

# Health Consultation

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**MARSHALL FORMER MANUFACTURED GAS PLANT #1**

**MARSHALL, SALINE COUNTY, MISSOURI**

**APRIL 4, 2005**

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES**  
Public Health Service  
Agency for Toxic Substances and Disease Registry  
Division of Health Assessment and Consultation  
Atlanta, Georgia 30333

## **Health Consultation: A Note of Explanation**

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

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MARSHALL, SALINE COUNTY, MISSOURI

Prepared by:

Missouri Department of Health and Senior Services  
Division of Environmental Health and Communicable  
Disease Prevention  
Under Cooperative Agreement with the  
U.S. Department of Health and Human Services  
Agency for Toxic Substances and Disease Registry

# **Health Consultation**

Marshall Former Manufactured Gas Plant #1

Marshall, MO

Saline County

March 24, 2005

Prepared by the:

Missouri Department of Health and Senior Services  
Division of Environmental Health and Communicable Disease Prevention  
Section for Environmental Public Health  
Under Cooperative Agreement with the  
Agency for Toxic Substances and Disease Registry

## STATEMENT OF ISSUES AND BACKGROUND

### Statement of Issues

The Missouri Department of Natural Resources (MDNR) has requested the Missouri Department of Health and Senior Services (DHSS), in conjunction with the federal Agency for Toxic Substances and Disease Registry (ATSDR), to complete a health consultation for the Marshall Former Manufactured Gas #1 Site in Marshall, MO. This health consultation focuses on the potential for human exposure to off site contamination in residential yards adjacent to the Marshall FMGP site.

### Background

The Marshall Former Manufactured Gas Plant (FMGP) #1 site is located at 400 North Lafayette Street in Marshall, Saline County, Missouri. From 1883 until 1924, Marshall FMGP #1 site produced natural gas using the coal gasification process. During that time, site features included a gasometer, purifier room, condenser room, coal house, lime house, tar well, and gas purifiers (1). Investigations completed in 1991 and 1996 documented that one or more of the site structures had leaked during operations and the subsurface soil was contaminated (2).

All structures associated with the former coal gasification operations have been removed from the site. The Marshall FMGP #1 site is currently used as a coin-operated laundromat and dry-cleaning business. A fence borders the site on three sides. One building is located on-site. Much of the area is covered with an asphalt parking lot (Figure 1). It was reported that the laundromat's asphalt parking lot covers a significant portion of the previously documented contaminated area and that local topography slopes toward the southeast (1).

MDNR and DHSS staff conducted a site visit on July 22, 2004, to determine current site conditions. The asphalt parking lot is in good condition with no obvious cracks or holes in the surface. There are several residences and other commercial businesses located adjacent to the site. Immediately north of the site is an automobile garage with several vehicles parked nearby. To the east, four homes have backyards that are separated from the site by a gravel alley. All residents within the area are supplied with water from the public water supply. No private wells are in use in the area.

During previous investigations of the site, coal tars were encountered buried at depths between 6-17 feet below ground surface. The investigations concluded that:

- There was no direct route of contact with contaminated on-site soils from the surface,
- The potential for contaminant releases to the area surface water and groundwater were extremely low,
- The potential for contaminant releases into the air and soil pathways appeared to be extremely low, and
- Surface barriers over the site area prevented the blowing of and direct contact with on-site contaminated soils.

The primary concern at this site is that nearby residents are being exposed to contaminants in the surface soil off-site. Residents could be exposed to the soil when gardening or other outdoor activities. Children have a tendency to be outside more frequently than adults, usually playing in the yard with toys or other children. The primary contaminants of concern are typical of other FMGP sites and include polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) (1). The PAHs found at the Marshall FMGP #1 site include: benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3,cd)pyrene.

The Screening Site Inspection conducted by the U.S. Environmental Protection Agency (EPA) in 1996 concluded that the Marshall FMGP #1 site does not pose a significant threat to human health or the environment (2). Two surface soil samples taken north of the site contained elevated levels of contaminants similar to those found on-site and there was a risk of direct exposure to residents and workers (2). However, it was unclear whether the contaminants were attributable to the site. The residential and commercial properties were not fully investigated to determine if the contamination posed a risk to human health or the environment.

In March 1998, DHSS prepared an Expedited Risk Assessment (RA) and Preliminary Remediation Goals (PRG) for the site at the request of MDNR. The RA examined risks resulting from exposure to contaminated surface soils and subsurface soils at the Marshall FMGP site and from exposure to off-site residential soils (3). The expedited RA is a type of assessment that is used as a tool for risk managers to evaluate the magnitude of risk a site poses to the public. The expedited RA found that the cancer risk to a future resident on-site was unacceptably high. There was also an unacceptable risk posed to current residents living on adjacent properties with high levels of contamination. The off-site residential yards were grouped together to evaluate whether any risk from this site existed for residents. Although the risk from exposure to individual residential yards was not examined, contaminant concentrations can be compared to the PRGs to allow evaluation of the risk in each yard. The residential PRGs calculated by the DHSS are listed in Table 1.

In March 2004, MDNR personnel collected surface soil samples from residential yards near the site and discrete subsurface soil samples on-site. In total, four soil boring samples and eight surface soil samples were collected. The soil boring samples were taken from depths of 3-4 feet, 7-8 feet, and 15-16 feet below ground surface. The surface soil samples were composite samples comprised of five evenly spaced aliquots collected from the first 2 inches of soil in each residential property or area of concern.

All samples collected on-site, except one taken from a depth of 3-4 feet below ground surface, had levels of one or more PAH above residential PRGs. None of the on-site samples collected contained elevated levels of VOCs. All of the residential yard samples contained levels of benzo(a)pyrene significantly above Cleanup Levels for Missouri (CALM) and EPA PRG values. Three of the four residential soil samples also contained elevated levels of dibenz(a,h)anthracene. Sample SS-01 was taken from the garden area of the residence. The background sample, SS-08, was taken from a vacant lot across Lafayette Street from the site. Table 1 is a listing of the PAH levels detected during the March 15, 2004 sampling event.

It appears that the majority of the contamination is on-site, in the subsurface, approximately 7-8 feet below ground surface. Transport of the contaminants by air is not likely because the site is covered by the asphalt parking lot and vegetation. Laundromat customers are not being exposed to the contamination. However, contaminants were found in the surface soil beyond the borders of the site fence in neighboring yards.

During recent conversations with MDNR staff, DHSS has learned that MDNR is planning to recommend removal actions be conducted at the residential properties surrounding the site.

## **DISCUSSION**

The concentrations of contaminants found in the soil were compared to CALM values established by MDNR and ATSDR comparison values. CALM values are risk-based soil and groundwater cleanup levels for sites contaminated with hazardous substances. The cleanup levels are designed to be protective of human health and the environment, and reflect the land use and varied human exposures those uses imply. There are specific values based on residential or industrial use and on the potential for contaminants to migrate into groundwater from soil. The only ATSDR comparison value available for this evaluation is a Cancer Risk Evaluation Guide (CREG) for excess cancer risk for Benzo(a)pyrene. CREGs are media-specific concentrations that are used to select environmental contaminants for further evaluation. The concentrations were also compared to risk-based PRG values set by EPA Region 9 for residential and industrial use.

Soil sampling results indicate that the contamination on-site is approximately 7-8 feet below ground surface. During the site visit, it was noted that the asphalt parking lot that covers the contaminated area is in good condition. It does not appear that human exposure is occurring to these soils. If the asphalt parking lot was removed or other digging occurred on-site, the contaminated soil would be uncovered and become accessible to site visitors.

The surface soil samples taken in the residential yards near the site contained elevated levels of PAHs. It is not known to what depth the contamination persists. Exposure to the contamination in the surface soil could be occurring, especially for the children who live in the residences. The samples taken were in limited areas and in the top 2 inches of the soil. The extent of the contamination and the depth to which it exists is not known. It is also not known how many children live in the residences or how often the residents are being exposed to the contaminated soil. One residence does have a large garden from which contaminated soil was taken.

The overall objective is to eliminate exposures to contaminated soils. Additional sampling would be helpful to resolve the unknown issues regarding the depth and extent of contamination. However, removal of the contaminated soil would be a permanent solution and protective of public health.

## TOXICOLOGICAL EVALUATION

### Polycyclic Aromatic Hydrocarbons

PAHs found in the soil samples are commonly known as “coal tars” and include compounds such as benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3,cd)pyrene. Typical sources of PAHs include asphalt roads, residential wood burning, municipal and industrial waste incineration, and hazardous waste sites. Cigarette smoke, vehicle exhausts, coal, coal tar, wildfires, and agricultural burning are also considered to be sources of PAHs. In general, PAHs do not easily dissolve in water. In soils, PAHs are most likely to stick tightly to particles. Some plants can uptake PAHs from contaminated soil via the roots depending on the concentration, solubility and molecular weight of the PAH and on the plant species. Vegetables and fruits obtained from a contaminated environment may contain higher PAH concentrations than those obtained from non-contaminated environments (4). In general, PAH concentrations in leaves, stems, and fruits tend to be higher than those in the roots.

People can be exposed to PAHs by ingestion, inhalation, or dermal contact. Studies in animals have shown that PAHs can cause harmful effects on the skin, body fluids, immune system, and reproductive system, along with birth defects and low birth weight. Similar effects could occur in people; however, no information is available to show that these effects do occur (3). It is not known how rapidly lungs absorb PAHs. Absorption is generally slow when PAHs are swallowed. PAHs enter all tissues that contain fat. They tend to be stored in kidneys, liver, and fat. Smaller amounts can be stored in the spleen, adrenal glands, and ovaries. Most PAHs that enter the body leave within a few days (4).

EPA has listed benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3,cd)pyrene as probable human carcinogens (4). A probable human carcinogen is a chemical that has limited evidence of carcinogenicity in humans, but sufficient evidence of carcinogenicity in animals. Benzo(a)pyrene is considered to be a potent experimental skin carcinogen.

Exposure to PAHs on-site is not likely; however, direct exposure to PAHs could occur off-site to the contaminated surface soils in the residential yards. Residents could be exposed to the PAHs in their yard soil through skin contact and incidental ingestion while playing or working in their yards, or by eating produce grown in contaminated soil. There is the potential risk of cancer for residents if there are many years of ingestion or skin contact with the soil.

### Children's Health

In general, children are more likely than adults to become exposed to contaminants in soil or water. In their daily activities, children have a tendency to have frequent hand-to-mouth contact and introduce non-food items into their mouths. Because children are smaller and their bodies typically retain more of the contaminants, it usually takes less of a contaminant to cause adverse



health effects in children than adults. It is anticipated that children would experience similar health effects to adults when exposed to PAHs. It is noted that human fetuses may be also particularly susceptible to the toxic effects produced by exposure to PAHs (4).

## CONCLUSIONS

Based on sampling results and current site conditions, it is evident that PAHs are present at the Marshall FMGP #1 site, and in the nearby residential yards, at levels above recommended risk-based levels. It appears that residents who visit the laundromat on-site are not being exposed to the contamination. Therefore, it is determined that the Marshall FMGP #1 on-site area is a *No Apparent Public Health Hazard*. The *No Apparent Public Health Hazard* category is one of the five categories used by the ATSDR and cooperating states for sites at which human exposure to contaminants is occurring, or has occurred in the past, but the exposure is below a level of health hazard.

Residents who live near the Marshall FMGP #1 site do have elevated levels of PAHs in the surface soil of their yards; however, the extent of the contamination in the surface soil of the off-site area is not known. In addition, the depth to which contamination persists in the subsurface has not been determined. The contaminant levels may vary throughout the off-site residential yards. Since discrete soil sampling was not conducted, it is difficult to determine homogeneity of contaminant levels throughout the yards. Also, the amount of exposure that is occurring to the contaminated soil is not known. Therefore, the off-site area that includes the residential yards is considered to be an *Indeterminate Public Health Hazard* for current exposures. The *Indeterminate Public Health Hazard* category is used by ATSDR and cooperating states for sites with incomplete information. These classifications were based on the following conclusions:

1. On-site subsurface and surface soil samples had levels of benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene significantly above CALM values; however exposure is not occurring because of the asphalt and vegetation covering the soil.
2. Exposure to the contaminated soils beneath the laundromat parking lot is not occurring due to the asphalt covering.
3. Benzo(a)pyrene was detected in levels significantly higher than the Residential CALM values in composite soil samples collected from all four residences off-site. Three of the four residential yards also had elevated levels of dibenz(a,h)anthracene in surface soil samples. The depth to which the contamination persists and the homogeneity of the contaminant levels throughout the yards is not known. The potential for human exposure to surface soil exists depending on the resident's activities.

## **RECOMMENDATIONS**

1. DHSS/ATSDR recommends eliminating potential exposure to contaminated surface soil in residential yards. Further sampling of the off-site residential yards would be helpful in determining the extent and depth of contamination. MDNR's decision to recommend a removal action in the residential yards would be a prudent and permanent solution.
2. Laundromat owners should maintain the asphalt parking lot to prevent uncovering of contaminated soils. Restrictions should be established to prevent disturbance of subsurface soils through drilling or digging on-site.
3. Laundromat owners and residents should maintain vegetated areas to prevent exposure to contaminated soils.

## **PUBLIC HEALTH ACTION PLAN**

This Public Health Action Plan (PHAP) for the Marshall FMGP #1 site contains an explanation of the actions to be taken by the Missouri Department of Health and Senior Services (DHSS), the Agency for Toxic Substances and Disease Registry (ATSDR), and other stakeholders. The purpose of the PHAP is to ensure that this public health consultation not only identifies public health hazards, but provides an action plan to mitigate and prevent adverse human health effects resulting from past, present, and future exposures to hazardous substances at or near the site. Below is a list of commitments of public health actions to be implemented by DHSS, ATSDR, or other stakeholders at the site:

1. DHSS/ATSDR will coordinate with the appropriate agencies or stakeholders to implement the recommendations in this public health consultation.
2. DHSS/ATSDR will address community health concerns and questions as they arise and provide necessary community and health professional education.
3. DHSS/ATSDR will review additional sampling data as it becomes available and provide guidance regarding possible health risk.
4. DHSS/ATSDR will update this public health consultation as more information becomes available.

**Preparers of the Report:**

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**Attachments:**

Figure 1, Site Sketch.

Table 1, Marshall FMGP #1, Selected Analytical Results for Soil Samples Collected on March 15, 2004

## **CERTIFICATION**

### **Certification**

This Marshall Former Manufactured gas Plant (FMGP) #1 Public Health Consultation was prepared by the Missouri Department of Health and Senior Services under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodologies and procedures existing at the time the health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

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Technical Project Officer, CAT, SPAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

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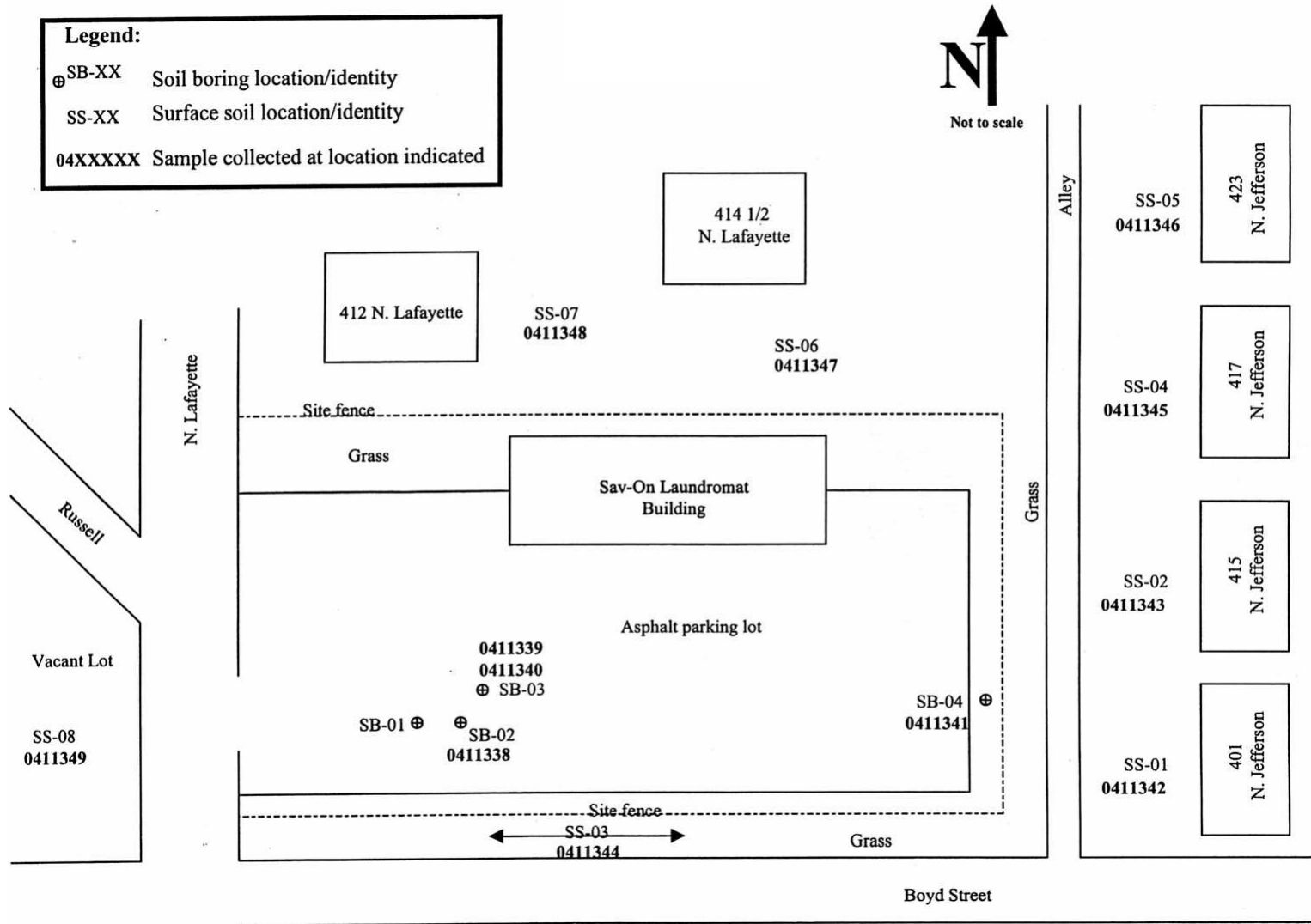
Team Lead, CAT, SPAB, DHAC, ATSDR

## REFERENCES

1. Missouri Department of Natural Resources. Removal Assessment Sampling Report. Marshall FMGP #1 Site. Marshall, Missouri, Saline County. 2004 March 15.
2. U.S. Environmental Protection Agency. Screening Site Inspection Report for Site Assessment Activity at Missouri Gas and Electric Company Former Manufactured Gas Plant Site. Marshall, Missouri. 1996 May 20.
3. Missouri Department of Health and Senior Services. Preliminary Removal Goals and Expedited Risk Assessment for the Marshall FMGP Site, Marshall, Saline County, Missouri. 1998 March.
4. Agency for Toxic Substances and Disease Registry. Toxicological profile for polycyclic aromatic hydrocarbons, update. Atlanta: U.S. Department of Health and Human Services; 1995 August.

# Figure 1

## Marshall FMGP #1 Site Sketch



Modified from: Missouri Department of Natural Resources. Removal Assessment Sampling Report. Marshall FMGP #1 Site. Marshall, Missouri. Saline County. 15 March 2004.

**TABLE 1: Marshall FMGP #1, Selected Analytical Results for Soil Samples Collected on March 15, 2004**

| Sample ID               | Depth of Sample | Benzo (a)pyrene | Benzo (a)anthracene | Benzo(b) fluoranthene | Benzo(k) fluoranthene | Dibenz(a,h) anthracene | Indeno(1,2,3-cd)pyrene |
|-------------------------|-----------------|-----------------|---------------------|-----------------------|-----------------------|------------------------|------------------------|
| SB-02                   | 15-16 feet      | 0.148           | <0.02               | <0.02                 | <0.02                 | <0.02                  | <0.02                  |
| SB-03                   | 7-8 feet        | <b>26.80</b>    | <b>25.0</b>         | <b>4.22</b>           | 6.64                  | <b>15.8</b>            | 21.1                   |
| SB-03 Rep               | 7-8 feet        | <b>14.60</b>    | <b>15.0</b>         | <b>3.23</b>           | 2.74                  | <b>8.63</b>            | 16.3                   |
| SB-04                   | 3-4 feet        | <0.02           | <0.02               | <0.02                 | <0.02                 | <0.02                  | <0.02                  |
| SS-01                   | 0-2 inches      | <b>0.200</b>    | 0.381               | 0.170                 | 0.220                 | <b>0.990</b>           | 0.496                  |
| SS-02                   | 0-2 inches      | <b>0.693</b>    | 0.208               | 0.115                 | 0.156                 | 0.129                  | 0.246                  |
| SS-03                   | 0-2 inches      | <b>3.30</b>     | <b>1.84</b>         | 0.564                 | 0.797                 | <b>3.10</b>            | 1.94                   |
| SS-04                   | 0-2 inches      | <b>0.586</b>    | 0.182               | <0.02                 | 0.170                 | 0.114                  | 0.118                  |
| SS-05                   | 0-2 inches      | <b>0.467</b>    | 0.180               | <0.02                 | 0.123                 | <0.02                  | 0.125                  |
| SS-06                   | 0-2 inches      | <b>3.40</b>     | <b>2.01</b>         | 0.779                 | 1.11                  | <b>3.33</b>            | 3.60                   |
| SS-07                   | 0-2 inches      | <b>0.713</b>    | 0.148               | <0.02                 | <0.02                 | <0.02                  | 0.142                  |
| SS-08 (bkgrd)           | 0-2 inches      | <b>1.5</b>      | 0.549               | 0.215                 | 0.340                 | <b>0.281</b>           | 0.661                  |
| CALM Res                |                 | 0.2             | 1                   | 0.9                   | 8                     | 0.2                    | 3                      |
| CALM Ind                |                 | 0.6             | 4                   | 4                     | 32                    | 0.6                    | 11                     |
| CALM C <sub>LEACH</sub> |                 | 24              | 0.2                 | 0.6                   | 0.6                   | 2                      | 1.8                    |
| EPA PRG Res             |                 | 0.062           | 0.62                | 0.62                  | 6.2                   | 0.062                  | 0.62                   |
| EPA PRG Ind             |                 | 0.21            | 2.1                 | 2.1                   | 2.1                   | 0.21                   | 2.1                    |
| MDHSS PRG Range         |                 | 0.09-9          | 0.9-88              | 0.9-88                | 9-880                 | 0.09-9                 | 0.9-88                 |
| ATSDR CREG              |                 | 0.1             |                     |                       |                       |                        |                        |

All values listed in parts per million (mg/kg).

Sample results in bold exceed the Cleanup Levels for Missouri (CALM), for residential use soil benchmarks.

CALM-Cleanup Level for Missouri groundwater target, residential and industrial soil benchmarks.

EPA PRG-EPA Region 9 Preliminary Remediation Goals, residential and industrial use, October 1999.

MDHSS PRG Range-Missouri Department of Health and Senior Services prepared an Expedited Risk Assessment and Residential Preliminary Remediation Goals for this site in 1998.

The PRGs are listed as an acceptable range of contaminant level.

ATSDR CREG –Cancer Risk Evaluation Guide for  $1 \times 10^{-6}$  excess cancer risk.