

Health Consultation

Airborne Chemicals from Wood Treatment Chemical

WILLIAM C. MEREDITH COMPANY, INCORPORATED

EAST POINT, FULTON COUNTY, GEORGIA

EPA FACILITY ID: GAD003323805

SEPTEMBER 29, 2004

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:

Exposure Investigation and Consultation Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

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Introduction

In July 2003, the Agency for Toxic Substances and Disease Registry (ATSDR) received a petition from a local resident requesting a public health evaluation of the William C. Meredith wood treatment facility (Meredith). The resident expressed concern about the release of potentially hazardous substances from the facility. In order to obtain information to respond to this request, ATSDR and the Georgia Division of Public Health (GA DPH) conducted an Exposure Investigation from October 2003 through mid-March 2004.

Background

Meredith is located in East Point, Georgia, on 640 acres of deeded land. The facility is in an industrial section of town that is adjacent to a residential neighborhood. The facility releases odors characteristic of wood treatment chemicals. The petitioner's main health concern is respiratory irritation. Meredith's processing involves the dipping of timber into low heat treatment reservoirs and the subsequent drying of the timber in the open air. The facility treats with either creosote or pentachlorophenol (Penta) on a rotational basis. Penta and creosote are both odorous because they contain volatile organic compounds (VOCs), but creosote is more odorous because it contains several polycyclic aromatic hydrocarbons (PAHs) mixed with naphthalene. In 2003, the facility increased its use of creosote, and the community became more concerned about the process.

Objective/Purpose

In a collaborative effort between ATSDR and GA DPH, ambient air concentrations of VOCs, PAHs, and Penta were sampled at the Meredith site. These chemicals were selected because they are emitted during wood treatment operations. Results of the exposure investigation are being shared with community residents, and governmental and industrial stakeholders.

Rationale

Operations at the Meredith facility, which is adjacent to a residential neighborhood, produce odors. Odors have increased recently as the frequency of creosote use has increased.

Creosote is a complex mixture of PAHs, phenols, sulfur, and nitrogen compounds. Creosote has a naphthalene odor similar to mothballs. Much of the toxicity of creosote is linked to a small group of PAHs, with benzo[a]pyrene and dibenz[a,h]anthracene being among the most toxic.

The exposure investigation focused on VOCs and PAHs as the airborne off-gassing of the creosote treatment process and focused on Penta and VOCs for the Penta treatment process.

Target Population

Residents of the East Point community within one-mile of Meredith were the primary focus of this investigation. The total affected population is estimated to be 2200 people. Because there is sufficient public space available for sampling, no homes were selected for sampling.

Methods

Environmental Sample Collection

Samples were collected near residences located downwind of the facility on several days during the fall and winter (2003-2004). A few samples were collected cross-wind of the facility. VOC samples were collected from October through March, PAH samples were collected from October through December, and Penta samples were collected from October to March.

Air Sampling

During the days that Meredith treated with creosote, the team sampled for airborne VOCs, PAHs, and Penta. During the days that Meredith treated with Penta, the team sampled for airborne VOCs and Penta (or for Penta only). The facility provided the treatment information which was confirmed by the presence of the different logs, black for creosote and brown for Penta.

VOCs were collected and analyzed consistent with the Carbotrap method for the determination of toxic organic adsorbent compounds in ambient air. This method determines VOCs and SVOCs in ambient air using adsorbent compound tubes with subsequent analysis by gas chromatography. A sample of ambient air was drawn by a pump into a carbotrap tube, which is a metal tube filled with carbon granules and pre-washed (XAD-2) resin. The sample chamber is closed with screw caps by a gloved scientist to prevent introduction of other VOCs. The samples were collected during an 8-hour period while the Meredith facility was operating and were shipped according to the chain of custody and storage procedures. The samples were analyzed by gas chromatography and mass spectroscopy.

Penta was collected with sorbent tubes consistent with OSHA Method 39 for the determination of Penta in air, and the tubes were subsequently analyzed by high performance liquid chromatography/ultraviolet-detection. Air was drawn by a pump into two daisy-chained tubes connected with flexible tubing and containing adsorbent granules of XAD-7 (glass tubes A and B). Air entered into tube A and exited tube B. Samples were collected at a rate of 0.2L/min. during an 8-hour period while the facility was operating. After each sample was collected, a third tube (glass tube C) was opened on one end and attached to the open end of tube A. Therefore, Tube A was now sandwiched between tubes B and C. Tube

B was then capped at its open end. The unique sandwiching method prevents Penta from leaving tube A. Samples were shipped according to the chain of custody and storage procedures. There are no known interferences with this sampling method.

PAHs were collected and analyzed consistent with NIOSH 5506 [“Compendium of methods for the determination of PAHs in air using a polytetrafluoroethylene (PTFE) filter and a liquid sorbent tube containing 150 mg of washed XAD-2 with 50 mg backup]. Analysis was performed by high performance liquid chromatography/ultra violet detection. A sample of ambient air was drawn by a pump (2 L/min) through a cellulose filter into a single glass tube containing adsorbent granules. The samples were collected during a 4- to 8-hour period while the facility was operating. After the sample was collected, the filter cartridge was capped and labeled separately from the tube. Samples were shipped according to the chain of custody and storage procedures. The values were reported as particulate phase and vapor phase for each PAH. Heat, ozone, NO₂, and ultra violet light may cause sample degradation

Quality Assurance

One blank sample for each sampling period was collected and analyzed to determine if the samples were contaminated during shipping or if the laboratory analysis was flawed. Accuracy of the analysis was evaluated using laboratory recovery data and instrument calibration results. All samples were compared to ensure confidence in the collection methods.

Sample collection, storage, and analysis description was documented by ATSDR on the chain-of-custody forms. The original forms were sent to the laboratory with the samples. Copies of the chain-of-custody forms were made by ATSDR prior to shipment of the samples.

Results

PAHs and Penta were detected in the air and appeared to be associated with the Meredith facility. Specific results are listed below along with health comparison values (Results are published in the units that they were measured in.) The comparison values are protective of health and allow exposure investigations to consistently identify those sites and chemicals that may need further investigation. Chemical-specific health implications are provided in the discussion section.

Polycyclic Aromatic Hydrocarbons (PAHs)

The table below summarizes the highest PAH¹ measurements collected at four locations in East Point near Meredith. To protect privacy, the table does not list specific addresses but does note the distance from the sampling locations to Meredith.

Table 1: Summary of PAH Results

Location	Property (Street name)	Date	naphthalene (ppb)	acenaphthylene (ppb)	acenaphthene (ppb)	fluorene (ppb)	phenanthrene (ppb)	anthracene (ppb)
East Point (background)	City Hall	13 Nov 03	.062	ND	ND	ND	ND	ND
Meredith fence	Lawrence & Davis	29 Oct 03	11	ND	0.19	0.34	0.17	0.0075
¼ mile	Connally	28 Oct 03	1.1	ND	ND	ND	0.0091	ND
1 mile	Harris (School)	28 Oct 03	ND	ND	ND	ND	ND	ND
>1 mile	Harris/Brian	14 Nov 03	0.33	ND	ND	ND	0.0036	ND
Comparison Level*			3.1*	>1100**	220*	150*	>1100**	1100*

ppb = parts per billion

ND = Not Detected

* EPA risk-based value (10⁻⁶) assuming continuous exposure for 70 years (EPA 1998)

** Expected to be less toxic than anthracene (factored by Toxic Equivalency Factor); EPA risk-based factor (10⁻⁶)

Concentrations above background are highlighted

Most samples taken in response to community complaints² of naphthalene odor contained naphthalene and other PAHs. The PAH data did not contain chemicals at levels of health concern (all chemicals near the residences are below the comparison levels). The fenceline-naphthalene levels were above the comparison level (3.1 ppb) as well as ATSDR's chronic non-cancer Minimal Risk Level (MRL) of 0.7 ppb, but it is unlikely that chronic exposures occur near the fenceline.

It is important to note that no benzo[a]pyrene or dibenz[a,h]anthracene was found³ and benzo[a]pyrene or dibenz[a,h]anthracene are the PAHs that are of concern at some creosote facilities [ATSDR, 2002 and 1995]. The comprehensive results are provided in the appendix.

¹ Many other chemicals were not detected in any samples, including dibenz[a,h]anthracene, benzo[a]pyrene, benzo[a]anthracene, and others expected to be more toxic than those detected.

² Samples were collected on several days when odors were reported to the Fire Department. Only the highest measurements were reported in the table above.

³ The Lowest Observed Adverse Effect Level for naphthalene is 10,000 ppb; rats and mice had lesions in the nose when exposed chronically.

Volatile Organic Compounds (VOCs)

The table below summarizes the highest VOCs measurements collected at four locations in East Point near the Meredith facility (the distance from the sampling locations to the facility is noted).

Table 2: Summary of VOC Results

Location	Property (Street name)	Date	benzene (ppb)	toluene (ppb)	ethylbenzene (ppb)	xylylene (ppb)	trimethyl benzene (ppb)	carbon tetrachloride (ppb)
East Point "background"	Connally	28 Oct 03	9	10	4.2	17.4	23.2	ND
Meredith fence	Lawrence & Davis	8 Dec 03	0.34	0.61	0.11	0.64	0.62	0.1
Near Meredith (fence)	Lawrence	1 Mar 04	0.35	0.99	0.26	1.01	0.80	0.13
>1 mile	Brian	28 Oct 03	6.1	15	3.1	15	10.8	ND
>1 mile	Harris/Brian	8 Dec 03	6.4	7.8	1.7	4.4	2.81	ND
Comparison Level*			10*	80**	1000**	100**	12.4***	30**

ppb = parts per billion

ND = Not Detected

* ATSDR interim guidance comparison value

**ATSDR Minimal Risk Level (MRL)

***EPA risk-based value (10^{-6}) assuming continuous exposure for 70 years (EPA 1998)

Noteworthy concentrations are highlighted

Samples were collected concurrent with Penta or PAH samples. The highest VOC levels were found in the background sample (as highlighted). The second and third highest were found far from Meredith (also highlighted). The results indicate that there are chemicals consistent with ordinary industry or automobiles in the East Point area but that the chemicals do not originate from Meredith. Additional analysis (reported in Table 4) confirms that the VOCs are not associated with Meredith. One chemical, carbon tetrachloride, was only present near Meredith (highlighted). The reported VOCs were found to be at safe levels. The comprehensive results are provided in the appendix.

Pentachlorophenol (Penta)

The table below summarizes the highest Penta measurements collected at four locations in East Point near the Meredith facility (the distance from the sampling locations to the facility is noted).

Table 3: Summary of Penta Results

Location	Property (Street name)	Date	Penta-chlorophenol ($\mu\text{g}/\text{m}^3$)
Meredith fence	Lawrence & Davis	28 Oct 03	30
Near Meredith (fence)	Lawrence	5 Mar 04	7.9
1 mile	Harris (School)	28 Oct 03	4.4
>1 mile	Lawrence (end)	5 Mar 04	1.8
Comparison Level*			0.052*
Concentrations in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) * EPA risk based value (10 ⁻⁶) assuming continuous exposure for 70 years (EPA 1998) Concentrations above the comparison value are highlighted			

Samples were collected downwind of the Meredith facility when Penta was being used and the characteristic odors were in the air. The results indicate that Penta pervades beyond the facility boundary and is carried downwind to the residential communities more than 1 mile from the Meredith facility. The measured levels exceed EPA's risk comparison level, which is based on continuous exposure for 70 years. ATSDR has not published a non-cancer MRL for air, but ATSDR has published a list on non-cancer effects associated with exposures to Penta, none of which have been associated with community exposures to Penta wood treatment [ATSDR, 2001].

Additional Analysis

Eight samples were analyzed for an expanded spectrum of chemicals that also included several of the same chemicals in the primary analyses. The table below identifies a number of chemicals associated with log treatment.

Table 4: Tentatively Identified Compounds in the VOC Samples

Location	Property (Street name)	Date	naphthalene	Acenaphthene	fluorene	a or b pinene	terpene
Fenceline	Lar&Davis	28-Oct 03	ID	-	-	ID	ID
Fenceline	Lar&Davis	15-Nov 03	ID	ID	ID	ID	-
Fenceline	Lawrence	8-Dec 03	ID	-	-	ID	-
Fenceline	Lawrence	1-Mar 04	ID	-	-	ID	-
Near fenceline	Lawrence	1-Mar 04	ID	-	-	ID	-
1/4 mile	Connally	28-Oct 03	ID	ID	-	ID	-
1/4 mile	Connally	28-Oct 03	ID	-	-	ID	ID
1+ mile	Brian/Harris	8-Dec 03	ID	-	-	ID	ID
1+ mile	HS	28-Oct 03	-	-	ID	ID	-

ID = Identified to be present

Detected chemicals are highlighted

Actual values are provided in the raw data. However, due to lack of specific calibration, the values are not accurate. The data for the chemicals known to be toxic are provided more accurately with the PAH results (Table 1).

This data summarizes the qualitative analysis of PAHs found within the VOC samples (that were summarized in Table 2). Although the results are qualitative, they help to differentiate the source of the chemicals in each of the other tables. The pinene and naphthalene reported in Table 4 are present in all samples collected downwind of Meredith.

Pinene is found in pine logs (treated or untreated) and pinene was found in all the samples. Although, there are pine trees on the property adjacent to the facility, a stand of live trees do not produce enough pinene to be detected a mile downwind.

Naphthalene is a marker of wood treatment. The identification of naphthalene in 7 of the 8 samples indicates that naphthalene is released from the site during the creosote and the Penta processes. PAHs were detected in some of the samples during the Penta process (October 28th), indicating that PAH exposures also occur during either process.

Limitations

The data collected at this site represents air levels measured near the residential area during the time of the investigation. Long-term average concentrations may be different and peak maximum concentrations are likely to be higher.

Several chemical-specific analysis were used to evaluate exposures, because no single sampling method can accurately detect all the chemicals. Samples were often collocated, but with differing flow rates, samples are slightly different. Tentatively identified compounds were used to confirm that samples represented downwind or upwind samples.

Accurate measurements naphthalene and other PAHs were only collected during the Creosote method (reported in Table 1).

No other major local source of Penta is known. Some PAHs are formed by the neighboring asphalt facility and some Penta is emitted from railroad ties and telephone poles.

Discussion

This exposure investigation found that most of the chemicals associated with the Meredith facility were at low levels. Most chemicals were well below health-based screening levels indicating that most chemicals are at levels known to have little cancer risk. The maximum naphthalene level was slightly higher than the protective comparison levels (both cancer and non cancer), but the average levels were 1000 times lower than those shown to produce adverse effects in any species.

One chemical, Penta, was found to be above EPA's cancer risk-based reference concentration. Exceeding a risk-based value does not mean that a cancer risk exists nor does it mean that the levels are harmful; it only means that the exposure scenario needs to be further investigated. Risk-based comparison values include protective worst case assumptions, namely, continuous lifetime exposure.

Air levels of Penta surrounding the Meredith facility were as high as 30 $\mu\text{g}/\text{m}^3$ at the fence line and as high as 4.4 $\mu\text{g}/\text{m}^3$ 1-mile downwind. The lowest level detected was 1.3 $\mu\text{g}/\text{m}^3$ and only in one sample could Penta not be detected. These values exceed EPA's reference concentration of 0.052 $\mu\text{g}/\text{m}^3$ [EPA, 1998]. ATSDR did not develop a non-cancer MRL for Penta in air because data was limited. However, some interpretations can be made by comparing the levels found in Meredith to levels collected inside log homes referenced in ATSDR's Toxicological Profile for Penta (ATSDR 2001), suggesting that the levels measured near Meredith may pose low cancer risk.

Studies of Penta-treated log homes revealed indoor air levels of Penta ranging from 0.5 $\mu\text{g}/\text{m}^3$ to 104 $\mu\text{g}/\text{m}^3$, with corresponding mean urine concentrations of 2.1 $\mu\text{g}/\text{L}$ to

69 µg/L, respectively [USDHHS, 1980; Cline, 1989]. Although significant health effects among the log home residents have not been reported, the urine levels of residents living in log homes did exceed the NHANES 100 percentile, and therefore may represent a higher exposure risk.

EPA and CDC decided that it was prudent to discontinue the use of Penta in wood used to build homes because of the high levels of Penta in the blood and urine of the residents who lived in log homes. The blood and urine Penta levels correlated most with the air levels, and all correlated with non-serious skin abnormalities. Although the skin abnormalities were thought to be from contact, the association of air levels and skin abnormalities persisted in log homes that were sealed in order to minimize skin contact [Hosenfeld, 1986].

Even though the Penta levels surrounding the Meredith facility (1.3-30 µg/m³) are within the range of log home studies (0.5-104 µg/m³), ATSDR believes that the Penta exposures near the facility are much less than the exposures of people living in log homes because people spend more time inside homes.

Conclusion

Exposure to airborne Penta poses an indeterminate public health hazard to the residents living near the Meredith facility because of the uncertainty of the frequency and duration of the exposure.

Air levels of PAHs and VOCs measured in the residential communities near the Meredith facility are below levels known to pose a public health hazard.

Recommendation

Conduct an Exposure Investigation that measures pentachlorophenol levels in residents' urine the day following air sampling during days when Penta is used.

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