 | mg/Kg | Arsenic, Total | 15 |
| COM001-SS-LP5-30' | 1/26/2012 | mg/Kg | Arsenic, Total | 29.2 |
| COM001-SS-LP5-40' | 1/26/2012 | mg/Kg | Arsenic, Total | 33.4 |
| COM001-SS-LP5-50' | 1/26/2012 | mg/Kg | Arsenic, Total | 45.3 |
| COM001-SS-LP6-0-6" | 1/25/2012 | mg/Kg | Arsenic, Total | 20.6 |
| COM001-SS-LP6-10' | 1/25/2012 | mg/Kg | Arsenic, Total | 19.6 |
| COM001-SS-LP6-15' | 1/25/2012 | mg/Kg | Arsenic, Total | 19.1 |
| COM001-SS-LP6-20' | 1/25/2012 | mg/Kg | Arsenic, Total | 50.3 |
| COM001-SS-LP6-5' | 1/25/2012 | mg/Kg | Arsenic, Total | 22.7 |
| COM001-SS-LP7-0-6" | 1/25/2012 | mg/Kg | Arsenic, Total | 48.6 |
| COM001-SS-LP7-10' | 1/25/2012 | mg/Kg | Arsenic, Total | 68.4 |
| COM001-SS-LP7-15' | 1/25/2012 | mg/Kg | Arsenic, Total | 72.9 |
| COM001-SS-LP7-19' | 1/25/2012 | mg/Kg | Arsenic, Total | 17 |
| COM001-SS-LP7-5' | 1/25/2012 | mg/Kg | Arsenic, Total | 62.5 |
| COM001-SS-LP8-0-6" | 1/25/2012 | mg/Kg | Arsenic, Total | 21.7 |
| COM001-SS-LP8-10' | 1/25/2012 | mg/Kg | Arsenic, Total | 21.5 |
| COM001-SS-LP8-20' | 1/25/2012 | mg/Kg | Arsenic, Total | 21.5 |
| COM001-SS-LP8-30' | 1/25/2012 | mg/Kg | Arsenic, Total | 22.7 |
| COM001-SS-LP8-40' | 1/25/2012 | mg/Kg | Arsenic, Total | 31.6 |
| COM001-SS-LP8-50' | 1/25/2012 | mg/Kg | Arsenic, Total | 20 |
| COM001-SS-LP8-54' | 1/25/2012 | mg/Kg | Arsenic, Total | 43.4 |
| COM001-SS-LP9-0-6" | 1/25/2012 | mg/Kg | Arsenic, Total | 44.9 |
| COM001-SS-LP9-10' | 1/25/2012 | mg/Kg | Arsenic, Total | 103 |
| COM001-SS-LP9-20' | 1/25/2012 | mg/Kg | Arsenic, Total | 45.4 |
| COM001-SS-LP9-30' | 1/25/2012 | mg/Kg | Arsenic, Total | 38.3 |

**Table 1 - Summary of Arsenic Data**

| | | | | |
|---|---|---|---|---|
| COM001-SS-LP9-40' | 1/25/2012 | mg/Kg | Arsenic, Total | 84.1 |
| COM001-SS-LP9-43' | 1/25/2012 | mg/Kg | Arsenic, Total | 56.2 |
| COM001-SS-LP4-40' | 1/26/2012 | mg/Kg | Arsenic, Total | 44.4 |
| COM001-SS-LP4-50' | 1/26/2012 | mg/Kg | Arsenic, Total | 21.2 |
| COM001-SS-LP4-60' | 1/26/2012 | mg/Kg | Arsenic, Total | 32.3 |
| COM001-SS-LP3-0-6" | 1/27/2012 | mg/Kg | Arsenic, Total | 32.3 |
| COM001-SS-LP3-10' | 1/27/2012 | mg/Kg | Arsenic, Total | 30.9 |
| COM001-SS-LP3-20' | 1/27/2012 | mg/Kg | Arsenic, Total | 22.5 |
| COM001-SS-LP3-30' | 1/27/2012 | mg/Kg | Arsenic, Total | 59 |
| COM001-SS-LP3-40' | 1/27/2012 | mg/Kg | Arsenic, Total | 20.9 |
| COM001-SS-LP3-45' | 1/27/2012 | mg/Kg | Arsenic, Total | 37.7 |
| COM001-SS-HM14-0-6 | 1/25/2012 | mg/Kg | Arsenic, Total | 16.2 |
| COM001-SS-HM14-6-12 | 1/25/2012 | mg/Kg | Arsenic, Total | 13.3 |
| COM001-SS-HM14-12-18 | 1/25/2012 | mg/Kg | Arsenic, Total | 14 |
| COM001-SS-HM14-18-24 | 1/25/2012 | mg/Kg | Arsenic, Total | 13.4 |
| COM001-SS-HM13-0-6" | 1/25/2012 | mg/Kg | Arsenic, Total | 46.7 |
| COM001-SS-HM13-6"-12" | 1/25/2012 | mg/Kg | Arsenic, Total | 32.7 |
| COM001-SS-HM13-12"-18" | 1/25/2012 | mg/Kg | Arsenic, Total | 39.9 |
| COM001-SS-HM1318"-24" | 1/25/2012 | mg/Kg | Arsenic, Total | 78.9 |
| COM001-SS-HM11-0-6" | 1/26/2012 | mg/Kg | Arsenic, Total | 29.7 |
| COM001-SS-HM11-6-12 | 1/26/2012 | mg/Kg | Arsenic, Total | 25.2 |
| | | | AVERAGE | 36.92 |
| | | | MAXIMUM | 120.00 |
| | | | MINIMUM | 13.30 |
| | | | STANDARD DEVIATION | 18.92 |
| | | | NDEP SCREENING/ACTION LEVEL | 32 |

**Table 2 - Summary of Lead Data**

| Sample | Date Collected | Units | Component | Result |
|---|---|---|---|---|
| COM001-SS-HM12-0-6" | 1/25/2012 | mg/Kg | Lead, Total | 38.8 |
| COM001-SS-HM12-12"-18" | 1/25/2012 | mg/Kg | Lead, Total | 13 |
| COM001-SS-HM12-18"-24" | 1/25/2012 | mg/Kg | Lead, Total | 19.2 |
| COM001-SS-HM12-6"-12" | 1/25/2012 | mg/Kg | Lead, Total | 25 |
| COM001-SS-HM6-0-6" | 1/27/2012 | mg/Kg | Lead, Total | 29.8 |
| COM001-SS-HM6-6-12" | 1/27/2012 | mg/Kg | Lead, Total | 22.9 |
| COM001-SS-HM6-12-18" | 1/27/2012 | mg/Kg | Lead, Total | 25.1 |
| COM001-SS-LR1-0-6" | 1/27/2012 | mg/Kg | Lead, Total | 33.7 |
| COM001-SS-LR1-6-12" | 1/27/2012 | mg/Kg | Lead, Total | 34.2 |
| COM001-SS-LR1-12-18" | 1/27/2012 | mg/Kg | Lead, Total | 27.2 |
| COM001-SS-LR1-18-24" | 1/27/2012 | mg/Kg | Lead, Total | 22.4 |
| COM001-SS-LR2-0-6" | 1/27/2012 | mg/Kg | Lead, Total | 38.2 |
| COM001-SS-LR2-6-12" | 1/27/2012 | mg/Kg | Lead, Total | 21.5 |
| COM001-SS-LR2-12-18" | 1/27/2012 | mg/Kg | Lead, Total | 21.7 |
| COM001-SS-LR2-18-24" | 1/27/2012 | mg/Kg | Lead, Total | 13.1 |
| COM001-SS-LR7-0-6" | 1/31/2012 | mg/Kg | Lead, Total | 11.8 |
| COM001-SS-LR7-6-12" | 1/31/2012 | mg/Kg | Lead, Total | 8 |
| COM001-SS-LR7-12-18" | 1/31/2012 | mg/Kg | Lead, Total | 9.1 |
| COM001-SS-LR7-18-24" | 1/31/2012 | mg/Kg | Lead, Total | 4.2 |
| COM001-SS-HM6-18-24" | 1/27/2012 | mg/Kg | Lead, Total | 23.1 |
| COM001-SS-HM15-0-6" | 1/25/2012 | mg/Kg | Lead, Total | 28.8 |
| COM001-SS-HM15-12-18" | 1/25/2012 | mg/Kg | Lead, Total | 23.3 |
| COM001-SS-HM15-18-24" | 1/25/2012 | mg/Kg | Lead, Total | 19.3 |
| COM001-SS-HM15-6-12" | 1/25/2012 | mg/Kg | Lead, Total | 21.1 |
| COM001-SS-HM-16-0-6" | 1/24/2012 | mg/Kg | Lead, Total | 51.4 |
| COM001-SS-HM-16-12-18" | 1/24/2012 | mg/Kg | Lead, Total | 45.9 |
| COM001-SS-HM-16-18-24" | 1/24/2012 | mg/Kg | Lead, Total | 51.7 |
| COM001-SS-HM-16-6-12" | 1/24/2012 | mg/Kg | Lead, Total | 49.9 |
| COM001-SS-HM-17-0-6" | 1/24/2012 | mg/Kg | Lead, Total | 44.7 |
| COM001-SS-HM-17-12"-18" | 1/24/2012 | mg/Kg | Lead, Total | 44.8 |
| COM001-SS-HM-17-18"-24" | 1/24/2012 | mg/Kg | Lead, Total | 43 |
| COM001-SS-HM-17-6"-12" | 1/24/2012 | mg/Kg | Lead, Total | 38.1 |
| COM001-SS-HM-18-0-6" | 1/24/2012 | mg/Kg | Lead, Total | 27.5 |
| COM001-SS-HM-18-12"-18" | 1/24/2012 | mg/Kg | Lead, Total | 23.4 |
| COM001-SS-HM-18-18"-24" | 1/24/2012 | mg/Kg | Lead, Total | 21.8 |
| COM001-SS-HM-18-6"-12" | 1/24/2012 | mg/Kg | Lead, Total | 34.7 |
| COM001-SS-HM-19-0-6" | 1/24/2012 | mg/Kg | Lead, Total | 42.8 |
| COM001-SS-HM-19-12-18" | 1/24/2012 | mg/Kg | Lead, Total | 40.7 |
| COM001-SS-HM-19-18-24" | 1/24/2012 | mg/Kg | Lead, Total | 41.7 |
| COM001-SS-HM-19-6-12" | 1/24/2012 | mg/Kg | Lead, Total | 43.5 |
| COM001-SS-HM20-0-6" | 1/24/2012 | mg/Kg | Lead, Total | 17.1 |
| COM001-SS-HM20-12"-18" | 1/24/2012 | mg/Kg | Lead, Total | 13.2 |
| COM001-SS-HM20-18"-24" | 1/24/2012 | mg/Kg | Lead, Total | 13.6 |
| COM001-SS-HM20-6"-12" | 1/24/2012 | mg/Kg | Lead, Total | 10 |
| COM001-SS-HM-7-0-6" | 1/25/2012 | mg/Kg | Lead, Total | 16.4 |
| COM001-SS-HM-7-6-12" | 1/25/2012 | mg/Kg | Lead, Total | 13.6 |
| COM001-SS-HM-7-12-18" | 1/25/2012 | mg/Kg | Lead, Total | 15.1 |
| COM001-SS-HM-7-18-24" | 1/25/2012 | mg/Kg | Lead, Total | 22 |
| COM001-SS-LP10-0-6" | 1/23/2012 | mg/Kg | Lead, Total | 35.4 |
| COM001-SS-LP10-10' | 1/23/2012 | mg/Kg | Lead, Total | 23 |
| COM001-SS-LP10-20' | 1/23/2012 | mg/Kg | Lead, Total | 25.4 |
| COM001-SS-LP10-30' | 1/23/2012 | mg/Kg | Lead, Total | 19.6 |
| COM001-SS-LP10-35' | 1/24/2012 | mg/Kg | Lead, Total | 18.6 |

**Table 2 - Summary of Lead Data**

| | | | | |
|---|---|---|---|---|
| COM001-SS-LP1-0-6" | 1/19/2012 | mg/Kg | Lead, Total | 50.6 |
| COM001-SS-LP1-10' | 1/19/2012 | mg/Kg | Lead, Total | 10.6 |
| COM001-SS-LP1-20' | 1/19/2012 | mg/Kg | Lead, Total | 17.5 |
| COM001-SS-LP1-30' | 1/19/2012 | mg/Kg | Lead, Total | 35.2 |
| COM001-SS-LP1b-35' | 1/19/2012 | mg/Kg | Lead, Total | 40.6 |
| COM001-SS-LP2-0-6" | 1/19/2012 | mg/Kg | Lead, Total | 13.9 |
| COM001-SS-LP2-10' | 1/19/2012 | mg/Kg | Lead, Total | 73.5 |
| COM001-SS-LP2-100' | 1/20/2012 | mg/Kg | Lead, Total | 41.6 |
| COM001-SS-LP2-20' | 1/19/2012 | mg/Kg | Lead, Total | 20.6 |
| COM001-SS-LP2-30' | 1/19/2012 | mg/Kg | Lead, Total | 14.1 |
| COM001-SS-LP2-40' | 1/19/2012 | mg/Kg | Lead, Total | 26.4 |
| COM001-SS-LP2-50' | 1/20/2012 | mg/Kg | Lead, Total | 51.6 |
| COM001-SS-LP2-60' | 1/20/2012 | mg/Kg | Lead, Total | 49.1 |
| COM001-SS-LP2-70' | 1/20/2012 | mg/Kg | Lead, Total | 68.9 |
| COM001-SS-LP2-90' | 1/20/2012 | mg/Kg | Lead, Total | 75.7 |
| COM001-SS-LP4-0-6" | 1/26/2012 | mg/Kg | Lead, Total | 17.2 |
| COM001-SS-LP4-10' | 1/26/2012 | mg/Kg | Lead, Total | 26.6 |
| COM001-SS-LP4-20' | 1/26/2012 | mg/Kg | Lead, Total | 43.3 |
| COM001-SS-LP4-30' | 1/26/2012 | mg/Kg | Lead, Total | 21.7 |
| COM001-SS-LP5-0-6" | 1/26/2012 | mg/Kg | Lead, Total | 32.3 |
| COM001-SS-LP5-10' | 1/26/2012 | mg/Kg | Lead, Total | 13 |
| COM001-SS-LP5-20"' | 1/26/2012 | mg/Kg | Lead, Total | 18.5 |
| COM001-SS-LP5-30' | 1/26/2012 | mg/Kg | Lead, Total | 35.5 |
| COM001-SS-LP5-40' | 1/26/2012 | mg/Kg | Lead, Total | 25.7 |
| COM001-SS-LP5-50' | 1/26/2012 | mg/Kg | Lead, Total | 24.3 |
| COM001-SS-LP6-0-6" | 1/25/2012 | mg/Kg | Lead, Total | 15.6 |
| COM001-SS-LP6-10' | 1/25/2012 | mg/Kg | Lead, Total | 13.7 |
| COM001-SS-LP6-15' | 1/25/2012 | mg/Kg | Lead, Total | 10 |
| COM001-SS-LP6-20' | 1/25/2012 | mg/Kg | Lead, Total | 17.9 |
| COM001-SS-LP6-5' | 1/25/2012 | mg/Kg | Lead, Total | 17.6 |
| COM001-SS-LP7-0-6" | 1/25/2012 | mg/Kg | Lead, Total | 30.6 |
| COM001-SS-LP7-10' | 1/25/2012 | mg/Kg | Lead, Total | 31.4 |
| COM001-SS-LP7-15' | 1/25/2012 | mg/Kg | Lead, Total | 24.1 |
| COM001-SS-LP7-19' | 1/25/2012 | mg/Kg | Lead, Total | 13.9 |
| COM001-SS-LP7-5' | 1/25/2012 | mg/Kg | Lead, Total | 26 |
| COM001-SS-LP8-0-6" | 1/25/2012 | mg/Kg | Lead, Total | 32.8 |
| COM001-SS-LP8-10' | 1/25/2012 | mg/Kg | Lead, Total | 11.6 |
| COM001-SS-LP8-20' | 1/25/2012 | mg/Kg | Lead, Total | 13.7 |
| COM001-SS-LP8-30' | 1/25/2012 | mg/Kg | Lead, Total | 14.3 |
| COM001-SS-LP8-40' | 1/25/2012 | mg/Kg | Lead, Total | 21.7 |
| COM001-SS-LP8-50' | 1/25/2012 | mg/Kg | Lead, Total | 21.1 |
| COM001-SS-LP8-54' | 1/25/2012 | mg/Kg | Lead, Total | 11 |
| COM001-SS-LP9-0-6" | 1/25/2012 | mg/Kg | Lead, Total | 26.4 |
| COM001-SS-LP9-10' | 1/25/2012 | mg/Kg | Lead, Total | 29.2 |
| COM001-SS-LP9-20' | 1/25/2012 | mg/Kg | Lead, Total | 42.3 |
| COM001-SS-LP9-30' | 1/25/2012 | mg/Kg | Lead, Total | 19.8 |
| COM001-SS-LP9-40' | 1/25/2012 | mg/Kg | Lead, Total | 31.9 |
| COM001-SS-LP9-43' | 1/25/2012 | mg/Kg | Lead, Total | 12.7 |
| COM001-SS-LP4-40' | 1/26/2012 | mg/Kg | Lead, Total | 38.1 |
| COM001-SS-LP4-50' | 1/26/2012 | mg/Kg | Lead, Total | 32.2 |
| COM001-SS-LP4-60' | 1/26/2012 | mg/Kg | Lead, Total | 29.2 |
| COM001-SS-LP3-0-6" | 1/27/2012 | mg/Kg | Lead, Total | 16.8 |
| COM001-SS-LP3-10' | 1/27/2012 | mg/Kg | Lead, Total | 18 |
| COM001-SS-LP3-20' | 1/27/2012 | mg/Kg | Lead, Total | 17.7 |

**Table 2 - Summary of Lead Data**

| | | | | |
|---|---|---|---|---|
| COM001-SS-LP3-30' | 1/27/2012 | mg/Kg | Lead, Total | 21.7 |
| COM001-SS-LP3-40' | 1/27/2012 | mg/Kg | Lead, Total | 11.3 |
| COM001-SS-LP3-45' | 1/27/2012 | mg/Kg | Lead, Total | 17.6 |
| COM001-SS-HM14-0-6 | 1/25/2012 | mg/Kg | Lead, Total | 21.1 |
| COM001-SS-HM14-6-12 | 1/25/2012 | mg/Kg | Lead, Total | 21 |
| COM001-SS-HM14-12-18 | 1/25/2012 | mg/Kg | Lead, Total | 19.7 |
| COM001-SS-HM14-18-24 | 1/25/2012 | mg/Kg | Lead, Total | 20.2 |
| COM001-SS-HM13-0-6" | 1/25/2012 | mg/Kg | Lead, Total | 17.1 |
| COM001-SS-HM13-6"-12" | 1/25/2012 | mg/Kg | Lead, Total | 13.8 |
| COM001-SS-HM13-12"-18" | 1/25/2012 | mg/Kg | Lead, Total | 13 |
| COM001-SS-HM1318"-24" | 1/25/2012 | mg/Kg | Lead, Total | 9.7 |
| COM001-SS-HM11-0-6" | 1/26/2012 | mg/Kg | Lead, Total | 23.1 |
| COM001-SS-HM11-6-12 | 1/26/2012 | mg/Kg | Lead, Total | 27.3 |
| | | | AVERAGE | 26.24 |
| | | | MAXIMUM | 75.70 |
| | | | MINIMUM | 4.20 |
| | | | STANDARD DEVIATION | 13.61 |
| | | | NDEP SCREENING/ACTION LEVEL | 400 |

**Table 3 - Summary of Mercury Data**

| Sample | Date Colle | Units | Component | Result |
|---|---|---|---|---|
| COM001-SS-HM12-0-6" | 1/25/2012 | mg/Kg | Mercury, Total | 0.191 |
| COM001-SS-HM12-12"-18" | 1/25/2012 | mg/Kg | Mercury, Total | 0.105 |
| COM001-SS-HM12-18"-24" | 1/25/2012 | mg/Kg | Mercury, Total | 0.139 |
| COM001-SS-HM12-6"-12" | 1/25/2012 | mg/Kg | Mercury, Total | 0.322 |
| COM001-SS-HM6-0-6" | 1/27/2012 | mg/Kg | Mercury, Total | 0.327 |
| COM001-SS-HM6-6-12" | 1/27/2012 | mg/Kg | Mercury, Total | 0.208 |
| COM001-SS-HM6-12-18" | 1/27/2012 | mg/Kg | Mercury, Total | 0.063 |
| COM001-SS-LR1-0-6" | 1/27/2012 | mg/Kg | Mercury, Total | 7.81 |
| COM001-SS-LR1-6-12" | 1/27/2012 | mg/Kg | Mercury, Total | 8.59 |
| COM001-SS-LR1-12-18" | 1/27/2012 | mg/Kg | Mercury, Total | 5.2 |
| COM001-SS-LR1-18-24" | 1/27/2012 | mg/Kg | Mercury, Total | 2.7 |
| COM001-SS-LR2-0-6" | 1/27/2012 | mg/Kg | Mercury, Total | 1.9 |
| COM001-SS-LR2-6-12" | 1/27/2012 | mg/Kg | Mercury, Total | 0.3 |
| COM001-SS-LR2-12-18" | 1/27/2012 | mg/Kg | Mercury, Total | 0.295 |
| COM001-SS-LR2-18-24" | 1/27/2012 | mg/Kg | Mercury, Total | 0.402 |
| COM001-SS-LR7-0-6" | 1/31/2012 | mg/Kg | Mercury, Total | 0.173 |
| COM001-SS-LR7-6-12" | 1/31/2012 | mg/Kg | Mercury, Total | 0.111 |
| COM001-SS-LR7-12-18" | 1/31/2012 | mg/Kg | Mercury, Total | 0.1 |
| COM001-SS-LR7-18-24" | 1/31/2012 | mg/Kg | Mercury, Total | 0.064 |
| COM001-SS-HM6-18-24" | 1/27/2012 | mg/Kg | Mercury, Total | 0.528 |
| COM001-SS-HM15-0-6" | 1/25/2012 | mg/Kg | Mercury, Total | 0.217 |
| COM001-SS-HM15-12-18" | 1/25/2012 | mg/Kg | Mercury, Total | 0.069 |
| COM001-SS-HM15-18-24" | 1/25/2012 | mg/Kg | Mercury, Total | 0.117 |
| COM001-SS-HM15-6-12" | 1/25/2012 | mg/Kg | Mercury, Total | 0.112 |
| COM001-SS-HM-16-0-6" | 1/24/2012 | mg/Kg | Mercury, Total | 0.329 |
| COM001-SS-HM-16-12-18" | 1/24/2012 | mg/Kg | Mercury, Total | 0.215 |
| COM001-SS-HM-16-18-24" | 1/24/2012 | mg/Kg | Mercury, Total | 0.287 |
| COM001-SS-HM-16-6-12" | 1/24/2012 | mg/Kg | Mercury, Total | 0.39 |
| COM001-SS-HM-17-0-6" | 1/24/2012 | mg/Kg | Mercury, Total | 0.218 |
| COM001-SS-HM-17-12"-18" | 1/24/2012 | mg/Kg | Mercury, Total | 0.183 |
| COM001-SS-HM-17-18"-24" | 1/24/2012 | mg/Kg | Mercury, Total | 0.247 |
| COM001-SS-HM-17-6"-12" | 1/24/2012 | mg/Kg | Mercury, Total | 0.192 |
| COM001-SS-HM-18-0-6" | 1/24/2012 | mg/Kg | Mercury, Total | 0.214 |
| COM001-SS-HM-18-12"-18" | 1/24/2012 | mg/Kg | Mercury, Total | 0.183 |
| COM001-SS-HM-18-18"-24" | 1/24/2012 | mg/Kg | Mercury, Total | 0.153 |
| COM001-SS-HM-18-6"-12" | 1/24/2012 | mg/Kg | Mercury, Total | 0.194 |
| COM001-SS-HM-19-0-6" | 1/24/2012 | mg/Kg | Mercury, Total | 0.177 |
| COM001-SS-HM-19-12-18" | 1/24/2012 | mg/Kg | Mercury, Total | 0.22 |
| COM001-SS-HM-19-18-24" | 1/24/2012 | mg/Kg | Mercury, Total | 0.181 |
| COM001-SS-HM-19-6-12" | 1/24/2012 | mg/Kg | Mercury, Total | 0.167 |
| COM001-SS-HM20-0-6" | 1/24/2012 | mg/Kg | Mercury, Total | 0.14 |
| COM001-SS-HM20-12"-18" | 1/24/2012 | mg/Kg | Mercury, Total | 0.155 |
| COM001-SS-HM20-18"-24" | 1/24/2012 | mg/Kg | Mercury, Total | 0.08 |
| COM001-SS-HM20-6"-12" | 1/24/2012 | mg/Kg | Mercury, Total | 0.041 |
| COM001-SS-HM-7-0-6" | 1/25/2012 | mg/Kg | Mercury, Total | 0.227 |
| COM001-SS-HM-7-6-12" | 1/25/2012 | mg/Kg | Mercury, Total | 0.196 |
| COM001-SS-HM-7-12-18" | 1/25/2012 | mg/Kg | Mercury, Total | 0.368 |
| COM001-SS-HM-7-18-24" | 1/25/2012 | mg/Kg | Mercury, Total | 0.35 |
| COM001-SS-LP10-0-6" | 1/23/2012 | mg/Kg | Mercury, Total | 0.675 |
| COM001-SS-LP10-10' | 1/23/2012 | mg/Kg | Mercury, Total | 0.187 |
| COM001-SS-LP10-20' | 1/23/2012 | mg/Kg | Mercury, Total | 0.41 |
| COM001-SS-LP10-30' | 1/23/2012 | mg/Kg | Mercury, Total | 0.813 |
| COM001-SS-LP10-35' | 1/24/2012 | mg/Kg | Mercury, Total | 0.205 |

**Table 3 - Summary of Mercury Data**

| | | | | |
|---|---|---|---|---|
| COM001-SS-LP1-0-6" | 1/19/2012 | mg/Kg | Mercury, Total | 21.8 |
| COM001-SS-LP1-10' | 1/19/2012 | mg/Kg | Mercury, Total | 0.403 |
| COM001-SS-LP1-20' | 1/19/2012 | mg/Kg | Mercury, Total | 0.944 |
| COM001-SS-LP1-30' | 1/19/2012 | mg/Kg | Mercury, Total | 6.7 |
| COM001-SS-LP1b-35' | 1/19/2012 | mg/Kg | Mercury, Total | 1.45 |
| COM001-SS-LP2-0-6" | 1/19/2012 | mg/Kg | Mercury, Total | 1.81 |
| COM001-SS-LP2-10' | 1/19/2012 | mg/Kg | Mercury, Total | 5.68 |
| COM001-SS-LP2-100' | 1/20/2012 | mg/Kg | Mercury, Total | 11.8 |
| COM001-SS-LP2-20' | 1/19/2012 | mg/Kg | Mercury, Total | 3.25 |
| COM001-SS-LP2-30' | 1/19/2012 | mg/Kg | Mercury, Total | 0.734 |
| COM001-SS-LP2-40' | 1/19/2012 | mg/Kg | Mercury, Total | 4.1 |
| COM001-SS-LP2-50' | 1/20/2012 | mg/Kg | Mercury, Total | 18.3 |
| COM001-SS-LP2-60' | 1/20/2012 | mg/Kg | Mercury, Total | 7.71 |
| COM001-SS-LP2-70' | 1/20/2012 | mg/Kg | Mercury, Total | 29 |
| COM001-SS-LP2-90' | 1/20/2012 | mg/Kg | Mercury, Total | 16.8 |
| COM001-SS-LP4-0-6" | 1/26/2012 | mg/Kg | Mercury, Total | 0.151 |
| COM001-SS-LP4-10' | 1/26/2012 | mg/Kg | Mercury, Total | 0.081 |
| COM001-SS-LP4-20' | 1/26/2012 | mg/Kg | Mercury, Total | 3.06 |
| COM001-SS-LP4-30' | 1/26/2012 | mg/Kg | Mercury, Total | 1.05 |
| COM001-SS-LP5-0-6" | 1/26/2012 | mg/Kg | Mercury, Total | 0.634 |
| COM001-SS-LP5-10' | 1/26/2012 | mg/Kg | Mercury, Total | 0.072 |
| COM001-SS-LP5-20"' | 1/26/2012 | mg/Kg | Mercury, Total | 0.107 |
| COM001-SS-LP5-30' | 1/26/2012 | mg/Kg | Mercury, Total | 0.133 |
| COM001-SS-LP5-40' | 1/26/2012 | mg/Kg | Mercury, Total | 0.21 |
| COM001-SS-LP5-50' | 1/26/2012 | mg/Kg | Mercury, Total | 0.092 |
| COM001-SS-LP6-0-6" | 1/25/2012 | mg/Kg | Mercury, Total | 1.19 |
| COM001-SS-LP6-10' | 1/25/2012 | mg/Kg | Mercury, Total | 1.08 |
| COM001-SS-LP6-15' | 1/25/2012 | mg/Kg | Mercury, Total | 0.583 |
| COM001-SS-LP6-20' | 1/25/2012 | mg/Kg | Mercury, Total | 0.341 |
| COM001-SS-LP6-5' | 1/25/2012 | mg/Kg | Mercury, Total | 1.41 |
| COM001-SS-LP7-0-6" | 1/25/2012 | mg/Kg | Mercury, Total | 1.01 |
| COM001-SS-LP7-10' | 1/25/2012 | mg/Kg | Mercury, Total | 1.53 |
| COM001-SS-LP7-15' | 1/25/2012 | mg/Kg | Mercury, Total | 1.29 |
| COM001-SS-LP7-19' | 1/25/2012 | mg/Kg | Mercury, Total | 0.112 |
| COM001-SS-LP7-5' | 1/25/2012 | mg/Kg | Mercury, Total | 0.181 |
| COM001-SS-LP8-0-6" | 1/25/2012 | mg/Kg | Mercury, Total | 1.73 |
| COM001-SS-LP8-10' | 1/25/2012 | mg/Kg | Mercury, Total | 0.304 |
| COM001-SS-LP8-20' | 1/25/2012 | mg/Kg | Mercury, Total | 0.352 |
| COM001-SS-LP8-30' | 1/25/2012 | mg/Kg | Mercury, Total | 0.431 |
| COM001-SS-LP8-40' | 1/25/2012 | mg/Kg | Mercury, Total | 0.571 |
| COM001-SS-LP8-50' | 1/25/2012 | mg/Kg | Mercury, Total | 1.2 |
| COM001-SS-LP8-54' | 1/25/2012 | mg/Kg | Mercury, Total | 0.235 |
| COM001-SS-LP9-0-6" | 1/25/2012 | mg/Kg | Mercury, Total | 0.665 |
| COM001-SS-LP9-10' | 1/25/2012 | mg/Kg | Mercury, Total | 1.32 |
| COM001-SS-LP9-20' | 1/25/2012 | mg/Kg | Mercury, Total | 7.11 |
| COM001-SS-LP9-30' | 1/25/2012 | mg/Kg | Mercury, Total | 0.244 |
| COM001-SS-LP9-40' | 1/25/2012 | mg/Kg | Mercury, Total | 0.181 |
| COM001-SS-LP9-43' | 1/25/2012 | mg/Kg | Mercury, Total | 0.123 |
| COM001-SS-LP4-40' | 1/26/2012 | mg/Kg | Mercury, Total | 0.301 |
| COM001-SS-LP4-50' | 1/26/2012 | mg/Kg | Mercury, Total | 0.346 |
| COM001-SS-LP4-60' | 1/26/2012 | mg/Kg | Mercury, Total | 0.138 |
| COM001-SS-LP3-0-6" | 1/27/2012 | mg/Kg | Mercury, Total | 0.114 |
| COM001-SS-LP3-10' | 1/27/2012 | mg/Kg | Mercury, Total | 0.087 |
| COM001-SS-LP3-20' | 1/27/2012 | mg/Kg | Mercury, Total | 0.92 |

**Table 3 - Summary of Mercury Data**

| | | | | |
|---|---|---|---|---|
| COM001-SS-LP3-30' | 1/27/2012 | mg/Kg | Mercury, Total | 0.208 |
| COM001-SS-LP3-40' | 1/27/2012 | mg/Kg | Mercury, Total | 0.084 |
| COM001-SS-LP3-45' | 1/27/2012 | mg/Kg | Mercury, Total | 0.073 |
| COM001-SS-HM14-0-6 | 1/25/2012 | mg/Kg | Mercury, Total | 0.257 |
| COM001-SS-HM14-6-12 | 1/25/2012 | mg/Kg | Mercury, Total | 0.344 |
| COM001-SS-HM14-12-18 | 1/25/2012 | mg/Kg | Mercury, Total | 0.319 |
| COM001-SS-HM14-18-24 | 1/25/2012 | mg/Kg | Mercury, Total | 0.239 |
| COM001-SS-HM13-0-6" | 1/25/2012 | mg/Kg | Mercury, Total | 0.249 |
| COM001-SS-HM13-6"-12" | 1/25/2012 | mg/Kg | Mercury, Total | 0.228 |
| COM001-SS-HM13-12"-18" | 1/25/2012 | mg/Kg | Mercury, Total | 0.263 |
| COM001-SS-HM1318"-24" | 1/25/2012 | mg/Kg | Mercury, Total | 0.265 |
| COM001-SS-HM11-0-6" | 1/26/2012 | mg/Kg | Mercury, Total | 0.598 |
| COM001-SS-HM11-6-12 | 1/26/2012 | mg/Kg | Mercury, Total | 1.16 |
| | | | AVERAGE | 1.69 |
| | | | MAXIMUM | 29.00 |
| | | | MINIMUM | 0.04 |
| | | | STANDARD DEVIATION | 4.26 |
| | | | NDEP SCREENING/ACTION LEVEL | 80 |

## Attachment 1

The Fehling Group, LLC

# Memo

To: Brian Rakvica, P.E. – McGinley and Associates

From: Kurt Fehling and Joanne Otani, RN, MSN, PHN

Date: February 9, 2012

Re: Assessment of Off-Site Residential Exposure to Arsenic via Inhalation of Resuspended Particulates During Soil Disturbance Activities at the Comstock Mine, Nevada

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This technical memorandum presents an assessment of the potential human health risks from arsenic in soil to off-site residents located near the Comstock Mine during soil disturbance (e.g., drilling, samples, etc.) activities. This assessment was conducted in accordance with current United States Environmental Protection Agency (U.S. EPA) guidance for assessing off-site residential exposures during construction activities (e.g., soil removal) (U.S. EPA, 1989; U.S. EPA, 2002; and U.S. EPA, 2009).

## Exposure Point Concentration of Arsenic in Soil

The U.S. EPA's risk assessment guidance for Superfund, Part A recommends that the exposure point concentration (EPC) for the assessment of risks be based on the 95 percent upper confidence limit of the arithmetic mean (95% UCL) (see excerpt pages attached). However, as a conservative measure of potential exposure, the maximum detected arsenic concentration of 120 mg/kg was used (B. Rakvica, personal communication, 2012).

## Off-Site Residential Exposure Scenario

According to U.S. EPA's Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (2002), off-site residential exposures during construction (e.g., soil removal activities) are related to the resuspension and off-site dispersion of soil particulates. This assessment uses the default exposure parameters and off-site particulate emission factor (PEF) for off-site residents (see excerpt pages attached). The one exception to the exposure assumptions is the length of time for the soil removal activities. This assessment assumes an exposure frequency of 20 days based on professional judgment (four geotechnical holes at five days or less per hole) and the number of days drilling activities are expected to occur at the site.

Risk estimates for inhalation exposures follow U.S. EPA's *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for*

*Inhalation Risk Assessment)* (U.S. EPA, 2009). That is, the concentration of a chemical in air is used as the exposure metric (*e.g.*, $mg/m^3$), rather than inhalation intake of a chemical in air based on inhalation rate and body weight (*e.g.*, mg/kg-day). The generic equation for calculating inhalation exposures is:

$$EC = \frac{C_{air} \ x \ ET \ x \ ED \ x \ EF}{AT}$$

where:

| | |
|---|---|
| EC | exposure concentration (in $\mu g/m^3$ or $mg/m^3$) |
| $C_{air}$ | chemical concentration in air (in $mg/m^3$); calculated by arsenic soil concentration of 120 mg/kg divided by the off-site particulate emission factor of $4.4x10^8$ $m^3/kg$ |
| ET | exposure time (hours per day) |
| ED | exposure duration (years of exposure) |
| EF | exposure frequency (number of days per year) |
| AT | averaging time; same as the ED for non-carcinogens and 613,200 hours (*i.e.*, 70 years; average lifetime) for carcinogens |

Table 1 presents the exposure assumptions used to calculate off-site residential exposures.

## Arsenic Toxicity Criteria

Toxicity values, when available, are published by the U.S. EPA in the on-line Integrated Risk Information System [IRIS]; USEPA 2012). Inhalation unit risks (IURs) represent the upper-bound excess lifetime cancer risk from continuous exposure to a chemical at a concentration of 1 $\mu g/m^3$. A higher value implies a more potent carcinogenic potential. Reference dosages (RfDs) are experimentally derived "no-effect" levels used to quantify the extent of toxic effects other than cancer due to exposure to chemicals (in units of mg/kg-d). Similarly, a reference concentration (RfC) is the derived "no-effect" concentration for a lifetime of continuous inhalation exposure (in units of $mg/m^3$). With RfDs or RfCs, a lower value implies a more potent toxicant. These criteria are generally developed by U.S. EPA risk assessment work groups and listed in the USEPA risk assessment guidance documents and databases.

For arsenic, the U.S. EPA's IRIS has a published IUR of $4.3x10^{-3}$ $(\mu g/m^3)^{-1}$. The U.S. EPA's IRIS does not have a published RfC for arsenic. However, the California's EPA has a published value of $1.5x10^{-5}$ $(mg/m^3)$ (CalEPA, 2012). In the absence of a USEPA value and to be conservative (e.g., health protective), the CalEPA value was used in this assessment.

## Arsenic Risk Characterization

In the last step of a risk assessment, the estimated rate at which a receptor intakes a chemical is compared with information about the toxicity of that chemical to estimate the potential risks posed by exposure to the chemical. This step is known as risk characterization. The methods used for assessing cancer risks and non-cancer adverse health effects are discussed below.

According to U.S. EPA (1989), this approach is appropriate for theoretical upper-bound incremental lifetime cancer risks (ILCRs) of less than $1x10^{-2}$. The following equations were used to calculate arsenic risks:

$$ILCR = EC_c \times IUR$$

where:

| | |
|---|---|
| EC_c | exposure concentration cancer endpoint ($\mu g/m^3$) |
| IUR | inhalation unit risk $(\mu g/m^3)^{-1}$ |

Carcinogenic risk estimates were compared to the USEPA *de minimis* risk level of 1 in 1 million ($10^{-6}$).If the estimated risk are below this risk level, the chemical is considered unlikely to pose an unacceptable carcinogenic risk to individuals under the given exposure conditions.

Non-cancer adverse health effects are estimated by comparing the estimated average exposure rate (*i.e.*, EC_nc estimated in the exposure assessment) with an exposure level at which no adverse health effects are expected to occur for a long period of exposure (*e.g.*, the RfC). EC_nc and RfC is compared by dividing the EC_nc by the RfC to obtain the EC_nc:RfC ratio, as follows:

$$HQ = \frac{EC_nc}{RfC}$$

where:

| | |
|---|---|
| HQ | hazard quotient |
| EC_nc | exposure concentration noncancer endpoint ($mg/m^3$) |
| RfC | reference concentration ($mg/m^3$) |

The EC_nc-to-RfC ratio is known as a hazard quotient (HQ). If a person's average exposure is less than the RfC (*i.e.*, if the HQ is less than 1), the chemical is considered unlikely to pose a significant non-carcinogenic health hazard to individuals under the given exposure conditions.

**Summary of Risk Results**

As shown in Table 1, the resultant ILCR for an off-site resident is $3x10^{-8}$. This value is below USEPA's *de minimis* risk level of $1x10^{-6}$. In addition, the HQ is 0.001. This value is below the target non-carcinogenic health hazard value of 1. Therefore, exposure to arsenic during soil disturbance activities is not expected to pose significant adverse health effects to off-site residents.

**Uncertainty Analysis**

This assessment assumed an exposure frequency of 20 days of soil removal activities based on professional judgment and the expected number of sampling days. If soil disturbance activities occurred over a longer period of time, the ILCR and HQ for arsenic would increase. Even if the U.S. EPA default residential exposure frequency of (350 days/year) is assumed, the resultant ILCR and HQ would still be below $1x10^{-6}$ ($5 x10^{-7}$) and a HQ of 1 (0.017) as presented in Table 2.

An additional scenario was also run to determine the maximum arsenic concentration that would not exceed the *de minimis* risk level and assuming 350 days per year exposure frequency. Table 3, shows such a scenario that assumes a drilling operation runs 24 hours per day, 7 days per week, for 30 years. Under this extremely conservative scenario, a maximum arsenic concentration of 300 mg/kg could be assumed as the exposure point concentration. The resultant ILCR and HQ would still meet the *de minimis* risk level of $1x10^{-6}$ ($1 x10^{-6}$) and a HQ of 1 (0.045).

## Limitations

The services described in this technical memorandum were performed consistent with generally accepted professional consulting principles and practices. No other warranty, expressed or implied, is made. These services were performed consistent with the agreement with the client. This report is solely for the use and information of the client. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this technical memorandum apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. The Fehling Group, LLC is not responsible for the impacts of any changes in environmental standards, practices, or regulation subsequent to performance of services and does not warrant the accuracy of information supplied by others, or the use of segregated portions of this technical memorandum.

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**Table 1. Estimation of Theoretical Cancer Risk and Noncancer Hazard Due to Arsenic**

| | Symbol | Value | Units | Notes |
|---|---|---|---|---|
| Arsenic concentration in soil (Csoil) | Csoil | 120 | mg/kg | Site-specific; Maximum |
| Exposure time | ET | 24 | hrs/day | Assumes continuous exposed soil during removal activites |
| Exposure freqency | EF | 20 | days/year | Professional judgment; length of time for removal activities |
| Exposure duration | ED | 30 | years | USEPA, 1989 |
| Particulate Emission Factor | PEF | 4.40E+08 | $m^3$/kg | Off-site resident PEF from construction scenario for USEPA (2002) SSLs |
| Averaging Time - cancer | AT_c | 613200 | hours | USEPA, 2009 |
| Averaging Time - noncancer | AT_nc | 262800 | hours | USEPA, 2009 |
| Conversion Factor | CF | 1.00E+03 | µg/mg | USEPA, 1989 |
| Arsenic Inhalation Unit Risk | IUR | 4.30E-03 | $(\mu g/m^3)^{-1}$ | USEPA, 2012 |
| Arsenic Reference Concentration | RfC | 1.50E-05 | $mg/m^3$ | USEPA, 2012 |
| Inhalation EC cancer | EC_c | 6.40E-06 | $\mu g/m^3$ | Calculated value |
| Inhalation EC noncancer | EC_nc | 1.49E-08 | $mg/m^3$ | Calculated value |
| Theoretical cancer risk | | 3E-08 | | |
| Noncancer hazard quotient | | 0.001 | | |

**Table 2. Estimation of Theoretical Cancer Risk and Noncancer Hazard Due to Arsenic**

| | Symbol | Value | Units | Notes |
|---|---|---|---|---|
| Arsenic concentration in soil (Csoil) | Csoil | 120 | mg/kg | Site-specific; Maximum |
| Exposure time | ET | 24 | hrs/day | Assumes continuous exposed soil during removal activites |
| Exposure freqency | EF | 350 | days/year | Professional judgment; length of time for removal activities |
| Exposure duration | ED | 30 | years | USEPA, 1989 |
| Particulate Emission Factor | PEF | 4.40E+08 | $m^3/kg$ | Off-site resident PEF from construction scenario for USEPA (2002) SSLs |
| Averaging Time - cancer | AT_c | 613200 | hours | USEPA, 2009 |
| Averaging Time - noncancer | AT_nc | 262800 | hours | USEPA, 2009 |
| Conversion Factor | CF | 1.00E+03 | µg/mg | USEPA, 1989 |
| Arsenic Inhalation Unit Risk | IUR | 4.30E-03 | $(\mu g/m^3)^{-1}$ | USEPA, 2012 |
| Arsenic Reference Concentration | RfC | 1.50E-05 | $mg/m^3$ | USEPA, 2012 |
| Inhalation EC cancer | EC_c | 1.12E-04 | $\mu g/m^3$ | Calculated value |
| Inhalation EC noncancer | EC_nc | 2.62E-07 | $mg/m^3$ | Calculated value |
| Theoretical cancer risk | | 5E-07 | | |
| Noncancer hazard quotient | | 0.017 | | |

**Table 3. Estimation of Theoretical Cancer Risk and Noncancer Hazard Due to Arsenic**

| | Symbol | Value | Units | Notes |
|---|---|---|---|---|
| Arsenic concentration in soil (Csoil) | Csoil | 300 | mg/kg | Risk based concentration (see text) |
| Exposure time | ET | 24 | hrs/day | Assumes continuous exposed soil during removal activites |
| Exposure freqency | EF | 365 | days/year | Professional judgment; length of time for removal activities |
| Exposure duration | ED | 30 | years | USEPA, 1989 |
| Particulate Emission Factor | PEF | 4.40E+08 | $m^3$/kg | Off-site resident PEF from construction scenario for USEPA (2002) SSLs |
| Averaging Time - cancer | AT_c | 613200 | hours | USEPA, 2009 |
| Averaging Time - noncancer | AT_nc | 262800 | hours | USEPA, 2009 |
| Conversion Factor | CF | 1.00E+03 | µg/mg | USEPA, 1989 |
| Arsenic Inhalation Unit Risk | IUR | 4.30E-03 | $(\mu g/m^3)^{-1}$ | USEPA, 2012 |
| Arsenic Reference Concentration | RfC | 1.50E-05 | $mg/m^3$ | USEPA, 2012 |
| Inhalation EC cancer | EC_c | 2.92E-04 | $\mu g/m^3$ | Calculated value |
| Inhalation EC noncancer | EC_nc | 6.82E-07 | $mg/m^3$ | Calculated value |
| Theoretical cancer risk | | 1E-06 | | |
| Noncancer hazard quotient | | 0.045 | | |