Health Consultation

Review of Groundwater Data
(2002 & 2004 EPA Delineation Investigations)

SIGMON'S SEPTIC TANK SERVICE FACILITY
STATESVILLE, IREDELL COUNTY, NORTH CAROLINA

EPA FACILITY ID: NCD062555792

APRIL 3, 2006

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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Prepared by:

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Background and Statement of Issues

On October 20, 2004, the Agency for Toxic Substances and Disease Registry (ATSDR) received a request from its Division of Regional Operations (DRO), Region IV Office, Atlanta, Georgia. DRO requested ATSDR to determine the potential public health impacts that the Sigmon Septic Tank Service Site—a former septic tank service and waste removal business—would have on nearby private wells (Benjamin Moore, Division of Regional Operations, ATSDR, Region 4, e-mail of October 2004 to Susan Moore, Division of Health Assessment and Consultation, ATSDR). The request originated from the United States Environmental Protection Agency (EPA), Region IV Office, Atlanta, Georgia. EPA initially sent analytical results of groundwater samples to ATSDR's DRO Region IV Office for public health review and evaluation (Warren Dixon, EPA, Region 4, e-mail of October 2004 to Benjamin Moore, ATSDR, Division of Regional Operations).

The Sigmon Septic Tank Service Site (CERCLIS No. NCD062555792) is located at 1268 Eufola Road, approximately 5 miles southwest of Statesville, Iredell County, North Carolina (NCDENR 1998, 2000; Black & Veatch 2004). This site has been listed under several names, including Sigmon's Septic Tank Service, AAA Enterprises, and Sigmon Environmental Services. Services provided by the former septic tank service facility have included the pumping and removal of septic tank wastes and heavy sludges for residential, commercial, and industrial customers, installation and repair of septic tanks, and other waste removal services to various industries.

Both federal and state environmental regulatory agencies have investigated the groundwater near the site for several years (NCDENR 1998, 2000; Black & Veatch 2004). ATSDR had previously determined that the groundwater pathway appeared to be of concern because two private wells showed nitrate levels greater than 10,000 parts per billion (ppb) (ATSDR 2002). Very young infants (0–6 months) who consume formula prepared with water containing nitrate levels greater than 10,000 ppb have an increased risk of higher methemoglobin levels (EPA 1990; Bosch et al. 1950; Walton 1951). Similarly, fetuses might be exposed to potential health risks if pregnant females drank water with comparable nitrate levels (Dorsch et al. 1984; Arbuckle et al. 1988; MMWR 1996).

Figure 1 shows the Sigmon Septic Tank Service Site and nearby residences. Former waste areas still remain at the site. These were used for waste handling and disposal during past operations at the former septic tank service facility. These areas include the Lagoon Area, Waste Pile, and Open Pits (Figure 1). These former waste areas are believed to be the chief source of groundwater problems within the area. In its previous public health consultation (PHC), ATSDR recommended that environmental regulatory agencies consider removing these areas from the Sigmon Septic Tank Service Site (ATSDR 2002). EPA is presently considering this recommendation while their delineation investigations continue at the site. ATSDR believes that removing the remaining waste areas at the site might reduce or even eliminate potential releases of hazardous substances to the surrounding soil, groundwater, or surface water. A reduction or elimination of hazardous wastes would in turn lower the potential impact on public health from contaminants released into the environment.

Discussion

Environmental Sampling and Chemical Analyses

ATSDR reviewed groundwater samples collected in October 2002 and May 2004 from several private wells and monitoring wells to determine whether any releases of hazardous substances may be impacting the health of private well users (Black and Veatch 2004). These private well users utilize the groundwater for drinking and other domestic purposes (washing, bathing, irrigation, etc.).

Rationale for the Selective Screening of Substances in Groundwater

The first step in any public health evaluation or assessment process is the application of conservative screening values to the available sampling data. This phase of the process helps to rule out any site-specific substances that would not pose a public health hazard under virtually any plausible exposure scenario. The remaining substances require further analysis to evaluate their potential for causing adverse health effects under site-specific exposure conditions (ATSDR 2005). It is during this second phase of the process that potential public health hazards are identified. The preliminary screening phase does not identify toxic exposures; it merely eliminates obviously nontoxic exposures, so that the evaluation of public health implications can focus on a reduced list of substances.

A substance is initially selected for further public health evaluation if its maximum detected level in groundwater exceeds its most relevant water comparison value (CV). A substance is also initially selected for further evaluation if it is detected in groundwater and no water CV exists for the substance. Following this initial screening, the detected concentration(s) of the selected substance(s) are compared to concentration ranges that were considered no apparent public health hazards in the previous PHC released for the site (ATSDR, 2002). The substances and their respective concentration ranges considered to pose no apparent public health hazard are listed in Table 1. If the detected concentrations fell within the concentration ranges considered to pose no apparent public health hazard, the substances were not reevaluated as to avoid repeating work already accomplished.

2002 and 2004 delineation investigations

EPA contracted Black and Veatch Special Projects Corporation (Black & Veatch) to conduct remedial investigation (RI) sampling activities at the Sigmon Septic Tank Service Site in accordance with their Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EPA 1997). In October 2002 and May 2004, samples were taken from (1) groundwater, (2) surface water, (3) sediments, (4) surface soil, and (5) subsurface soil. Groundwater samples were collected from 9 private wells and 5 monitoring wells (Figures 2 and 3). Thirty-one water samples (22 from private wells and 9 from monitoring wells) were collected from these groundwater wells. Subsequently, these 31 samples (or some subset thereof) were analyzed to characterize metals, volatile organic compounds (VOCs), semivolatile organic

compounds (SVOCs), and pesticides/polychlorinated biphenyls (PCBs). Tables 2 through 11 (Appendix B) list the analytical results of the water samples collected from the private wells. The results were compared to water comparison values (CVs) along with the selection screening criteria to see if further analysis was indicated for any of these substances. The following is a summary of ATSDR's initial public health screen for each private well.

- *Private well SS-PW-01***.** Of the 14 substances in the well, none exceeded any available water CV; however, 3 substances were found for which there were no available CVs. The concentrations of these 3 substances were within the range of levels previously considered to pose no apparent public health hazard at this site (ATSDR 2002). Therefore, none of the substances in SS-PW-01 was selected for further public health evaluation (Table 2).

- *Private well SS-PW-03.* Of the 32 substances in the well, 4 showed maximum levels that exceeded available water CVs; however, 2 of these substances did not require further public health evaluation because their maximum measured concentrations were within the range considered no apparent public health hazard. Eight other substances were also detected in the well that had no available water CVs; however, 3 of these were within the range considered no apparent public health hazard. Seven of the substances in SS-PW-03 were therefore selected for further public health evaluation (Table 3).

- *Private well SS-PW-04.* Of the 14 substances detected in this well, none exceeded any available water CV. However, 4 of these substances had no available water CVs, 3 of these were within the range considered no apparent public health hazard. Therefore, only one of the substances in SS-PW-04 was selected for further evaluation (Table 4).

- *Private well SS-PW-05.* Only one of the 14 substances in this well showed maximum levels that exceeded available water CVs. This one substance did require further public health evaluation. Three other substances in the well had no available water CVs; however, all three had concentrations within the range considered no apparent public health hazard. On the basis of the selective screening criteria used in this PHC, only 1 of the substances in this well was selected for further public health evaluation (Table 5).

- *Private well SS-PW-06.* None of the 16 substances in this well exceeded any available water CVs; however, 3 of these substances had no available water CVs. All 3 showed measured concentrations within the range considered not to pose a public health hazard. Therefore, none of the substances in SS-PW-06 were selected for further evaluation (Table 6).

- *Private well SS-PW-07.* None of the 9 substances in this well exceeded the available water CVs; however, no water CVs were available for 3 of these

substances. The concentrations of all 3 were within the range considered to pose no apparent public health hazard. Therefore, none of the substances in this well were selected for further evaluation (Table 7).

- *Private well SS-PW-08.* None of the 15 substances in this well exceeded the available water CVs; however, no water CVs were available for 5 of these substances. The concentrations of 3 of these substances were within the range considered no apparent public health hazard and only 2 of the substances in this well were selected for further evaluation (Table 8).

- *Private well SS-PW-09.* Two of the 10 substances in this well had maximum levels that exceeded available water CVs, thus requiring further public health evaluation. Three other detected substances had no available water CVs, but all 3 were within the range considered no apparent public health hazard. Therefore, two of the substances in this well were selected for further evaluation (Table 9).

  Lead levels in this well in October 2002 were 50 parts per billion (ppb), which exceeded the maximum contaminant level action (MCLA) of 15 ppb for lead in drinking water set by EPA under the Superfund statues. Black & Veatch (2004) conducted follow-up sampling on March 19, 2003 and April 9, 2003, during which water samples were collected outdoors at the wellhead and indoors at the water tap. Seven substances were detected in this well during this round of sampling (Table 10). None of these exceeded any available water CVs, but water CVs were unavailable for 2 of these substances. However, these 2 substances were within the concentration range considered to pose no apparent public health hazard. The lead levels at the indoor water tap were lower than those measured at the wellhead, suggesting a possible lead source at the wellhead that should be assessed further.

- *Private well SS-PW-10.* Two of the 11 substances in this well had maximum levels exceeding available water CVs, thus requiring further evaluation. Three other substances detected in the well had no available water CVs. However, all 3 were within the range considered no apparent public health hazard. On this basis, 2 of the substances in this well were selected for further evaluation (Table 11).

Tables 13 through 17 (see Appendix B) list the constituents detected in the water samples collected from the monitoring wells. These results were compared to the relevant CVs. Although we applied the selection screening criteria to each monitoring well, none of the substances detected in these wells was selected for further analysis. We believe that the monitoring wells will never be used for potable or other domestic purposes. Thus, no exposures can occur to any hazardous substances contained in the wells. Nevertheless, ATSDR recommends routine sampling and analysis of groundwater samples from both the monitoring wells and nearby private wells until potential source areas of contamination at the site are removed. This is seen as a responsive public health action to reduce and/or prevent exposures to hazardous substances that

could possibly migrate into nearby private wells. The following briefly summarizes ATSDR's initial public health screen for each monitoring well.

- *Monitoring well SS-MW-11C.* Of the 35 substances detected in this on-site monitoring well, 7 had maximum levels that exceeded available water CVs and would have required further public health evaluation (ATSDR 2002). Four other substances were also detected in the well that would have required further public health analysis. Although no CVs were available for these substances, all 4 had concentrations exceeding the range considered to constitute no apparent public health hazard (Table 13). However, because this monitoring well will not be used for potable or other domestic purposes, none of these substances was selected for further evaluation. Otherwise, 11 of the substances detected in this monitoring well would have required further public health evaluation.

- *Monitoring well SS-MW-14.* Ten of the 33 substances in this on-site monitoring well had maximum levels that exceeded available water CVs. One of these would not have required further public health evaluation because its maximum concentration was within the range considered no apparent public health hazard. Four other substances in the well had no available water CVs. Again, one of these would not have required further public health evaluation because its concentration was within the range considered no apparent public health hazard (Table 14). Because this monitoring well will not be used for potable or other domestic purposes, none of these substances was selected for further public health evaluation. Otherwise, 12 of the detected substances in this monitoring well would have been selected for further evaluation.

- *Monitoring well SS-MW-10B.* Of the 18 substances in this off-site monitoring well, only one had a maximum level that exceeded its available water CV. However, this concentration was within the range considered no apparent public health hazard requiring no further evaluation. Three other substances were also detected in the well for which there were no available water CVs, but all 3 had concentrations within the range considered to pose no apparent public health hazard (Table 15). Based on this and the belief this monitoring well will not be used for potable or other domestic purposes, none of these substances was selected for further public health evaluation.

- *Monitoring well SS-MW-12B.* Of the 17 substances detected in this off-site monitoring well, three substances showed maximum concentrations that exceeded their available water CVs. Two of these would not require further public health evaluation because their maximum concentrations were within the range considered to pose no apparent public health hazard. Four other substances in the well had no available water CVs. Three of these had concentrations within the range considered to pose no apparent public health hazard (Table 16). Based on the belief this monitoring well will not be used for potable or other domestic

purposes, none of these substances was selected for further public health evaluation. Even if this was not the case, only 2 substances in this well would have been selected for further evaluation.

- *Monitoring well SS-MW-13B.* Of the 30 substances detected in this off-site well, 8 had maximum levels that exceeded available water CVs. One of these would not have required further evaluation because its maximum measured concentration was within the range considered to pose no apparent public health hazard. Four other substances were also detected in the well that had no available water CVs. Two showed concentrations within the range considered to constitute no apparent public health hazard (Table 17). Because we believe this well will not be used for potable or other domestic purposes, none of these substances was selected for evaluation. Otherwise, 9 of the detected substances in this monitoring well would have been selected for further public health evaluation.

Chemicals Selected for Further Public Health Analysis

ATSDR's review of the groundwater analyses of the private wells is summarized in Table 12. Using Table 12, our environmental health scientists selected substances detected in the private wells for further public health analysis. These substances were categorized into 2 groups: those that exceeded available CVs and those for which there were no available CVs. The following substances were selected for analysis:

Substances exceeding drinking water CVs*	Substances without drinking water CVs
Arsenic	Yttrium
Copper	2-Hexanone
Lead	Endosulfan II
Zinc	Endrin aldehyde
α-BHC[†]	Endrin ketone
Heptachlor epoxide	γ-Chlordane

* Comparison values
[†] α-Benzenehexachloride

Monitoring Well Data

ATSDR's review of the groundwater analyses of the monitoring wells are summarized in Tables 18 and 19. As noted previously, it is understood that monitoring wells will not be used for potable or other domestic purposes. Nevertheless, ATSDR still recommends routine sampling and analysis of groundwater from both the monitoring wells and nearby private wells until

potential source areas of contamination at the site are removed. Following the selective screening criteria used for the potable water wells, ATSDR environmental health scientists noted additional substances detected in the monitoring wells (highlighted in blue and yellow in Tables 18 and 19) that were not included in the substances selected for further analysis. Exposures to these additional substances are minimal to none since the water in these wells is not used for potable purposes. However, these additional substances could possibly migrate into nearby private wells that are used for potable and other domestic purposes and they should be continually monitored until potential sources of contamination at the site are removed. These additional substances are listed below:

Substances exceeding drinking water comparison values	Substances without drinking water comparison values
Chromium	Calcium*
Iron*	Magnesium*
Manganese*	Potassium*
Mercury	
Nickel	
Sodium*	
Thallium	
Vanadium	
Benzene	
Trichloroethene	
Aldrin	
β-BHC[†]	
Heptachlor	

* These substances are essential nutrients and are typically not harmful under most environmental exposure scenarios (ATSDR 2005). However, they should still be monitored to ensure that they do n not reach harmful concentrations.

[†] β-Benzenehexachloride.

ATSDR also reviewed the groundwater analyses in the private wells and monitoring wells to determine if the number of VOCs detected in on-site wells were comparable to those in the off-site wells. Only two off-site wells (monitoring well SS-MW-13B and private well SS-PW-03) showed VOC levels comparable to those in the on-site wells (Table 20). Both wells are south to

southwest of the site, and are believed to be hydraulically downgradient (Figure 4). In a previous PHC, ATSDR listed two private wells as posing health risks because detected nitrate levels were greater than 10,000 ppb (ATSDR 2002). These two private wells (SS-PW-02 and SS-PW-03) are also located south to southwest of the site and are likewise believed to be hydraulically downgradient. This suggests that substances from the site may be migrating off-site. To err on the side of public health, we recommend responsive actions to reduce or prevent migration of these substances from the site (e.g., eliminating all potential source areas). Moreover and until potential source areas are eliminated at the site, we recommend responsive actions to reduce or prevent exposures to substances that are perhaps migrating from the site and impacting private wells. One such responsive action is to install water filtration/purification systems to homes in close proximity to the site.

Assessment Limitations

We note the following issues regarding the groundwater contamination near the Sigmon Septic Tank Service Site:

- Nitrates – ATSDR health scientists were especially concerned that none of the samples were analyzed for nitrates in the private potable wells. In a previous PHC about the site (ATSDR 2002), ATSDR noted that two private wells containing nitrate levels greater than 10,000 ppb posed an increased health risk to very young infants (0–6 months). Both of these wells (SS-PW-02 and SS-PW-03) appear to be hydraulically downgradient from the potential source areas at the site (Figure 4; SS-PW-02 is not shown on the figure but is nearly adjacent to SS-PW-03). Pregnant females and their fetuses also need to be included in this sensitive population. Sensitive populations are defined as people who might be more sensitive or susceptible to exposures to hazardous substances because of factors such as age, occupation, sex, or behaviors (e.g., cigarette smoking). For additional insight about sensitive populations, please refer to page 13 of this PHC (i.e., “Child health considerations”).

  Five wells may possibly be hydraulically connected in the general area where nitrates might be a problem (ATSDR 2002). Two of the wells are private (SS-PW-02 and SS-PW-03). The other 3 are monitoring wells (SS-MW-11C, SS-MW-14, and SS-MW-13B), 2 of which are on-site and 1 is off-site. No data were collected for private well SS-PW-02 during October 2002 or May 2004 because it was dry in October 2002 and was not sampled in May 2004. The only evidence suggesting that the private well is hydraulically connected to the others are the nitrate levels measured in the well before and during 1999 (ATSDR 2002).

- Lead sources – Lead was detected in 8 private wells near the Sigmon Septic Tank Service Site. However, only 2 of these (SS-PW-09 and SS-PW-10) contained maximum lead levels (50 ppb and 140 ppb, respectively) that exceeded EPA’s lead action level of 15 ppb. It is noteworthy that when these lead levels were detected (October 2002 and May 2004), they were higher than the levels in on-site monitoring wells SS-MW-11C and SS-

MW-14 (7–16 ppb, respectively), which are relatively close to the source areas. Therefore, even though lead is a site contaminant, it is possible that other sources, such as plumbing (lead piping, lead-based solder, and lead-containing water faucets or spigots), could have contributed to the high measurements. These varied results could also be due to possible discrepancies in sampling methodology (e.g., concentration fluctuations associated with faucet run-time).

Whether or not the potential lead sources are identified, the maximum detected lead levels in private wells SS-PW-09 and SS-PW-10 do present the potential of adversely affecting public health. Concerned residents should therefore ask their physicians to determine their blood lead levels. Meanwhile, residents can take short-term remedies to reduce lead concentrations in their drinking water and, thus minimize their exposure.

- *If the source of lead is in the plumbing.* Let the tap water run for 30 seconds to 2 minutes before using it for drinking or cooking. The longer water remains in pipes, the greater is the likelihood that lead may dissolve into it. Water that has been in the pipes for more than 4 hours should be flushed for 3 to 5 minutes. For example, this should be done first thing in the morning and upon arriving home in the evening. A good indication of when to stop flushing the cold-water tap is when the water becomes noticeably colder. Use cold water for cooking or making infant formula because water from the hot-water tap tends to leach lead from the pipes and plumbing more quickly. This can result in higher lead concentrations in hot water.

- *If the source of lead is the groundwater.* If the tap water contains lead in excess of 15 ppb even after flushing, residents should consider using bottled water for drinking or cooking. Alternatively, they might consider a water purification system that removes lead and other contaminants. Purification systems range in size and cost from simple water pitcher filtration to purification systems for the entire household.

- Well construction quality – The Sigmon Septic Tank Service Site is located in a rural area, and it was therefore difficult to determine when some of these private potable wells were constructed. Due to the lack of construction details, it was also hard to verify the integrity of the wells. (Contaminants may enter poorly constructed wells more easily than well-constructed ones.)

  Chlorination by-products – Two VOCs classified as trihalomethanes were detected in two private wells (chloroform in SS-PW-06 and bromoform in SS-PW-08). Neither of these chemicals was detected in the on-site monitoring wells close to the source areas. Trihalomethanes are common by-products of the chlorination of drinking water. Chlorination is an effective means of treating drinking water for infectious bacteria (coliforms) and other pathogens. However, guidelines are established to ensure that the chlorination of non-municipal water sources is done correctly. Therefore, it may be wise

to contact your county health department to determine if the proper guidelines for chlorinating such water sources are being followed. Chlorination of the well water would be a plausible source of the observed trihalomethanes. However, it is also possible that the trihalomethanes leached from septic tank leaching fields; this is not uncommon in a rural area with private wells.

- Presence of bacteria – Drinking water quality can also be affected by the presence of bacteria and other pathogens. Unpleasant taste, odor, and water color are not only caused by elevated levels of metals such as iron and manganese, but also by some types of bacteria. Due to the type of business formerly conducted at the Sigmon Septic Tank Service Site and private septic tanks in the area, bacteria could be migrating from on-site source areas and private septic tanks outside of the site. Prior to the release of a previous PHC for the site, ATSDR personnel contacted a representative of the Iredell County Health Department (ICHD). The representative informed ATSDR that none of the nearby private wells had been sampled or analyzed for fecal or total coliform counts (ATSDR 2002). The representative did state that the ICHD would provide such an analysis at the request of any concerned well owner.

Exposure Pathways

Exposure to the chemicals detected in the water samples were determined to be *intermediate* and *chronic* (that is, moderate and long-term exposures, respectively) that can occur via ingestion, inhalation (VOCs), and dermal contact when groundwater is used for drinking, showering and bathing, or other household purposes. Several studies have indicated that significant exposures to VOCs can occur during showering and bathing as chemicals volatilize and are subsequently inhaled and/or absorbed through the skin. Such exposures to VOCs may equal or exceed those from ingestion, but usually by no more than a factor of 2 (Jo et al. 1990; Kerger, Schmidt & Paustenbach 2000; Kezic et al. 1997; Mattie et al. 1994; EPA 1999). Because of the low frequency of VOC detection (5%–15%) and the fact that none of the detected levels exceeded any available drinking water comparison values, ATSDR considered VOC exposure through inhalation and skin absorption to be minimal, if any. Therefore, ingestion was the primary route of human exposure considered in this PHC; it is also the route of exposure for other, nonvolatile substances that were detected at a higher frequency (e.g., metals).

Public health implications

The substances discussed below were selected for further evaluation on the basis of the selective screening criteria for this PHC. Some of these substances were selected merely because their detected levels in one or more private potable wells exceeded available water CVs. (See Appendix A for a description of comparison values and their proper interpretation.) The toxicological evaluations of these substances are based on the best available medical and toxicological information (ATSDR 2005).

Substances detected in the groundwater through the sampling of private potable wells were screened with health-based comparison values (Tables 2–12). Health-based CVs represent those levels expected to be safe even for sensitive populations, excluding hypersensitive (allergic) individuals. Exceeding a CV does not indicate that adverse health effects are expected, but identifies substances that may require additional evaluation of factors that may influence the toxicity and likelihood of health effects. Exposures to potential carcinogens are further evaluated using risk assessment to describe the increases risk of cancer compared to background levels. Those substances exceeding CVs or for which comparison values do not exist were further evaluated for potential adverse health effects.

Further evaluation identified lead as the only substance for which intervention is recommended for specific water wells. Lead levels of 140 µg/L and 50 µg/L (ppb) were detected in 2 specific wells. These exceeded the EPA action level for lead of 15 µg/L (EPA 2004a). This action level is based on the maximum contaminant level (MCL), which is not strictly a health-based screening level. These levels may be a cause of concern for women of child-bearing age that may become pregnant, as well as for the fetus and young children. Women of child-bearing age should be protected because the fetus could be exposed before the mother-to-be learns she is pregnant. A threshold for effects has not been identified for lead exposures to the fetus or young children.

Cumulative exposures to multiple substances are not considered likely for these wells, considering the type of substances, the low levels detected, and their modes of action. Adverse health effects due to the potential additive impact of carcinogens and noncarcinogenic substances are considered unlikely.

Substances without drinking water comparison values

A health-based comparison value has not been developed for the ingestion of 2-hexanone. 2-Hexanone is used as a solvent and is regulated in the workplace where airborne exposure may occur. Short-chain ketones such as 2-hexanone are of concern mainly due to inhalation and dermal exposure (Topping et al. 2001). Low levels of ketones can be found in the environment and 2-hexanone has been reported in milk and cream in the range of 7–18 ppb (ATSDR 1992). While inhalation is the primary exposure route for adverse health effects, ingestion of very high levels leads to similar adverse health effects as seen in animals. 2-Hexanone is no longer manufactured since 1982 but can be found as a waste product, a product of environmental oxidative degradation, and a mammalian metabolite of n-hexane (ATSDR 1999). The CV of n-hexane is 420 µg/L for ingesting tap water and inhaling any vapors due to off-gassing (EPA 2004b). On the basis of limited laboratory animal data and by comparison to similar chemicals, exposure to the low maximum level of 0.52 µg/L detected in the water sample is not expected to result in adverse health effects.

No oral CV exists for yttrium, but the oral toxicity of this metal has been described as low and the inhalation toxicity varies greatly with the yttrium compound (OSHA). The scientific literature does not report oral toxicity at site-specific concentrations (2 µg/L, or 2 ppb). The lowest published lethal subcutaneous dose in the rat is more than 10 grams per kilogram (10

million ppb) and adverse effects were not observed in rats dosed intraperitoneally (a more sensitive route) with 60,000 µg/kg (60,000 parts per billion) of yttrium every other day for 5 months (OSHA). The U.S. Occupational Safety and Health Administration (OSHA) has established a permissible exposure limit (PEL) for yttrium inhalation of 1,000 µg/m^3 (1,000 ppb) (OSHA), and the National Institute for Occupational Safety and Health (NIOSH) has established an immediately dangerous to life and health (IDLH) level of 500,000 µg/m^3 (500,000 ppb) (NIOSH 1995). Such doses resulting from exposures would be extremely high compared to these site-specific levels. While appropriate studies are not available to determine a safe yttrium oral exposure level, there is no evidence to expect adverse health effects at the site-specific levels found here.

"Technical chlordane" is a mixture of at least 23 isomers (different configurational forms of chlordane) that include gamma-chlordane (γ-chlordane) and other surrogate chemicals. The approximate composition of technical chlordane is as follows: *trans*-chlordane, or γ-chlordane, 24%; chlordene isomers, 21.5%; *cis*-chlordane, or alpha-chlordane (α-chlordane), 19%; heptachlor, 10%; nonachlor, 7%; diels-alder adduct of cyclopentadiene and pentachlorocyclopentadiene, 2%; hexachlorocyclopentadiene, 1%; octachlorocyclopentene, 1%; and miscellaneous constituents, 15.5% (IARC 1979). Because γ-chlordane is one of the components of chlordane, its detected levels were compared to the CVs for chlordane. The detected levels for γ-chlordane did not exceed the noncancer CVs for chlordane (ATSDR's chronic child environmental media evaluation guide, or EMEG, of 6 ppb or EPA's MCL of 2 ppb). One detected water level for γ-chlordane did exceed the cancer CV for chlordane (ATSDR's cancer risk evaluation guide, or CREG, of 0.1 ppb), resulting in an increased lifetime cancer risk of less than 10^{-5} (1 in 100,000). However, no adverse health effects are expected at these detected levels for γ-chlordane.

Little is known about the properties of endrin aldehyde (an impurity and breakdown product of endrin) or endrin ketone (a photodegradation product of endrin when it is exposed to light). As noted, endrin aldehyde is a minor impurity of the pesticide endrin, which is no longer produced (ATSDR 1997; Merck 2001). The production and use of endrin may have resulted in the release of both endrin aldehyde and endrin ketone into the environment, either by the direct release of endrin or from various waste streams formed in its production. Due to their associated histories with the pesticide endrin, both endrin aldehyde and endrin ketone are usually considered surrogates of endrin. Thus, their detected levels are usually compared against the CVs of endrin as an environmental health screen. None of the detected levels of endrin aldehyde or endrin ketone exceeded the noncancer comparison values for endrin (ATSDR's chronic child EMEG of 3 ppb or EPA's MCL of 2 ppb). Therefore, no adverse health effects are expected from exposures to endrin aldehyde or endrin ketone at their detected levels in well water here.

Endosulfan is a mixture of two different isomers of the same chemical. Commercially, this mixture for endosulfan is composed of 70% of endosulfan I and 30% of endosulfan II. The biological half-life is 1–2 weeks for endosulfan and both isomers are metabolized to endosulfan sulfate (Accu-Chem). Moreover, endosulfan I and endosulfan II are usually considered surrogates of the chemical endosulfan. Because the detected water level for endosulfan II does

not exceed the noncancer CV for endosulfan (ATSDR chronic child EMEG of 20 ppb), no adverse health effects are expected from exposures to endosulfan II at this level in well water.

Substances exceeding drinking water comparison values

The heptachlor epoxide level in one sample exceeded a comparison value for cancer, but not a noncancer CV. Exposures could result in a slight increase in the risk for developing cancer, but health effects are unlikely since the risk is less than 10^{-5} for a lifetime exposure. This corresponds to a risk of 1 cancer case in a population of 100,000 and is likely to be less, considering the conservative nature of estimating the risk, the use of maximum exposure values, and an actual less than continuous lifetime exposure.

Moreover, the detected water level in one sample exceeded a cancer comparison value for alpha-BHC (α-hexachlorocyclohexane) but not a noncancer CV. Exposures could result in a slight increase in the risk for developing cancer, but health effects are unlikely since the risk is also less than 10^{-5} for lifetime exposures.

The water level for arsenic did not exceed noncancer CVs; however, the cancer comparison value was exceeded, resulting in a slight increase in cancer risk. Nevertheless, health effects are unlikely, as the increase in cancer risk is less than 10^{-5} for a lifetime exposure.

Only the maximum detected levels for both copper and zinc slightly exceeded their respective noncancer comparison values; however, adverse health effects are not expected from lifetime exposures at these levels.

Child health considerations

ATSDR considers children in the evaluation for all environmental exposures and uses health guidelines that are protective for children. When evaluating any potential health effects via ingestion, children are considered a special or sensitive population. Because of their lower body weight, the same exposure will result in a higher dose compared to adults. Average body weight differences, as well as average differences in child-specific intake rates for various environmental media, are taken into account by ATSDR's child EMEGs.

Although not known during the October 2002 and May 2004 delineation investigations, past nitrate levels in two private wells located directly below the on-site source areas have posed an increased risk of elevated methemoglobin levels in very young infants (less than 6 months of age) from drinking formula prepared with this water. Another group at similar risk is pregnant females carrying fetuses. Current lead levels in two private wells also exceeded the EPA lead action level of 15 ppb and may potentially pose increased health risks, especially to young children who drink the well water. However, the sources of lead contamination in these two wells are also unknown. Regardless of the source, to ensure prudent public health interventions, ATSDR recommends supplying households whose wells may have been potentially impacted by

nitrates, lead, and/or other substances that perhaps migrated from the site with an alternative water source (bottled water or connection to a municipal water line) or installing water filtration/purification systems that yield safe drinking water.

Conclusions

1. During the October 2002 and May 2004 delineation investigations at the Sigmon Septic Tank Service Site, private wells SS-PW-09 and SS-PW-10 showed maximum lead levels of 50 and 140 ppb, respectively. These measured levels potentially could adversely affect the health of individuals using the wells for potable purposes.

2. Although not measured during the October 2002 and May 2004 delineation investigations, private wells SS-PW-02 and SS-PW-03 had nitrate levels greater than 10,000 ppb between 1991 and 1999 (ATSDR 2002). At that time, the maximum detected nitrate levels in both wells posed an increased risk of higher methemoglobin levels in very young infants (0–6 months) drinking formula prepared with water from these wells. The sensitive population also included pregnant females who drank water from these wells could adversely affect their fetuses.

3. Other substances detected in nearby private wells surrounding the Sigmon Septic Tank Service Site posed no apparent public health hazard to residents using water from nearby private wells. The detected substances considered to pose no apparent public hazard are shown under the following two categories:

   • Substances exceeding comparison values – arsenic, copper, zinc, α-BHC, and heptachlor epoxide;

   • Substances without comparison values – yttrium, 2-hexanone, methyl acetate, methylcyclohexane, endosulfan II, endrin aldehyde, endrin ketone, and γ-chlordane.

4. ATSDR identified several limitations in the delineation investigations regarding groundwater contamination found near the Sigmon's Septic Tank Service Site: (1) unknown presence of nitrates, (2) unknown lead sources, (3) unknown well construction quality, (4) unknown origin of chlorination by-products, and (5) unknown presence of bacterial and other pathogens. It is uncertain what future impact these limitations may have regarding long-term exposure to groundwater from nearby private wells. However, these limitations should be addressed in the interest of public health.

Recommendations

1. Consider supplying an alternative water source (bottled water or connection to a municipal water line) or implementing another remedy (e.g., installation of a water

filtration/purification system) that yields potable water within safe drinking water standards to households whose private wells may be impacted by nitrates, lead, and/or other substances that perhaps have migrated from the site. Continue this responsive action until the appropriate investigations are completed, strategies formulated, remedial actions implemented, and local water supplies are brought within safe drinking standards.

2. Consider removing the source areas from the Sigmon Septic Tank Service Site to reduce and/or prevent any potential migration of hazardous substances into nearby private wells.

3. Consider continuing to routinely collect and analyze groundwater samples, particularly for nitrates and lead, from both the monitoring wells and nearby private wells until the appropriate investigations are completed, strategies formulated, remedial actions implemented, and local water supplies are brought within safe drinking standards.

Public health action plan

1. Follow up with EPA in educating and informing concerned residents about the public health importance of using an alternative water source (bottled water or connection to a municipal water line) or implementing another remedy (installation of a water filtration/purification system) that yields safe drinking water until further notified that their own water is within safe drinking water standards

2. Follow-up with EPA and Iredell County Health Department in educating and informing concerned residents of the public health significance of having drinking water tested for lead, applying approaches at home to reduce the amount of lead in drinking water, and checking blood lead levels periodically.

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Appendix A

Comparison Values

ATSDR comparison values (CVs) are media-specific concentrations that are considered to be safe under default conditions of exposure. They are used as screening values in selecting site-specific chemicals for further evaluation of their public health implications. Generally, a chemical is selected for further public health evaluation because its maximum concentration in air, water, or soil at the site exceeds at least one of ATSDR's CVs. Supplementing this conservative approach is ATSDR's guidance that requires environmental health scientists to exercise professional judgment when selecting chemicals for further public health evaluation, evaluating exposure pathways, and determining the public health implications of site-specific exposures (ATSDR 1992). ATSDR may also select detected chemical substances for further public health evaluation and discussion because ATSDR has no CVs for certain specified chemicals or because the community has expressed special concern about the substance, whether it exceeds CVs or not.

It must be emphasized that CVs are *not* thresholds of toxicity. While concentrations at or below the relevant CV are generally considered to be safe, it does not automatically follow that any environmental concentration that exceeds a CV would be expected to produce adverse health effects. In fact, the whole purpose behind highly conservative, health-based standards and guidelines is to enable health professionals to recognize and resolve potential public health problems before they become actual health hazards. For that reason, ATSDR's CVs are typically 1 to 3 orders of magnitude (10–1,000 times) lower than the corresponding no-effect levels or lowest-effect levels on which they are based. The probability that adverse health outcomes will actually occur depends not on environmental concentrations alone, but on several additional factors, including site-specific conditions of exposure, individual lifestyle, and genetic factors affecting the route, magnitude, and duration of actual exposures, and individual physiological responses to those exposures.

Listed below are the abbreviations for selected CVs and units of measure used within this document. Following this list of abbreviations are more complete descriptions of the various comparison values used within this document, as well as a brief discussion on one of ATSDR's most conservative CVs.

CREG = cancer risk evaluation guide
EMEG = environmental media evaluation guide
LTHA = drinking water lifetime health advisory
MCL = maximum contaminant level
MCLA = maximum contaminant level action
MRL = minimal risk level
RBC = risk-based concentration
RfD = reference dose
RMEG = reference dose media evaluation guide

Units of measure

ppm	=	parts per million, e.g., mg/L (water), mg/kg (soil)
ppb	=	parts per billion, e.g., μg/L (water), μg/kg (soil)
kg	=	kilogram (1,000 grams)
mg	=	milligram (0.001 gram)
μg	=	microgram (0.000001 gram)
L	=	liter (1,000 milliliters or 1.057 quarts of liquid, or 0.001 m^3 of air)
m^3	=	cubic meter (a volume of air equal to 1,000 liters)

Cancer risk evaluation guides (CREGs) are derived by ATSDR. They are estimated chemical concentrations theoretically expected to cause no more than one excess case of cancer per million people exposed over a lifetime. CREGs are derived from EPA's cancer slope factors and therefore reflect estimates of risk based on the assumption of zero threshold and lifetime exposure. Such estimates are necessarily hypothetical. As stated in EPA's 1986 Guidelines for Carcinogenic Risk Assessment (EPA 1986), "the true value of the risk is unknown and may be as low as zero."

Drinking water equivalent levels (DWELs) are lifetime exposure levels specific for drinking water (assuming that all exposure is from that medium) at which adverse, noncarcinogenic health effects would not be expected to occur. They are derived from EPA reference doses (RfDs) by factoring in default ingestion rates and body weights to convert the RfD to an equivalent concentration in drinking water.

Minimal risk levels (MRLs) are ATSDR estimates of daily human exposures to a chemical that are unlikely to be associated with any appreciable risk of deleterious noncancer effects over a specified duration of exposure. MRLs are calculated with data from human and animal studies and are reported for acute (≤14 days), intermediate (15–364 days), and chronic (≥365 days) exposures. MRLs for oral exposure ingestion) are doses typically expressed in mg/kg/day. Inhalation MRLs are concentrations typically expressed in either parts per billion (ppb) or micrograms per meter cubed ($\mu g/m^3$). The latter are identical to ATSDR's EMEGs for airborne contaminants. ATSDR's MRLs are published in ATSDR toxicological profiles for specific chemicals.

Environmental media evaluation guides (EMEGs) are media-specific concentrations that are calculated from ATSDR's Minimal Risk Levels by factoring in default body weights and ingestion rates. Different EMEGs are calculated for adults and children, as well as for acute (≤14 days), intermediate (15–364 days), and chronic (≥365 days) exposures.

EPA reference dose (RfD) is an estimate of the daily exposure to a contaminant unlikely to cause any noncarcinogenic adverse health effects over a lifetime of chronic exposure. Like the ATSDR MRL, the EPA RfD is a dose and is typically expressed in mg/kg/day.

Reference dose media evaluation guide (RMEG) is the concentration of a contaminant in air, water, or soil that ATSDR derives from EPA's RfD for that contaminant by factoring in default values for body weight and the media-specific intake rate. Like ATSDR EMEGs, RMEGs are calculated for both adults and children.

Risk-based concentrations (RBCs) are media-specific values derived by the Region III Office of the U.S. Environmental Protection Agency from EPA RfDs, RfCs, or cancer slope factors, by factoring in default values for body weight, exposure duration, and ingestion/inhalation rates. These values represent levels of chemicals in air, water, soil, and fish that are considered safe over a lifetime of exposure. RBCs for noncarcinogens and carcinogens are analogous to ATSDR EMEGs and CREGs, respectively.

Lifetime health advisories (LTHAs) are calculated from the drinking water equivalent level (DWEL) and represent the concentration of a substance in drinking water estimated to have negligible deleterious effects in humans over a lifetime of 70 years, assuming 2 liter per day water consumption for a 70-kilogram adult. In the absence of chemical-specific data, LTHAs are 20% and 10% of the corresponding DWELs for noncarcinogenic organic and inorganic compounds, respectively. LTHAs are not derived for compounds that are potentially carcinogenic for humans.

Maximum contaminant levels (MCLs) are drinking water standards established by the EPA. They represent levels of substances in drinking water that EPA deems protective of public health over a lifetime (70 years) at an adult exposure rate of 2 liters of water per day. They differ from other protective comparison values in that they (1) reflect consideration of both carcinogenic and noncarcinogenic effects, (2) take into account the availability and economics of water treatment technology, and (3) are legally enforceable.

Maximum contaminant level action (MCLA) are action levels for drinking water set by EPA under Superfund. When the relevant action level is exceeded, a regulatory response is triggered.

When screening individual chemical substances, ATSDR staff compares the highest single concentration of a chemical detected at the site with the appropriate CV available for the most sensitive of the potentially exposed individuals (usually children). Typically, the cancer risk evaluation guide (CREG) or chronic environmental media evaluation guide (cEMEG) is used. This worst-case approach introduces a high degree of conservatism into the analysis and often results in the selection of many chemical substances for further public health evaluation that upon closer scrutiny will not be judged to pose any hazard to human health. However, in the interest of public health, it is more prudent to use an environmental screen that identifies many chemicals for further evaluation that may later be determined to be harmless, as opposed to one that may overlook even a single potential hazard to public health. The reader should keep in mind the conservativeness of this approach when interpreting ATSDR's analysis of the potential health implications of site-specific exposures.

APPENDIX B

TABLE 1
Chemical levels considered no apparent health hazard

ATSDR's 2002 public health conclusions for Sigmon's Septic Tank Service Site

(Summary of chemical concentrations found in all private wells between 1991–1999)

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)			ATSDR PUBLIC HEALTH CONCLUSION AS CITED IN March 2002 HEALTH CONSULTATION
	Detected concentrations			
	Range	Mean	Median	
INORGANIC MOITIES				
Nitrates	100–23,350	8,164	8,600	Potential public health concern
Sulfates	6,000	6,000	6,000	No apparent public health hazard
METALS				
Aluminum	200–1,700	950	950	No apparent public health hazard
Barium	16–400	164	90	No apparent public health hazard
Calcium	21,000–95,000	58,000	58,000	No apparent public health hazard
Cobalt	1.2– 2.6	2.1	2.4	No apparent public health hazard
Copper	14–60	37.6	38	No apparent public health hazard
Iron	14–5,500	1,736	195	No apparent public health hazard
Lead	2–28	8.9	4.5	No apparent public health hazard
Magnesium	1,600–12,000	6,983	7,250	No apparent public health hazard
Manganese	4.2–830	153.1	78	No apparent public health hazard
Mercury	1–7	2.8	1.6	No apparent public health hazard
Nickel	2.3–4.2	3.25	3.25	No apparent public health hazard
Potassium	1,300–7,000	2,990	2,150	No apparent public health hazard
Sodium	5,300–15,000	10,150	10,150	No apparent public health hazard
Zinc	28–2,500	541	155	No apparent public health hazard
ORGANIC COMPOUNDS				
Acetone	5–233	71.9	47.5	No apparent public health hazard
Benzene	0.4	0.4	0.4	No apparent public health hazard
Bromodichloromethane	3	3	3	No apparent public health hazard
Chlorobenzene	0.4	0.4	0.4	No apparent public health hazard
Chloroform	0.6–39	13.46	0.78	No apparent public health hazard
Dibromochloromethane	1	1	1	No apparent public health hazard

TABLE 1 (continued)
Chemical levels considered no apparent health hazard

ATSDR's 2002 public health conclusions for Sigmon's Septic Tank Service Site

(Summary of chemical concentrations found in all private wells between 1991–1999)

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)			ATSDR PUBLIC HEALTH CONCLUSION AS CITED IN March 2002 HEALTH CONSULTATION
	Detected concentrations			
	Range	Mean	Median	
1,2-Dichlorobenzene	0.3–48	24	24	No apparent public health hazard
1,4-Dichlorobenzene	0.27–44	3.91	0.77	No apparent public health hazard
1,1-Dichloroethane	0.4–1.5	0.7	0.6	No apparent public health hazard
1,2-Dichloroethane	0.53	0.53	0.53	No apparent public health hazard
cis -1,2-Dichloroethene	0.43–3.5	1.3	0.8	No apparent public health hazard
Methylene chloride	2	2	2	No apparent public health hazard
Tetrachloroethene (PCE)	0.29–0.53	0.41	0.41	No apparent public health hazard
Trichloroethene (TCE)	0.27–0.89	0.5	0.35	No apparent public health hazard
Xylenes	0.5–5.1	2.2	1.6	No apparent public health hazard

Reference: Agency for Toxic Substances and Disease Registry. March 29, 2002. Health Consultation: Sigmon's Septic Tank Service Facility (Review of Groundwater Data). US DHHS, Public Health Service; Atlanta, GA

TABLE NOTES

Footnotes for Tables 2 through 12

Notes:

A substance is selected for further public health evaluation if its maximum detected level in groundwater exceeds its respective water comparison value (see sky blue highlighting). This screening criteria is not applicable if disclaimer No. 5 is specified (see lavender highlighting). Moreover, a substance may also be selected for further public health evaluation if detected and no available water comparison value exists for the substance (see yellow highlighting); however, this screening criteria is also not applicable if tdisclaimer No. 5 is specified (see lime highlighting). Therefore, a response of "Yes" under the subheading "Further public health evaluation required" indicates that the substance was further evaluated by ATSDR health scientists.

CREG: Cancer Risk Evaluation Guide
EMEG: Environmental Media Evaluation Guide (prefixes: a = acute, c = chronic, i = intermediate)
LTHA: Drinking Water Lifetime Health Advisory
MCL: Maximum Contaminant Level
RBC: Risk Based Concentration. (Note, RBC values derived from equations documented in following reference: EPA Region III Risk-based Concentration Table. Philadelphia: United States Environmental Protection Agency, Region III. Available at: *http://www.epa.gov/reg3hwmd/risk/riskmenu.htm.* Background Information – [PDF].)
RMEG: Reference Dose Media Evaluation Guide
ppb: parts per billion

Laboratory Qualifiers
A – Analyte analyzed in replicate. Reported value is average of replicates.
AJ – Analyte analyzed in replicate. Reported value is average of replicates. Reported value is an estimate.
J – Identification of analyte is acceptable; reported value is an estimate.
N – Presumptive evidence is present; analyte reported as tentative identification.
NJ – Presumptive evidence is present; analyte reported as tentative identification. Reported value is an estimate .
U – Analyte not detected at or above reporting limit.

[1] Listed value in EPA MCL column is a secondary drinking water regulation (SDWR) as set by EPA. SDWRs are unenforceable federal guidelines regarding taste, odor, color, and other non-aesthetic effects of drinking water. EPA recommends them to the states as reasonable goals, but federal law does not require water supply systems to comply with them. However, the states may adopt their own enforceable regulations governing these concerns. To be safe, check your state's drinking water regulations.

[2] Listed value in EPA MCL column is a maximum contaminant level action (MCLA) for drinking water as set by EPA under Superfund. If the relevant action level is exceeded, a regulatory response is triggered.

[3] Listed value in EPA MCL column is a health-based drinking water advisory as set by EPA. The drinking water advisory is based on the assumption that an individual is placed on a sodium-restricted diet of 500 mg/day.

[4] Listed value in EPA MCL column is a proposed MCL under the 1994 proposed rule for disinfection by products rule; the current MCL for most trihalomethanes is 100 ppb under the 1996 Drinking Water Advisory Report.

[5] Detected concentration(s) are within a range of concentrations for the specific chemical considered to be no apparent public health hazard as cited in a previous public health consultation released for the Sigmon Septic Tank Service site (ATSDR, 2002).

TABLE 2

Substances found in private well SS-PW-01

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	October 2002	October 2002 (Duplicate)	May 14, 2004	May 14, 2004 (Duplicate)			
METALS							
Aluminum				56 J	20,000 child iEMEG		No
Barium	31	31	39	37	700 child RMEG	2,000	No
Calcium[5]	1,700	1,700	3,200 J	3,500 J			No
Cobalt			0.08 J	0.08 J	100 child iEMEG		No
Copper[2]	78	45	110 J	55 J	200 child iEMEG	1,300	No
Iron[1]	90	68		47 J	11,000 RBC	300	No
Lead[2]	12	4.3	7.5 J	3.8 J		15	No
Magnesium[5]	400	390	570 J	620 J			No
Manganese[1]	26	24	7.1	6.7	300 LTHA	50	No
Potassium[5]	1,200	1,200	1,200 J	1,200 J			No
Sodium[3]	3,700	3,600	3,600 J	3,800 J		20,000	No
Strontium	12	12			4,000 LTHA		No
Zinc[1]	5.6		12 J	10 J	3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS							
Tetrachloroethene (PCE)	0.12 J				10 LTHA	5	No

TABLE 3

Substances detected in private well SS-PW-03

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	October 2002	October 2002 (Duplicate)	May 14, 2004	May 14, 2004 (Duplicate)			
METALS							
Arsenic	1.2 A				0.02 CREG	10	Yes
Barium	130 A		67		700 child RMEG	2,000	No
Calcium[5]	39,000 A		36,000				No
Cobalt	3.6 A		0.16 J		100 child iEMEG		No
Copper[2]			2.8		200 child iEMEG	1,300	No
Iron[1]	250 A				11,000 RBC	300	No
Magnesium[5]	6,900 A		3,100 J				No
Manganese[1,5]	270 A		20		300 LTHA	50	No
Mercury[5]	2.1 A		0.98		2 LTHA	2	No
Nickel			3.2		100 LTHA		No
Potassium[5]	3,100 A		2,600 J				No
Selenium			0.43 J		50 child cEMEG	50	No
Silver			0.07 J		50 child RMEG		No
Sodium[3]	9,400 A		6,000			20,000	No
Strontium	180 A				4,000 LTHA		No
Vanadium			0.45 J		30 child iEMEG		No
Yttrium	2.1 A						Yes
Zinc[1]			4.9 J		3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS							
Benzene	0.26 J				0.6 CREG	5	No
Chlorobenzene	0.54				100 LTHA	100	No
1,2-Dichlorobenzene	0.46 J		0.17 J		600 LTHA	600	No
1,4-Dichlorobenzene	2.2		1		75 LTHA	75	No
1,1-Dichloroethane	0.69		0.2 J		800 RBC		No
cis -1,2-Dichloroethene	0.52 J				70 LTHA	70	No
1,2-Dichloropropane			0.67		700 child iEMEG	5	No
2-Hexanone			0.52 J				Yes
Methyl acetate			0.91		6,100 RBC		No
Methylcyclohexane	0.12 J				6,300 RBC		No
PESTICIDES							
alpha-BHC (alpha-Hexachlorocyclohexane)	0.027 N				0.006 CREG		Yes
Endrin aldehyde	0.017 J						Yes
Endosulfan II	0.011 JN						Yes
gamma-Chlordane	0.67 J						Yes

TABLE 4

Substances found in private well SS-PW-04

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	October 2002	October 2002 (Duplicate)	May 14, 2004	May 14, 2004 (Duplicate)			
METALS							
Barium	53		110		700 child RMEG	2,000	No
Beryllium			0.14 J		20 child cEMEG	4	No
Calcium[5]	5,000		5,500				No
Cobalt			0.35 J		100 child iEMEG		No
Copper[2]	34		72 J		200 child iEMEG	1,300	No
Lead[2]	5		4.4 J			15	No
Magnesium[5]	1,400		2,200 J				No
Manganese[1]	8.2		18		300 LTHA	50	No
Nickel			1.9		100 LTHA		No
Potassium[5]	1,900		2,400 J				No
Sodium[3]	2,600		4,000 J			20,000	No
Strontium	33				4,000 LTHA		No
Zinc[1]	280		330 J		3,000 child iEMEG	5,000 (SDWR)	No
PESTICIDES							
Endrin aldehyde			0.015 NJ				Yes

TABLE 5

Substances found in private well SS-PW-05

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	October 2002	October 2002 (Duplicate)	May 14, 2004	May 14, 2004 (Duplicate)			
METALS							
Barium	30		56		700 child RMEG	2,000	No
Calcium[5]	3,400		5,300				No
Cobalt			0.33 J		100 child iEMEG		No
Copper[2]	20		100 J		200 child iEMEG	1,300	No
Lead[2]	1.3		3.1 J			15	No
Magnesium[5]	700		1,100 J				No
Manganese[1]	9.3		5.4		300 LTHA	50	No
Nickel			1.3		100 LTHA		No
Potassium[5]	1,300		1,500 J				No
Sodium[3]			1,800 J			20,000	No
Strontium	18				4,000 LTHA		No
Zinc[1]	14		42		3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS							
Methyl-t-butyl ether (MTBE)	0.26 J		0.39 J		200 LTHA		No
PESTICIDES							
Heptachlor epoxide	0.032		0.01		0.004 CREG	0.2	Yes

TABLE 6

Substances found in private well SS-PW-06

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	October 2002	October 2002 (Duplicate)	May 14, 2004	May 14, 2004 (Duplicate)			
METALS							
Aluminum			110 J		20,000 child iEMEG		No
Barium			30		700 child RMEG	2,000	No
Calcium[5]			2,900 J				No
Cobalt			0.27 J		100 child iEMEG		No
Copper[2]			21 J		200 child iEMEG	1,300	No
Iron[1]			37 J		11,000 RBC	300	No
Lead[2]			1.3 J			15	No
Magnesium[5]			660 J				No
Manganese[1]			13		300 LTHA	50	No
Nickel			2.9		100 LTHA		No
Potassium[5]			840 J				No
Sodium[3]			910 J			20,000	No
Zinc[1]			20 J		3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS							
Carbon disulfide	1.6				1,000 child RMEG		No
Chloroform[4]	0.32 J				100 child cEMEG	80	No
Tetrachloroethene (PCE)	0.1 J				10 LTHA	5	No

TABLE 7

Substances found in private well SS-PW-07

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	October 2002	October 2002 (Duplicate)	May 14, 2004	May 14, 2004 (Duplicate)			
METALS							
Barium	16				700 child RMEG	2,000	No
Calcium[5]	2,200						No
Copper[2]	27				200 child iEMEG	1,300	No
Lead[2]	1.5					15	No
Magnesium[5]	560						No
Potassium[5]	1,500						No
Sodium[3]	4,100					20,000	No
Strontium	16				4,000 LTHA		No
Zinc[1]	11				3,000 child iEMEG	5,000 (SDWR)	No

TABLE 8

Substances found in private well SS-PW-08

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	October 2002	October 2002 (Duplicate)	May 14, 2004	May 14, 2004 (Duplicate)			
METALS							
Aluminum			200		20,000 child iEMEG		No
Barium	14		15		700 child RMEG	2,000	No
Calcium[5]	6,600		6,300				No
Copper[2]	15		70 J		200 child iEMEG	1,300	No
Lead[2]	1.6		7.5 J			15	No
Magnesium[5]	1,400		1,600 J				No
Manganese[1]			3.6		300 LTHA	50	No
Potassium[5]	1,700		1,400 J				No
Sodium[3]	4,900		5,800			20,000	No
Strontium	36				4,000 LTHA		No
Vanadium			1.8		30 child iEMEG		No
Zinc[1]	620		200 J		3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS							
Bromoform[4]			1.6 J		4 CREG	80	No
PESTICIDES							
Endrin ketone			0.01 NJ				Yes
gamma-Chlordane			0.011 N				Yes

TABLE 9

Substances found in private well SS-PW-09

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	October 2002	October 2002 (Duplicate)	May 14, 2004	May 14, 2004 (Duplicate)			
METALS							
Barium			27	28	700 child RMEG	2,000	No
Calcium[5]	25,000		25,000	23,000			No
Copper[2]	270		60 J	150 J	200 child iEMEG	1,300	Yes
Lead[2]	50		8.3 J	20 J		15	Yes
Magnesium[5]	1,800		1,300 J	1,300 J			No
Manganese[1]			5.7	5.8	300 LTHA	50	No
Potassium[5]			1,100 J	1,000 J			No
Sodium[3]	4,800		3,200 J	3,300 J		20,000	No
Strontium	28				4,000 LTHA		No
Zinc[1]	21		37 J	42 J	3,000 child iEMEG	5,000 (SDWR)	No

TABLE 10

Followup sampling and analyses conducted in private well SS-PW-09

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	March 19, 2003	April 9, 2003	April 9, 2003 (Tap unfiltered)	April 9, 2003 (Tap filtered)			
METALS							
Calcium[5]	22,000 A	21,000 A	21,000 A	20,000			No
Copper[2]	40 A	64 AJ	36	40	200 child iEMEG	1,300	No
Lead[2]	6 A	14 A	1 U	2.3		15	No
Magnesium[5]	1,900 A	1,900 A	1,900	1,800			No
Sodium[3]	5,100 A	5,100 A	5,000	4,700		20,000	No
Strontium	26 A	26 A	25	24	4,000 LTHA		No
Zinc[1]	56 A	61 A	130	250	3,000 child iEMEG	5,000 (SDWR)	No

TABLE 11

Substances found in private well SS-PW-10

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	October 2002	October 2002 (Duplicate)	May 14, 2004	May 14, 2004 (Duplicate)			
METALS							
Barium			12		700 child RMEG	2,000	No
Calcium[5]			4,300 J				No
Copper[2]			37 J		200 child iEMEG	1,300	No
Iron[1]			130		11,000 RBC	300	No
Lead[2]			140 J			15	Yes
Magnesium[5]			870 J				No
Manganese[1]			7.1		300 LTHA	50	No
Potassium[5]			1,100 J				No
Sodium[3]			5,600			20,000	No
Zinc[1]			3,400 J		3,000 child iEMEG	5,000 (SDWR)	Yes
VOLATILE ORGANIC COMPOUNDS							
Tetrachloroethene (PCE)			0.21 J		10 LTHA	5	No

TABLE 12

Substances detected in private wells near the Sigmon Facility

(Summary of chemical concentrations in all private wells from October 2002–May 2004)

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	Range	Mean	Median	Detection rate			
METALS							
Aluminum	56–200	107.2	110	3/22	20,000 child iEMEG		No
Arsenic	1.2	1.2	1.2	1/22	0.02 CREG	10	Yes
Barium	12–130	34	31	17/22	700 child RMEG	2,000	No
Beryllium	0.14	0.14	0.14	1/22	20 child cEMEG	4	No
Calcium[5]	1,700–39,000	7,989.4	5,900	22/22			No
Cobalt	0.08–3.6	0.27	0.27	7/22	100 child iEMEG		No
Copper[2]	2.8–270	45.21	45	21/22	200 child iEMEG	1,300	Yes
Iron[1]	37–250	83.78	79	6/22	11,000 RBC	300	No
Lead[2]	1.3–140	6.04	5	19/22		15	Yes
Magnesium[5]	390–6,900	1,217.31	1,350	22/22			No
Manganese[1, 5]	3.6–270	11.87	8.2	15/22	300 LTHA	50	No
Mercury[5]	0.98–2.1	1.43	1.54	2/22	2 LTHA	2	No
Nickel	1.3–3.2	2.19	2.4	4/22	100 LTHA		No
Potassium[5]	840–3,100	1,447.75	1,300	17/22			No
Selenium	0.43	0.43	0.43	1/22	50 child cEMEG	50	No
Silver	0.07	0.07	0.07	1/22	50 child RMEG		No
Sodium[3]	910–9,400	3,958.84	4,100	21/22		20,000	No
Strontium	12–180	26.12	25.5	12/12	4,000 LTHA		No
Vanadium	0.45–1.8	0.9	1.13	2/22	30 child iEMEG		No
Yttrium	2.1	2.1	2.1	1/12			Yes
Zinc[1]	4.9–3,400	54.82	42	20/22	3,000 child iEMEG	5,000 (SDWR)	Yes
VOLATILE ORGANIC COMPOUNDS							
Benzene	0.26	0.26	0.26	1/19	0.6 CREG	5	No
Bromoform[4]	1.6	1.6	1.6	1/19	4 CREG	80	No
Carbon disulfide	1.6	1.6	1.6	1/19	1000 child RMEG		No
Chlorobenzene	0.54	0.54	0.54	1/19	100 LTHA	100	No
Chloroform[4]	0.32	0.32	0.32	1/19	100 child cEMEG	80	No
1,2-Dichlorobenzene	0.17–0.46	0.28	0.32	2/19	600 LTHA	600	No
1,4-Dichlorobenzene	1–2.2	1.48	1.6	2/19	75 LTHA	75	No
1,1-Dichloroethane	0.2–0.69	0.37	0.45	2/19	800 RBC		No
cis -1,2-Dichloroethene	0.52	0.52	0.52	1/19	70 LTHA	70	No
1,2-Dichloropropane	0.67	0.67	0.67	1/19	700 child iEMEG	5	No
2-Hexanone	0.52	0.52	0.52	1/19			Yes
Methyl acetate	0.91	0.91	0.91	1/19	6,100 RBC		No

TABLE 12 (continued)

Substances detected in private wells near the Sigmon Facility

(Summary of chemical concentrations in all private wells from October 2002–May 2004)

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	Range	Mean	Median	Detection rate			
Methylcyclohexane	0.12	0.12	0.12	1/19	6,300 RBC		No
Methyl-t-butyl ether (MTBE)	0.26–0.39	0.32	0.33	2/19	200 LTHA		No
Tetrachloroethene (PCE)	0.1–0.21	0.14	0.12	3/19	10 LTHA	5	No
PESTICIDES							
alpha-BHC (alpha-Hexachlorocyclohexane)	0.027	0.027	0.027	1/19	0.006 CREG		Yes
Endosulfan II	0.011	0.011	0.011	1/19			Yes
Endrin aldehyde	0.017	0.017	0.017	1/19			Yes
Endrin ketone	0.01	0.01	0.01	1/19			Yes
gamma-Chlordane	0.011–0.67	0.086	0.341	2/19			Yes
Heptachlor epoxide	0.01–0.032	0.02	0.02	2/19	0.004 CREG	0.2	Yes

TABLE NOTES

Footnotes for Tables 13 through 19

Notes:

Please note that no substance was selected for further public health evaluation simply because no one is expected to drink water from these monitoring wells. The tables do indicate where maximum detect levels exceeded their respective water comparison value (see blue highlighting). This screening criterion, however, could be not applicable if disclaimer No. 5 was specified (see lavender highlighting). Moreover, the tables also indicate where substances may be selected for further public health evaluation if detected and no available water comparison value exists for the substance (see yellow highlighting). Likewise, this screening criterion also could be not applicable if disclaimer No. 5 is specified (see green highlighting).

CREG: Cancer Risk Evaluation Guide
EMEG: Drinking Water Lifetime Health Advisory
LTHA: Drinking Water Lifetime Health Advisory
MCL: Maximum Contaminant Level
RBC: Risk-based Concentration (Note, RBC values derived from equations documented in following reference: EPA Region III Risk-based Concentration Table. Philadelphia: United States Environmental Protection Agency. Available at: *http://www.epa.gov/reg3hwmd/risk/riskmenu.htm.* Background Information - [PDF].)
RMEG: Reference Dose Media Evaluation Guide
ppb: parts per billion

Laboratory Qualifiers

J – Identification of analyte is acceptable; reported value is an estimate.
N – Presumptive evidence is present; analyte reported as tentative identification.
NJ – Presumptive evidence is present; analyte reported as tentative identification. Reported value is an estimate.

[1] Listed value in EPA MCL column is a secondary drinking water regulation (SDWR) as set by EPA. SDWRs are unenforceable federal guidelines regarding taste, odor, color, and other non-aesthetic effects of drinking water. EPA recommends them to states as reasonable goals, but federal law does not require water supply systems to comply with them. The states may, however, adopt their own enforceable regulations governing these concerns. To be safe, check your state's drinking water regulations.

[2] Listed value in EPA MCL column is a maximum contaminant level action (MCLA) for drinking water as set by EPA under Superfund. If the relevant action level is exceeded, a regulatory response is triggered.

[3] Listed value in EPA MCL column is a health-based drinking water advisory as set by EPA. The drinking water advisory is based on the assumption that an individual is placed on a sodium-restricted diet of 500 mg/day.

[4] Listed value in EPA MCL column is a proposed MCL under the 1994 proposed rule for disinfection by products rule; the current MCL for most trihalomethanes is 100 ppb under the 1996 Drinking Water Advisory Report.

[5] Detected concentration(s) are within a range of concentrations for the specific chemical considered to be no apparent public health hazard as cited in a previous public health consultation released for the Sigmon Septic Tank Service site (ATSDR, 2002).

TABLE 13

Substances found in on-site monitoring well SS-MW-11C

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)		WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations				
	October 2002	May 14, 2004			
METALS					
Aluminum		100 J	20,000 child iEMEG		No
Arsenic	26	4	0.02 CREG	10	No
Barium	260	420	700 child RMEG	2,000	No
Calcium	34,000	170,000			No
Chromium	0.8	9.8	100 LTHA	100	No
Cobalt	21	8.5	100 child iEMEG		No
Copper[2]	15	7.6	200 child iEMEG	1,300	No
Iron[1]	70,000	6,200 J	11,000 RBC	300	No
Lead[2]		7.2		15	No
Magnesium	100,000	47,000 J			No
Manganese[1]	17,000	19,000	300 LTHA	50	No
Nickel	12	18	100 LTHA		No
Potassium	12,000	12,000			No
Selenium		0.5 J	50 child cEMEG	50	No
Sodium[3]	10,000	160,000		20,000	No
Thallium	19		0.5 LTHA	2	No
Vanadium	4.8	2.6	30 child iEMEG		No
Zinc[1]		14	3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS					
Benzene	1 J	1.4 J	0.6 CREG	5	No
Chlorobenzene	18	7.6 J	100 LTHA	100	No
1,2-Dichlorobenzene	2 J	0.99 J	600 LTHA	600	No
1,3-Dichlorobenzene		0.12 J	600 LTHA		No
1,4-Dichlorobenzene	18	14 J	75 LTHA	75	No
1,1-Dichloroethane	1 J		800 RBC		No
cis -1,2-Dichloroethene	2 J	0.35 J	70 LTHA	70	No

TABLE 13 (continued)

Substances found in on-site monitoring well SS-MW-11C

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)		WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations				
	October 2002	May 14, 2004			
Ethylbenzene		0.097 J	700 LTHA	700	No
Isopropylbenzene (Cumene)		0.59	1,000 child RMEG		No
Toluene	66	0.1 J	200 child iEMEG	1,000	No
Total Xylenes	2 J	0.37 J	2,000 child iEMEG	10,000	No
SEMI-VOLATILE ORGANIC COMPOUNDS					
1,1-Biphenyl	1 J		500 child RMEG		No
Caprolactam	3 J	64	5,000 child RMEG		No
Naphthalene	6 J	1.8 J	100 LTHA		No
2-Methylnaphthalene	1 J	0.71 J	500 child cEMEG		No
PESTICIDES					
alpha-BHC (alpha-Hexachlorocyclohexane)		0.012 N	0.006 CREG		No
Endosulfan II		0.0089 J			No

TABLE 14

Detected substances found in on-site monitoring well SS-MW-14

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb) Detected concentrations		WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	October 2002	May 14, 2004			
METALS					
Aluminum		19,000	20,000 child iEMEG		No
Barium		450	700 child RMEG	2,000	No
Beryllium		2.1	20 child cEMEG	4	No
Cadmium		1.4	2 child cEMEG	5	No
Calcium[5]		62,000			No
Chromium		7.7	100 LTHA	100	No
Cobalt		25	100 child iEMEG		No
Copper[2]		16	200 child iEMEG	1,300	No
Iron[1]		9,800 J	11,000 RBC	300	No
Lead[2, 5]		16		15	No
Magnesium		35,000			No
Manganese[1]		17,000	300 LTHA	50	No
Mercury		44 J	2 LTHA	2	No
Nickel		9.6	100 LTHA		No
Potassium		7,300			No
Silver		1.4	50 child RMEG		No
Sodium[3]		35,000		20,000	No
Vanadium		46	30 child iEMEG		No
Zinc[1]		46	3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS					
Benzene		0.11 J	0.6 CREG	5	No
Chlorobenzene		0.29 J	100 LTHA	100	No
1,4-Dichlorobenzene		2.1 J	75 LTHA	75	No
cis -1,2-Dichloroethene		0.14 J	70 LTHA	70	No
Methyl-t-butyl ether (MTBE)		1.8	200 LTHA		No
Total xylenes		0.56	2,000 child iEMEG	10,000	No

TABLE 14 (continued)

Detected substances found in on-site monitoring well SS-MW-14

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)		WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations				
	October 2002	May 14, 2004			
SEMI-VOLATILE ORGANIC COMPOUNDS					
Caprolactam		74	5,000 child RMEG		No
PESTICIDES					
Aldrin		0.03 NJ	0.002 CREG		No
alpha-BHC (alpha-Hexachlorocyclohexane)		0.044 NJ	0.006 CREG		No
beta-BHC (beta-Hexachlorocyclohexane)		0.088 J	0.02 CREG		No
4,4'-DDE (*p,p*'-DDE)		0.069 J	0.1 CREG		No
Endrin ketone		0.039 NJ			No
Heptachlor		0.061 N	0.008 CREG	0.4	No
Methoxychlor		0.078 J	40 LTHA	40	No

TABLE 15

Substances detected in off-site monitoring well SS-MW-10B

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb) Detected concentrations		WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	October 2002	May 14, 2004			
METALS					
Aluminum	1,500	270	20,000 child iEMEG		No
Barium	12	5 J	700 child RMEG	2,000	No
Calcium[5]	6,900	5,200			No
Chromium	5.5	9.9	100 LTHA	100	No
Cobalt		0.27 J	100 child iEMEG		No
Copper[2]	11	8.4	200 child iEMEG	1,300	No
Iron[1, 5]	650	260 J	11,000 RBC	300	No
Lead[2]		2.1		15	No
Magnesium[5]	1,300	1,100 J			No
Manganese[1]	45	15	300 LTHA	50	No
Nickel	7.4	6.9	100 LTHA		No
Potassium[5]	2,300	1,500 J			No
Sodium[3]	7,200	6,200		20,000	No
Vanadium	2.6	1.3 J	30 child iEMEG		No
Zinc[1]	28	16	3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS					
Chloroform[4]		0.077 J	100 child cEMEG	80	No
Ethylbenzene		0.022 J	700 LTHA	700	No
SEMI-VOLATILE ORGANIC COMPOUNDS					
Caprolactam		39	5,000 child RMEG		No

TABLE 16

Substances detected in off-site monitoring well SS-MW-10B

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb) Detected concentrations		WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	October 2002	May 14, 2004			
METALS					
Aluminum	700	400	20,000 child iEMEG		No
Barium	21	16	700 child RMEG	2,000	No
Calcium[5]	7,300	3,900 J			No
Chromium	9.1	2.2	100 LTHA	100	No
Cobalt		0.17 J	100 child iEMEG		No
Copper[2]	5.5	0.51 J	200 child iEMEG	1,300	No
Iron[1, 5]	720	320 J	11,000 RBC	300	No
Magnesium[5]	1,700	890 J			No
Manganese[1, 5]	230	23	300 LTHA	50	No
Nickel	9	0.97 J	100 LTHA		No
Potassium[5]	3,600	2,300 J			No
Sodium[3]	8,200	7,300		20,000	No
Vanadium	2.7	1.9	30 child iEMEG		No
Zinc[1]	4.9		3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS					
Chloroform[4]	3 J		100 child cEMEG	80	No
PESTICIDES					
beta-BHC (beta-Hexachlorocyclohexane)	0.031 NJ		0.02 CREG		No
gamma-Chlordane		0.0097 NJ			No

TABLE 17

Substances found in off-site monitoring well SS-MW-13B

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb) Detected concentrations		WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	October 2002	May 14, 2004			
METALS					
Aluminum	1,800	58 J	20,000 child iEMEG		No
Barium	260	200	700 child RMEG	2,000	No
Calcium[5]	76,000	86,000			No
Chromium	160	6.6	100 LTHA	100	No
Cobalt	8.5	9.4	100 child iEMEG		No
Copper[2]	67	3.7	200 child iEMEG	1,300	No
Iron[1, 5]	2,600	1,400 J	11,000 RBC	300	No
Lead[2]	7.5	2.6		15	No
Magnesium[5]	22,000	24,000 J			No
Manganese[1]	5,200	9,400	300 LTHA	50	No
Nickel	130	38	100 LTHA		No
Potassium[5]	5,200	3,700 J			No
Sodium[3]	22,000	20,000		20,000	No
Zinc[1]	160	12	3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS					
Benzene		0.87	0.6 CREG	5	No
Chlorobenzene	7 J	7.3 J	100 LTHA	100	No
Chloroethane		0.49 J	3.6 car. RBC		No
Chloroform[4]	5 J	0.49 J	100 child cEMEG	80	No
1,2-Dichlorobenzene	1 J	2.4	600 LTHA	600	No
1,4-Dichlorobenzene	3 J	6 J	75 LTHA	75	No
1,1-Dichloroethane	1 J	1.6	800 RBC		No
cis -1,2-Dichloroethene	3 J	5.1	70 LTHA	70	No
Ethylbenzene		0.054 J	700 LTHA	700	No
Isopropylbenzene (Cumene)		0.14 J	1,000 child RMEG		No
Toluene	16		200 child iEMEG	1,000	No

TABLE 17 (continued)

Substances found in off-site monitoring well SS-MW-13B

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)		WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations				
	October 2002	May 14, 2004			
Trichloroethene (TCE)		0.24 J	0.026 car. RBC	5	No
Total xylenes		1.1	2,000 child iEMEG	10,000	No
SEMI-VOLATILE ORGANIC COMPOUNDS					
Caprolactam	34	70	5,000 child RMEG		No
PESTICIDES					
Endrin aldehyde	0.046 NJ				No
Heptachlor		0.018 N	0.008 CREG	0.4	No

TABLE 18

Substances found in on-site monitoring wells near the Sigmon Facility

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	Range	Mean	Median	Detection Rate			
METALS							
Aluminum	100–19,000	1,378.4	9,550	2/3	20,000 child iEMEG		No
Arsenic	4–26	10.2	15	2/3	0.02 CREG	10	No
Barium	260–450	366.28	420	3/3	700 child RMEG	2,000	No
Beryllium	2.1	2.1	2.1	1/3	20 child cEMEG	4	No
Cadmium	1.4	1.4	1.4	1/3	2 child cEMEG	5	No
Calcium[5]	34,000–170,000	71,029.68	62,000	3/3			No
Chromium	0.8–9.8	3.92	7.7	3/3	100 LTHA	100	No
Cobalt	8.5–25	16.46	21	3/3	100 child iEMEG		No
Copper[2]	7.6–16	12.22	15	3/3	200 child iEMEG	1,300	No
Iron[1]	6,200–70,000	16,202.12	9,800	3/3	11,000 RBC	300	No
Lead[2, 5]	7.2–16	10.73	11.6	2/3		15	No
Magnesium[5]	35,000–100,000	54,792.61	47,000	3/3			No
Manganese[1]	17,000–19,000	17,642.11	17,000	3/3	300 LTHA	50	No
Mercury	44	44	44	1/3	2 LTHA	2	No
Nickel	9.6–18	12.75	12	3/3	100 LTHA		No
Potassium[5]	7,300–12,000	10,167.83	12,000	3/3			No
Selenium	0.5	0.5	0.5	1/3	50 child cEMEG	50	No
Silver	1.4	1.4	1.4	1/3	50 child RMEG		No
Sodium[3]	10,000–160,000	38,258.62	35,000	3/3		20,000	No
Thallium	19	19	19	1/3	0.5 LTHA	2	No
Vanadium	2.6–46	8.31	4.8	3/3	30 child iEMEG		No
Zinc[1]	14–46	25.38	30	2/3	3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS							
Benzene	0.11–1.4	0.54	1	3/3	0.6 CREG	5	No
Chlorobenzene	0.29–18	3.41	7.6	3/3	100 LTHA	100	No
1,2-Dichlorobenzene	0.99–2	1.41	1.5	2/3	600 LTHA	600	No
1,3-Dichlorobenzene	0.12	0.12	0.12	1/3	600 LTHA		No
1,4-Dichlorobenzene	2.1–18	8.09	14	3/3	75 LTHA	75	No
1,1-Dichloroethane	1	1	1	1/3	800 RBC		No
cis -1,2-Dichloroethene	0.14–2	0.46	0.35	3/3	70 LTHA	70	No
Ethylbenzene	0.097	0.097	0.097	1/3	700 LTHA	700	No
Isopropylbenzene (Cumene)	0.59	0.59	0.59	1/3	1,000 child RMEG		No
Methyl-t-butyl ether (MTBE)	1.8	1.8	1.8	1/3	200 LTHA		No
Toluene	0.1–66	2.57	33.05	2/3	200 child iEMEG	1,000	No
Total xylenes	0.37–2	0.75	0.56	3/3	2,000 child iEMEG	10,000	No

TABLE 18 (continued)

Substances found in on-site monitoring wells near the Sigmon Facility

CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	Range	Mean	Median	Detection Rate			
SEMI-VOLATILE ORGANIC COMPOUNDS							
1,1-Biphenyl	1	1	1	1/3	500 child RMEG		No
Caprolactam	3–74	24.22	64	3/3	5,000 child RMEG		No
Naphthalene	1.8–6	3.29	3.9	2/3	100 LTHA		No
2-Methylnaphthalene	0.71–1	0.84	0.86	2/3	500 child cEMEG		No
PESTICIDES							
Aldrin	0.03	0.03	0.03	1/3	0.002 CREG		No
alpha-BHC (alpha-Hexachlorocyclohexane)	0.012–0.044	0.023	0.028	2/3	0.006 CREG		No
beta-BHC (beta-Hexachlorocyclohexane)	0.088	0.088	0.088	1/3	0.02 CREG		No
4,4'-DDE (*p,p'*- DDE)	0.069	0.069	0.069	1/3	0.1 CREG		No
Endosulfan II	0.0089	0.0089	0.0089	1/3			No
Endrin ketone	0.039	0.039	0.039	1/3			No
Heptachlor	0.061	0.061	0.061	1/3	0.008 CREG	0.4	No
Methoxychlor	0.078	0.078	0.078	1/3	40 LTHA	40	No

TABLE 19

Substances found in off-site monitoring wells near the Sigmon Facility

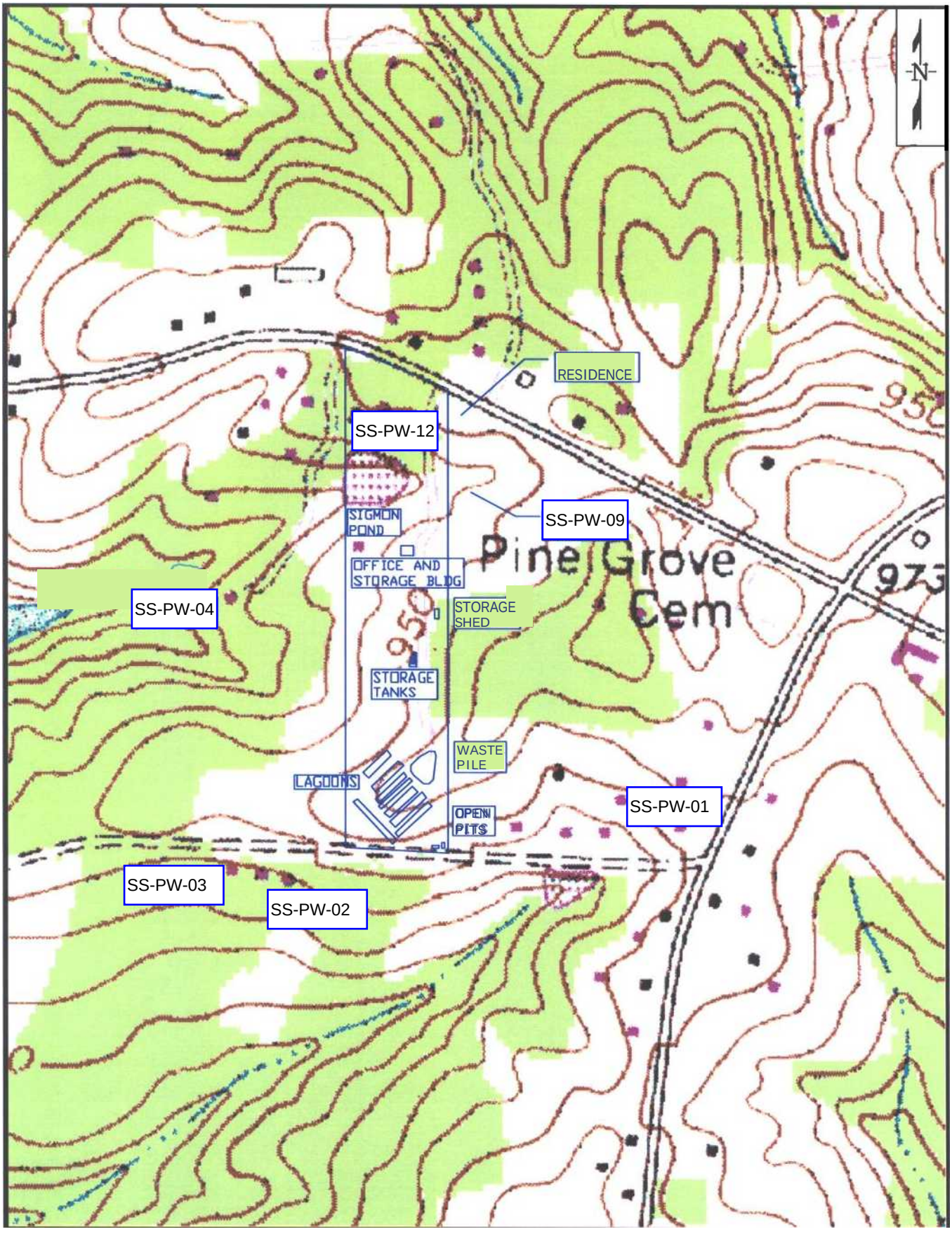
CHEMICAL SUBSTANCE	CHEMICAL CONCENTRATIONS (ppb)				WATER COMPARISON VALUES (ppb)	EPA MCL (ppb)	FURTHER PUBLIC HEALTH EVALUATION REQUIRED
	Detected concentrations						
	Range	Mean	Median	Detection Rate			
METALS							
Aluminum	58 -- 1,800	477.4	550	6/6	20,000 child iEMEG		No
Barium	5 -- 260	31.87	18.5	6/6	700 child RMEG	2,000	No
Calcium[5]	3,900 -- 86,000	13,722.25	7,100	6/6			No
Chromium	2.2 -- 160	10.24	7.85	6/6	100 LTHA	100	No
Cobalt	0.17 -- 9.4	1.38	4.39	4/6	100 child iEMEG		No
Copper[2]	3.7 -- 67	9.29	6.95	6/6	200 child iEMEG	1,300	No
Iron[1, 5]	260–2,600	722.07	685	6/6	11,000 RBC	300	No
Lead[2]	2.1–7.5	3.45	2.6	6/6		15	No
Magnesium[5]	890–24,000	3,233.22	1,500	6/6			No
Manganese[1]	15–9,400	236.4	137.5	6/6	300 LTHA	50	No
Nickel	0.97–130	11.41	8.2	6/6	100 LTHA		No
Potassium[5]	1,500–5,200	2,862.04	2,950	6/6			No
Sodium[3]	6,200–22,000	10,273.51	7,750	6/6		20,000	No
Vanadium	1.3–2.7	2.04	2.25	4/6	30 child iEMEG		No
Zinc[1]	4.9–60	21.13	16	5/6	3,000 child iEMEG	5,000 (SDWR)	No
VOLATILE ORGANIC COMPOUNDS							
Benzene	0.87–0.87	0.87	0.87	1/6	0.6 CREG	5	No
Chlorobenzene	7–7.3	7.15	7.15	2/6	100 LTHA	100	No
Chloroethane	0.49–0.49	0.49	0.49	1/6	3.6 car. RBC		No
Chloroform[4]	0.077–5	0.87	1.75	4/6	100 child cEMEG	80	No
1,2-Dichlorobenzene	1–2.4	1.55	1.7	2/6	600 LTHA	600	No
1,4-Dichlorobenzene	3–6	4.24	4.5	2/6	75 LTHA	75	No
1,1-Dichloroethane	1–1.6	1.26	1.3	2/6	800 RBC		No
cis -1,2-Dichloroethene	3–5.1	3.91	4.05	3/6	70 LTHA	70	No
Ethylbenzene	0.022–0.054	0.034	0.038	2/6	700 LTHA	700	No
Isopropylbenzene	0.14–0.14	0.14	0.14	1/6	1,000 child RMEG		No
Toluene	16–16	16	16	1/6	200 child iEMEG	1,000	No
Trichloroethene	0.24–0.24	0.24	0.24	1/6	0.026 car. RBC	5	No
Total xylenes	1.1–1.1	1.1	1.1	1/6	2,000 child iEMEG	10,000	No
SEMI-VOLATILE ORGANIC COMPOUNDS							
Caprolactam	34–70	45.28	39	3/6	5,000 child RMEG		No
PESTICIDES							
beta-BHC (beta-Hexachlorocyclohexane)	0.031	0.031	0.031	1/6	0.02 CREG		No
Endrin aldehyde	0.046	0.046	0.046	1/6			No
gamma-Chlordane	0.0097	0.0097	0.0097	1/6			No
Heptachlor	0.018	0.018	0.018	1/6	0.008 CREG	0.4	No

TABLE 20

Matched VOC detections in groundwater wells near the Sigmon Facility

DETECTED VOCS IN ON-SITE MONITORING WELLS	SIMILAR DETECTED VOCS IN OTHER GROUNDWATER WELLS			
	Monitoring Well SS-MW-13B	Other Off-Site Monitoring Wells	Private Well SS-PW-03	Other Private Wells
Benzene	Benzene		Benzene	
Chlorobenzene	Chlorobenzene		Chlorobenzene	
1,2-Dichlorobenzene	1,2-Dichlorobenzene		1,2-Dichlorobenzene	
1,3-Dichlorobenzene				
1,4-Dichlorobenzene	1,4-Dichlorobenzene		1,4-Dichlorobenzene	
1,1-Dichloroethane	1,1-Dichloroethane		1,1-Dichloroethane	
cis -1,2-Dichloroethene	*cis* -1,2-Dichloroethene		*cis* -1,2-Dichloroethene	
Ethylbenzene	Ethylbenzene	Ethylbenzene		
Isopropylbenzene	Isopropylbenzene			
Methyl-T-butyl ether				Methyl-T-butyl ether
Toluene	Toluene			
Total xylenes	Total xylenes			
Percent matched	83.3%	8.3%	50.0%	8.3%

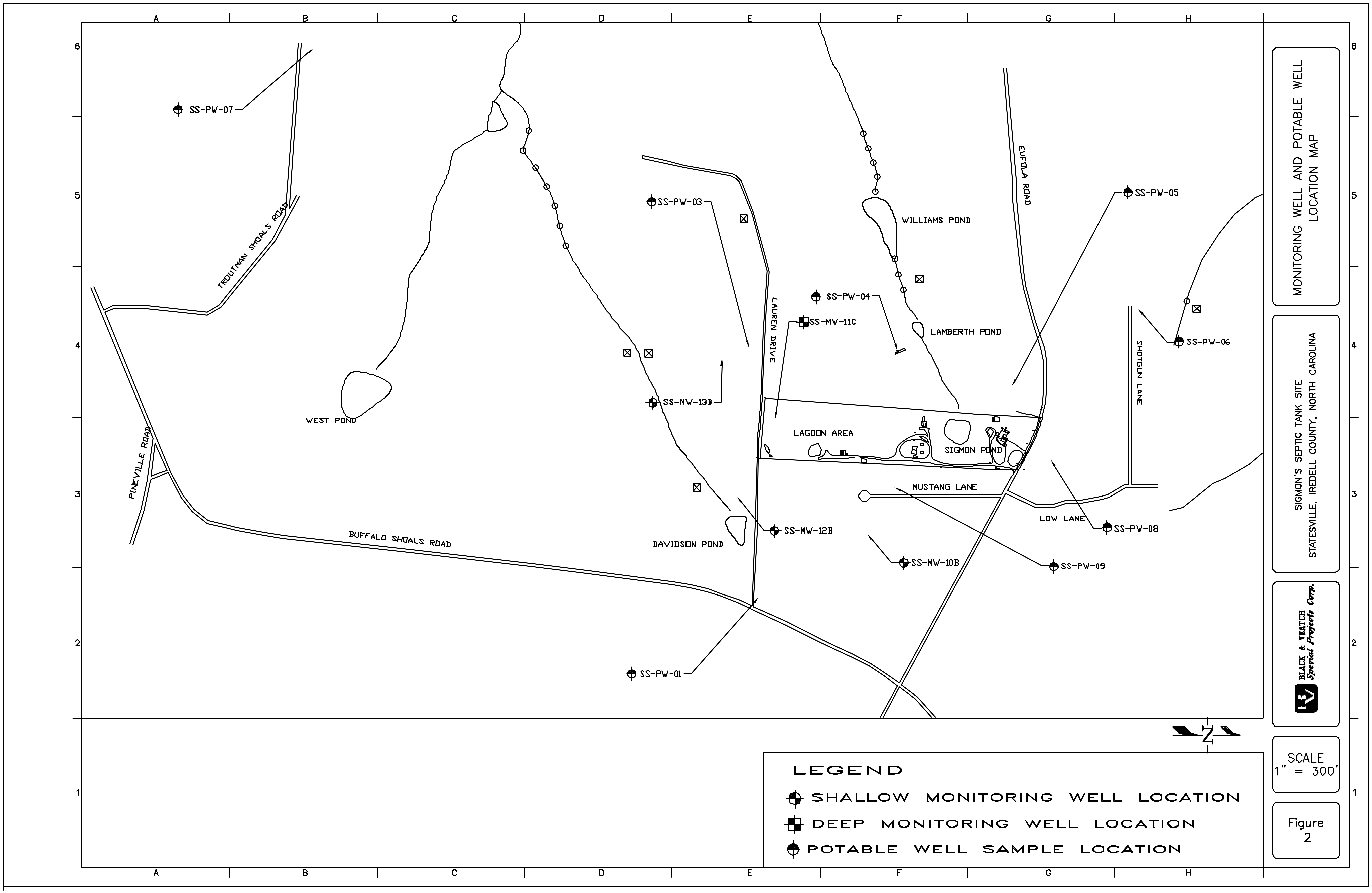
APPENDIX C

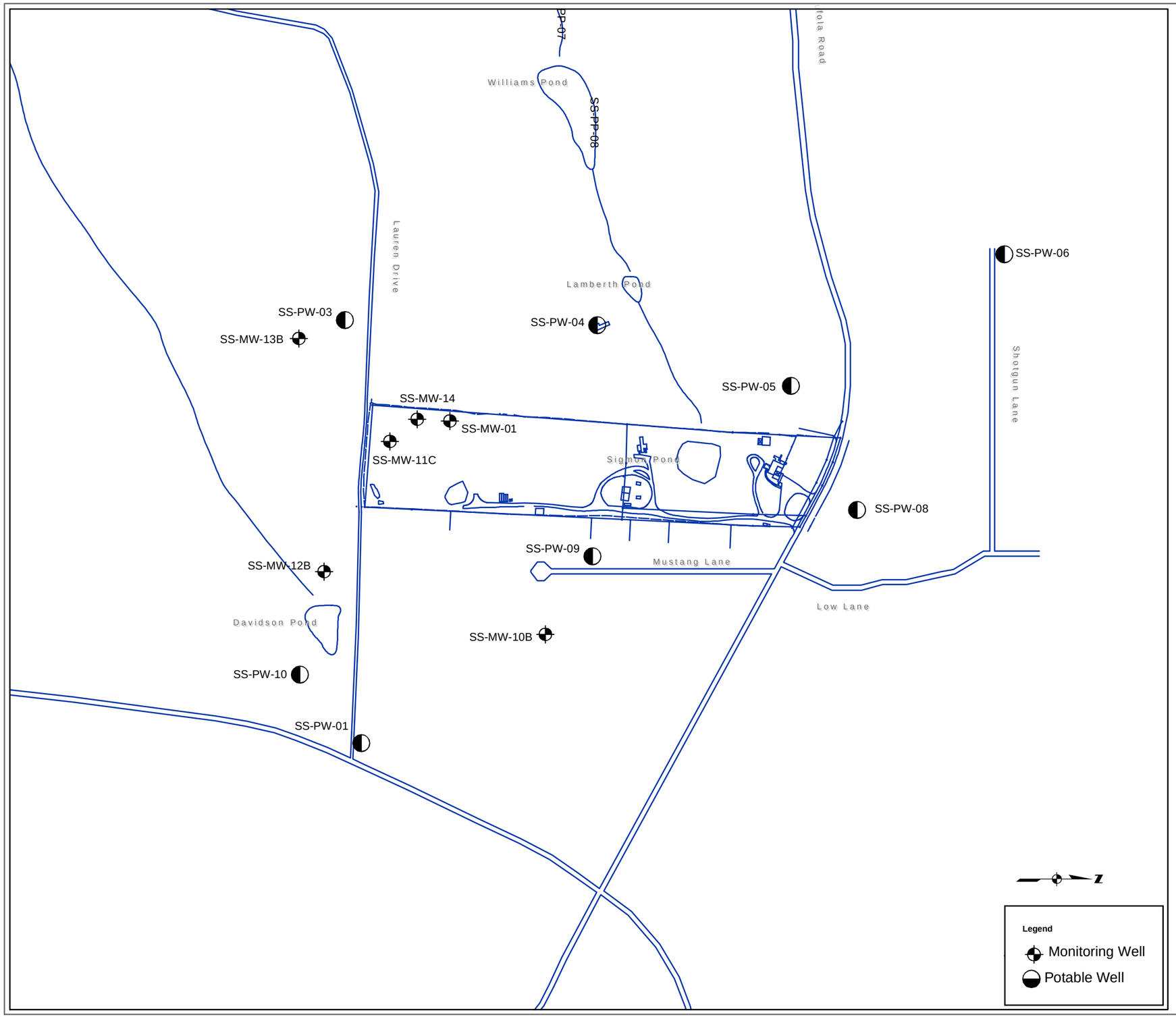


REP. - USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP; TROUTMAN, NC 1993. 1" = 600'

SITE LAYOUT MAP
SIGMON'S SEPTIC TANK SITE
STATESVILLE, IREDELL COUNTY, NORTH CAROLINA

FIGURE
1


SS-PW-07
TROUTMAN SHOALS ROAD
WEST POND
PINEVILLE ROAD
BUFFALO SHOALS ROAD
SS-PW-03
SS-MW-13B
DAVIDSON POND
SS-PW-01
LAUREN DRIVE
SS-MW-12B
SS-PW-04
SS-MW-11C
WILLIAMS POND
LAMBERTH POND
LAGOON AREA
SIGMON POND
MUSTANG LANE
SS-MW-10B
SS-PW-09
EUFOLA ROAD
SS-PW-05
SHOTGUN LANE
SS-PW-06
LOW LANE
SS-PV-08
N
LEGEND
SHALLOW MONITORING WELL LOCATION
DEEP MONITORING WELL LOCATION
POTABLE WELL SAMPLE LOCATION
MONITORING WELL AND POTABLE WELL LOCATION MAP
SIGMON'S SEPTIC TANK SITE
STATESVILLE, IREDELL COUNTY, NORTH CAROLINA
BLACK & VEATCH Special Projects Corp.
SCALE
1" = 300'
Figure
2



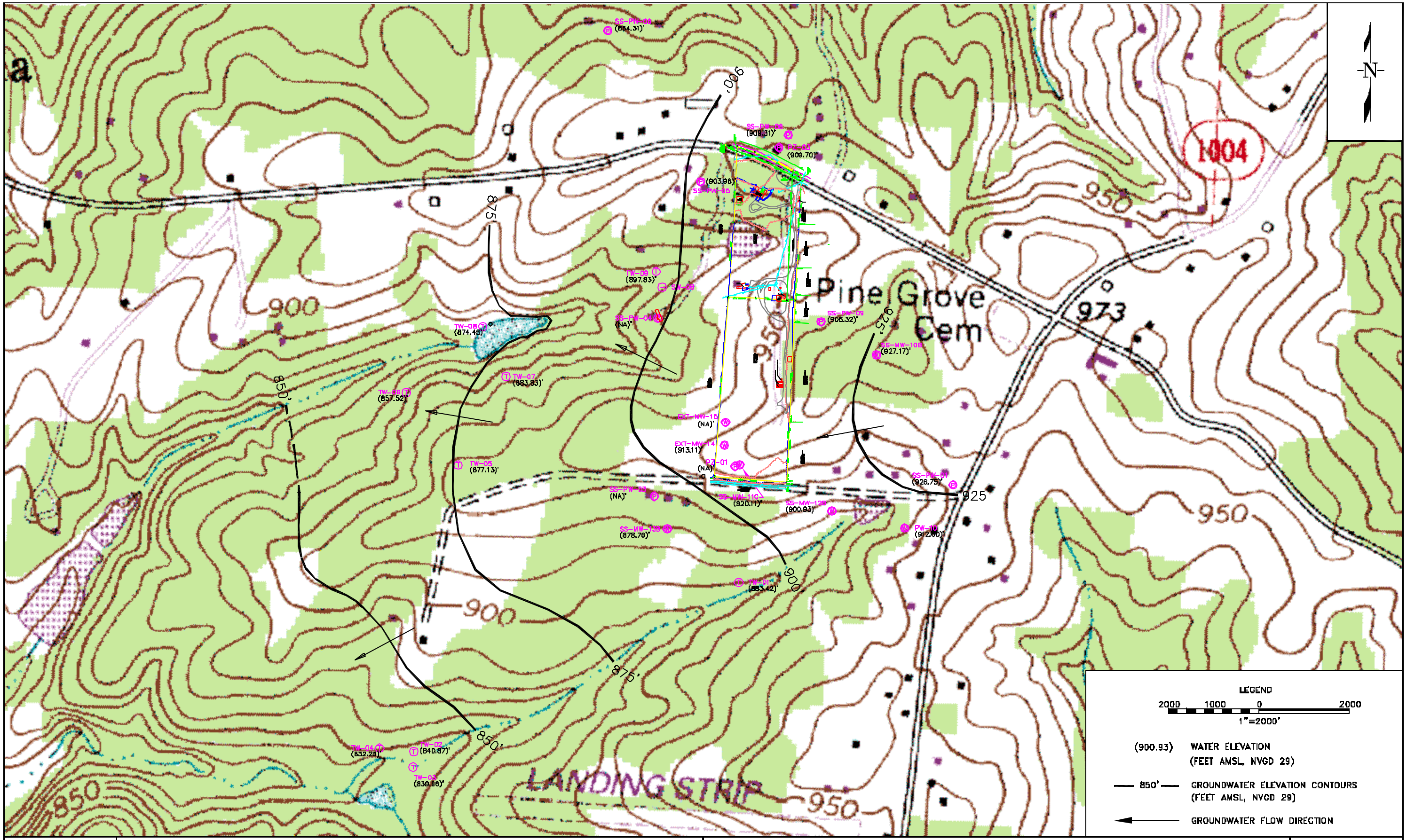
2004 ACTUAL RI GROUNDWATER, PUSHPOINT, & POTABLE WATER LOCATION MAP

SIGMON'S SEPTIC TANK SITE
STATESVILLE, IREDELL COUNTY, NORTH CAROLINA

SCALE
1 in. equals 400 ft.

Figure
3

CAD DWG NO: 25PHASE1-GW ORIGINAL DWG SIZE
DATE: 02-03-00 NDG 11 x 17
PLOT SCALE: 1"=200' FILE: R:\MACDILL\SWMU85\ACAD\



BV	SIGMONS SEPTIC TANK SITE STATESVILLE NORTH CAROLINA	GROUNDWATER POTENTIOMETRIC SURFACE MAP AS MEASURED ON 05-21-2004	FIGURE 4