Health Consultation

EVALUATION OF OFF-SITE ENVIRONMENTAL MEDIA

MERCER RUBBER COMPANY SITE
HAMILTON SQUARE, MERCER COUNTY, NEW JERSEY

EPA FACILITY ID: NJD002328961

SEPTEMBER 27, 2007

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:

New Jersey Department of Health and Senior Services
Public Health Services Branch
Consumer and Environmental Health Services
Hazardous Site Health Evaluation Program

Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Summary

In February 2004, a concerned citizen petitioned the federal Agency for Toxic Substances and Disease Registry (ATSDR) regarding potential environmental exposures to hazardous chemicals associated with the former Mercer Rubber Company, Hamilton Square, Mercer County, New Jersey. The Mercer Rubber Company (and its successors) manufactured rubber products from the 1860s until plant closing in early 1993. The petition was accepted in May 2004. Through a cooperative agreement with the ATSDR, the New Jersey Department of Health and Senior Services (NJDHSS) prepared two documents for public comment: a public health assessment, which reviewed the potential for past, present and future environmental exposures to area residents, and a health consultation that reviewed cancer incidence in the community for the time period 1979 through 2001. Two public meetings were held to present the findings of the draft reports.

Former Mercer Rubber Company employees and/or long-time area residents indicated that manufacturing process wastes were dumped in off-site areas. Since off-site sampling was not conducted, the public health assessment recommendations for the site consisted of the sampling of soil and shallow groundwater. In response, the New Jersey Department of Environmental Protection conducted environmental sampling of off-site areas. The purpose of this health consultation is to identify and evaluate public health implications of exposures associated with the polycyclic aromatic hydrocarbons (PAHs) and metals detected in the off-site area. Incidental ingestion of soil, sediment and surface water were identified as the completed exposure pathways. An evaluation of past, current and future exposures to contaminants detected at the off-site areas did not indicate non-cancer health concerns. Using conservative exposure parameters, the calculated lifetime excess cancer risk for exposure to PAHs was about seven additional cancer cases among one million persons exposed, which may be considered a very small risk compared to the lifetime risk of being diagnosed with cancer. In addition, the concentrations of contaminants, including PAHs detected in the soil and sediment collected from the Sayen Garden area is not unusual compared to what is typically found in the sediment of waterways due to runoff from a developed area. As such, the off-site areas pose ***No Public Health Hazard*** to area residents including children.

The NJDHSS and ATSDR do not propose any exposure related follow-up and/or recommendations for the off-site areas of the Mercer Rubber Company site. Copies of this report will be made available to concerned area residents via the township library and the internet.

Statement of Issues

In February 2004, a concerned citizen petitioned the Agency for Toxic Substances and Disease Registry (ATSDR) regarding potential environmental exposures to hazardous chemicals associated with the former Mercer Rubber Company, Hamilton Square, Mercer County, New Jersey. In response, the New Jersey Department of Health and Senior Services (NJDHSS), in cooperation with the ATSDR, evaluated on-site environmental data and remediation history for the Mercer Rubber Company site in a public health assessment report (ATSDR 2007). The NJDHSS and ATSDR held two public meetings to present the findings. Recommendations for the Mercer Rubber Company site were as follows:

- the collection of soil samples in off-site areas where wastes were allegedly dumped, and,
- the sampling of area shallow groundwater to assist in evaluating the potential for vapor intrusion of contaminants into residential homes.

In October 2006 and March 2007, the New Jersey Department of Environmental Protection (NJDEP) conducted environmental sampling in response to the recommendations made by the NJDHSS and ATSDR. Off-site soil from alleged waste dumping areas, surface water and sediment from the unnamed creek and the skating pond, residential wells and groundwater from nearby areas were collected and analyzed. The purpose of this health consultation was to identify and evaluate public health implications of exposure pathways associated with off-site area.

Background

The Mercer Rubber Company (and its successor companies) manufactured rubber products from 1866 to 1993. The site was located at 136 Mercer Street in Hamilton Square, Mercer County. The on-site buildings were demolished in 2000 and 11 single family residences were built.

In 1912, one of the former owners of the Mercer Rubber Company purchased an adjacent 30 acre parcel of land. The area is now known as the Sayen House and Gardens, and includes the historic Sayen House, gardens, ponds, gazebos, and walking trails. Former Mercer Rubber Company workers have stated that waste products from the plant were dumped at the Sayen Gardens property while the company was in operation. In response, NJDEP conducted environmental sampling of alleged off-site waste dumping areas in October 2006. Off-site soil from alleged waste dumping areas, surface water and sediment from the unnamed creek and the skating pond, residential wells and groundwater from nearby areas were collected and analyzed. Subsequently, the NJDEP was informed about additional areas where alleged dumping may have occurred. In response to these concerns, and to delineate contamination detected in October 2006 sampling, the NJDEP conducted a second round of sampling in the Sayen Gardens in March 2007.

Environmental Contamination

An evaluation of site-related environmental contamination consists of a two tiered approach: 1) a screening analysis; and 2) a more in-depth analysis to determine public health implications of site-specific exposures. First, maximum concentrations of detected substances are compared to media-specific environmental guideline comparison values (CVs). If concentrations exceed the environmental guideline CV, these substances, referred to as Contaminants of Concern (COC), are selected for further evaluation. Contaminant levels above environmental guideline CVs do not mean that adverse health effects are likely, but that a health guideline comparison is necessary to evaluate site-specific exposures. Once exposure doses are estimated, they are compared with health guideline CVs to determine the likelihood of adverse health effects.

Environmental Guideline Comparison

There are a number of CVs available for screening environmental contaminants to identify COCs. These include ATSDR Environmental Media Evaluation Guides (EMEGs) and Reference Media Evaluation Guides (RMEGs). EMEGs are estimated contaminant concentrations that are not expected to result in adverse noncarcinogenic health effects. RMEGs represent the concentration in water or soil at which daily human exposure is unlikely to result in adverse noncarcinogenic effects. If the substance is a known or a probable carcinogen, ATSDR's Cancer Risk Evaluation Guides (CREGs) were also considered as comparison values. CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million (10^{-6}) persons exposed during their lifetime (70 years). In the absence of an ATSDR CV, other comparison values may be used to evaluate contaminant levels in environmental media. These include New Jersey Maximum Contaminant Levels (NJMCLs) for drinking water, and USEPA Region 3 Risk-Based Concentrations (RBCs). RBCs are contaminant concentrations corresponding to a fixed level of risk (i.e., a Hazard Quotient[1] of 1, or lifetime excess cancer risk of one in one million (10^{-6}), whichever results in a lower contaminant concentration) in water, air, biota, and soil. For soils and sediments, other CVs include the NJDEP Residential and Non-Residential Direct Contact Soil Cleanup Criteria (RDCSCC, NRDCSCC). Based primarily on human health impacts, these criteria also take into account natural background concentrations, analytical detection limits, and ecological effects.

Substances exceeding applicable environmental guideline CVs were identified as COCs and evaluated further to determine whether these contaminants pose a health threat to exposed or potentially exposed receptor populations. In instances where an environmental guideline CV was unavailable, the substance may be retained for further evaluation.

[1]The ratio of estimated site-specific exposure to a single chemical from a site over a specified period to the estimated daily exposure level at which no adverse health effects are likely to occur.

Environmental Sampling

In October 2006 and March 2007, the NJDEP conducted environmental sampling at off-site areas of the Mercer Rubber Company site. Soil, sediment and groundwater from off-site areas were collected and analyzed. Subsequent to October 2006 sampling, several community members have indicated additional areas where alleged dumping may have occurred or that contaminated material may have been present. In March 2007, three new locations were sampled. In addition, samples were also collected for further delineation of areas sampled in October 2006 but these data are not summarized in the following section.

Soil

Soil samples were collected from the following alleged waste dumping areas:

Location	Depth	Number of Samples
Area north of Sayen House	Shallow (0 – 6 inch) Deep (6 – 12 inch)	8 8
Area near the skating pond	Shallow (0 – 6 inch)	4

The maximum and the mean of contaminant concentrations detected in the shallow and deep soil samples collected from the area north of the Sayen House and shallow soil samples collected from the skating pond are provided in Tables 1, 2 and 3, respectively. The tables also list the comparison values (CVs) for the screening environmental contaminants. The CVs for acenapthylene, dibenzofuran, phenanthrene and benzo[g,h,i]perylene detected in the shallow soil are unavailable (see Table 1). Maximum concentrations of benzo[a]pyrene and dibenz[a,h]anthracene exceeded their corresponding environmental guideline CVs.

The maximum concentrations of contaminants detected in the deep soil samples were below their corresponding CVs (see Table 2).

The CVs for benzo[g,h,i]perylene detected in the shallow soil collected from the skating pond are unavailable (see Table 3). Maximum concentration of benzo[a]pyrene detected in the shallow samples collected from the skating pond exceeded its environmental guideline CVs.

Two of the soil samples (7A and 10A) were analyzed for dioxin congeners and the results were reported as toxicity equivalents (TEQs). Concentrations detected in both samples were below the screening value of 50 parts per trillion (ppt) of TEQs (ATSDR 1997).

In March 2007, surface soil samples from the area behind the gazebo, at the north end of the park and the bermed area along the unnamed tributary of Miry Run were collected and analyzed for metals and PAHs. The concentration of lead (480 mg/kg) in one surface soil sample collected from the area behind the gazebo exceeded its

environmental guideline CVs (400 mg/kg). The concentration of benzo[b]fluoranthene, benzo[a]anthracene and benzo[a]pyrene detected in the soil of bermed area along the unnamed creek exceeded their environmental guideline CVs.

Surface Water

The surface water of the unnamed tributary of the Miry Run within the Sayen Gardens was sampled. A total of 11 surface water samples were collected, approximately 140 feet apart, beginning at the culvert located near Mercer Street. Two surface water samples were collected from the skating pond.

Maximum concentrations of arsenic, lead, nickel and thallium detected in the surface water samples exceeded their environmental guideline CVs (see Table 4).

Sediment

Sediment from the unnamed tributary of the Miry Run within the Sayen Gardens was sampled. A total of 11 locations were sampled (with 1 shallow and 1 deep), approximately 140 feet apart, beginning at the culvert located near Mercer Street. The maximum and the mean of contaminant concentrations detected in the shallow and deep sediment samples are provided in Table 5 and 6, respectively.

The CVs for acenapthylene, dibenzofuran, phenanthrene and benzo[g,h,i]perylene detected in the shallow soil are unavailable (see Table 5 and 6). Maximum concentrations of benzo[a]anthracene, benzo[b]fluoranthene, benzo[a]pyrene and indeno[1,2,3-cd]pyrene and dibenz[a,h]anthracene detected in both the shallow and deep sediment samples exceeded their corresponding environmental guideline CVs.

Two sediment samples from the skating pond were collected. The maximum and the mean concentrations are provided in Table 7. Maximum concentrations of benzo[a]anthracene, benzo[b]fluoranthene, benzo[a]pyrene and indeno[1,2,3-cd]pyrene detected in the skating pond sediment samples exceeded their corresponding environmental guideline CVs.

Three of the sediment samples (7A, 11B and 13A) were analyzed for dioxin congeners and the results were reported as TEQs. Concentrations detected in the three samples were below the screening value of 50 part per trillion (ppt) of TEQs.

Groundwater and Domestic Wells

Contaminant concentrations were below detection levels in the groundwater and drinking water samples.

Contaminants of Concern: Summary

The maximum concentration of contaminants detected in soil and sediment, along with Environmental Guideline CVs are presented in Tables 1 through 7. The maximum concentrations of the following contaminants detected in the soil and sediment exceeded their corresponding environmental guideline CVs, and as such, are designated as the COCs for the site:

Location	**PAHs**	**Metals**
October 2006 Sampling		
Shallow Soil (north of Sayen House)	Benzo[a]pyrene, Dibenz[a,h]anthracene	Lead
Shallow Soil (skating pond)	Benzo[a]pyrene	Lead
Surface Water (unnamed creek)		Arsenic, Lead, Thallium
Shallow Sediment (unnamed creek)	Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[a]pyrene, Indeno[1,2,3-cd]pyrene, Dibenz[a,h]anthracene	
Deep Sediment (unnamed creek)	Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[a]pyrene, Dibenz[a,h]anthracene	
Sediment (skating pond)	Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[a]pyrene, Indeno[1,2,3-cd]pyrene	
March 2007 Sampling		
Shallow Soil (area behind gazebo)		Lead
Sediment (bermed area along the unnamed creek)	Benzo[b]fluoranthene, Benzo[a]anthracene, Benzo[a]pyrene	

A brief discussion of the toxicologic characteristics of the COCs are presented in Appendix A.

Discussion

The method for assessing whether a health hazard exists to a community is to determine whether there is a completed exposure pathway from a contaminant source to a receptor population and whether exposures to contamination are high enough to be of health concern. Site-specific exposure doses can be calculated and compared with health guideline CVs.

Assessment Methodology

An exposure pathway is a series of steps starting with the release of a contaminant in environmental media and ending at the interface with the human body. A completed exposure pathway consists of five elements:

1. source of contamination;
2. environmental media and transport mechanisms;
3. point of exposure;
4. route of exposure; and
5. receptor population.

Generally, the ATSDR considers three exposure pathway categories: 1) completed exposure pathways, that is, all five elements of a pathway are present; 2) potential exposure pathways, that is, one or more of the elements may not be present, but information is insufficient to eliminate or exclude the element; and 3) eliminated exposure pathways, that is, one or more of the elements is absent. Exposure pathways are used to evaluate specific ways in which people were, are, or will be exposed to environmental contamination in the past, present, and future.

Based on results and knowledge of accessibility of the media to the population, exposure pathways for individuals who live (or lived) in the area were identified as follows:

Completed Pathways

Ingestion of contaminated soil and sediment (past, present, future). A number of PAHs were detected in the surface soil and sediment of Sayen Gardens. Residents, including children, may have been exposed to contaminants while living and engaging in outdoor recreational activities.

Ingestion of surface water from the unnamed creek (past, present, future). A number of metals were identified as the COCs in the surface water samples collected from the unnamed creek. Residents, including children, may have been exposed to surface water contaminants during outdoor recreational activities.

A summary of completed exposure pathways identified for the site is presented in Table 8.

Exposure Point Concentration

Exposure to contaminants is used as the basis for determining health risks at hazardous waste sites. Although the maximum concentration of contaminants is usually used to identify COCs, it would be inappropriate to calculate site risk based on the single highest concentration. Due to inherent uncertainties in this approach, a single measurement is unlikely to represent the contamination at the entire site. Alternatively, a 'conservative estimate' of the average chemical concentration, known as the exposure point concentration (EPC), in an environmental medium can be used to effectively represent a concentration at a hazardous waste sites. Unless there is site-specific evidence to the contrary, an individual receptor is assumed to be equally exposed to media within all portions of the exposure area over the time frame of the public health assessment.

In 1992, the USEPA recommended that the 95 percent upper confidence limit (UCL) of the arithmetic mean should be used as the EPC (USEPA 1992). Subsequently, USEPA developed a software package, ProUCL® (USEPA 2002, USEPA 2004, USEPA 2007) that uses rigorous parametric and nonparametric statistical methods on data sets to estimate risk assessment parameters of interest, such as the EPC. For the Mercer Rubber site, the ProUCL 4.0 was used to estimate the surface soil and surface water EPCs for the site (see Table 9). The table also shows the type of distribution or non-parametric method used to estimate the 95% UCL.

Non-Cancer Health Effects

Ingestion – Soil and Sediment

The following site-specific exposure assumptions (USEPA 1997; NJDEP 2004) were used to calculate contaminant exposure doses:

Receptor	Soil Ingestion Rate (mg)	Body Weight (kg)	Exposure Frequency	Number of Years Exposed
Child	200	21	2x per week for six months	10
Adult	100	70		30

Exposures are based on ingestion of contaminated soil; non-cancer exposure doses were calculated using the following formula:

$$\textit{Exposure Dose (mg/kg/day)} = \frac{C \times IR \times EF}{BW}$$

where, mg/kg/day = milligrams of contaminant per kilogram of body weight per day;
C = concentration of contaminant in soil (mg/kg);
IR = soil ingestion rate (kg/day);

EF = exposure factor representing the site-specific exposure scenario; and,
BW = body weight (kg)

Lead

The 95% UCL of mean concentrations of lead detected in the surface soil and sediment of the Sayen Garden area is 358 mg/kg (see Table 9) which is lower than the health guideline CV (400 mg/kg). As such, non-cancer adverse health effects associated with lead exposures is not expected in children and adults.

PAHs

PAHs are a class of over 100 different compounds that are found in and formed during incomplete combustion of coal, oil, wood, or other organic substances (ATSDR 1995). More commonly they are found in petroleum based products such as coal tar, asphalt, creosote, and roofing tar. In the environment, PAHs are found as complex mixtures of compounds, and many have similar toxicological effects and environmental fate. Because they are produced by combustion processes, PAHs are widespread in the environment. PAHs have been found to exhibit antiandrogenic[2] properties in human cell cultures and are implicated in the loss of fertility in males (Kizu 2003). Non-cancer adverse health effects associated with PAH exposures has been observed in animals but generally not in humans (ATSDR 1995).

As part of National Water Quality Assessment Program, the US Geological Survey collected sediments from 536 sites in 20 major river basins (Lopes and Furlong 2001). The 75th percentile and the maximum sediment concentration of a few PAHs are as follows:

Contaminant	Sediment Concentration (mg/kg)	
	75th Percentile	Maximum
Benzo[a]pyrene	0.08	9.9
Dibenz[a,h]anthracene	<0.05	4.4
Benzo[a]anthracene	0.79	12
Benzo[b]fluoranthene	0.92	12
Indeno[1,2,3-cd]pyrene	0.63	8.4
Benzo[k]fluoranthene	0.84	10

(Lopes and Furlong 2001)

The table shows that the maximum concentrations of PAHs detected in the soil and sediment collected from the Sayen Garden area (see Table 9) is within the respective

[2]An antiandrogen is any of a group of hormone receptor antagonist compounds that are capable of preventing or inhibiting the biologic effects of androgens (i.e., male sex hormones) on normally responsive tissues in the body.

concentration range reported for sediments. The levels were found to be not unusual compared to what is typically found in the sediment of waterways due to runoff from a developed area (NJDEP 2007). It should also be noted that the PAHs were not identified as the on-site COCs of the Mercer Rubber Company site (ATSDR 2007).

Based on the 95% UCL of mean concentrations of PAHs detected in the surface soil and sediment of the Sayen Garden area, the chronic exposure doses for children and adults were calculated (see Table 10); no health guideline CVs are available for these PAHs identified as COCs. However, the NOAEL, RfD and associated critical health effects for a number of PAHs (i.e., acenaphthene, anthracene, fluoranthene, fluorene, naphthalene and pyrene) are available and is shown below:

Reference Dose for Chronic Oral Exposure			
PAH	**NOAEL (mg/kg/day)**	**RfD (mg/kg/day)**	**Health Effect**
Acenaphthene	175	0.06	Hepatotoxicity
Anthracene	1,000	0.3	No observed effect
Fluoranthene	125	0.04	Nephropathy, increased liver weights, hematological alterations, and clinical effects
Fluorene	125	0.04	Decreased red blood count, packed cell volume and hemoglobin
Naphthalene	71	0.02	Decreased mean terminal body weight in males
Pyrene	75	0.03	Kidney effects (renal tubular pathology, decreased kidney weights)

Source: EPA 2006

The RfD's of these PAHs are based on the NOAEL for less serious health effects and are much higher than those calculated for the PAHs detected in the soils and sediments. Based on the 95% UCL of mean concentration of benzo[b]fluoranthene detected in surface soil and sediment of the Sayen Garden area (6.5 mg/kg, see Table 10), the calculated chronic child exposure dose (8.84×10^{-6} mg/kg/day) was about 2,250 times lower than the lowest reported RfD (i.e., 0.02 mg/kg/day for naphthalene). The exposure doses associated with the remaining PAHs were also several orders of magnitude lower than the lowest reported RfD. As such, non-cancer adverse health effects associated with on-site PAH exposures in the past is unlikely in children and adults.

Incidental Ingestion - Surface Water

In order to assess exposures from incidental ingestion of surface water contaminants, an exposure dose was calculated using the following formula:

$$\textit{Exposure Dose (mg/kg/day)} = \frac{C \times IR \times EF}{BW}$$

where mg/kg/day = milligrams of contaminant/kilogram of body weight/day;

C = concentration of contaminant in water (mg/L);
IR = ingestion rate (L/day);
EF = exposure factor representing the site-specific exposure scenario; and,
BW = body weight (kg).

The following exposure assumptions (USEPA 1997) were used to calculate contaminant doses.

Incidental Ingestion Rate	
50	2x per week for six months

Maximum chronic exposure doses calculated for children and adults for arsenic and thallium were lower than their corresponding health guideline CV and, therefore, are unlikely to cause adverse non-cancer health effects (see Table 11).

The health guideline CV is unavailable for lead. The 95% UCL of mean concentrations of lead detected in the surface water of the unnamed creek (10.98 μg/L) did not exceed the Action Level for drinking water (15 μg/L).

Cancer Health Effects

The site-specific lifetime excess cancer risk (LECR) indicates the cancer potential of contaminants. LECR estimates are usually expressed in terms of excess cancer cases in an exposed population in addition to the background rate of cancer. For perspective, the lifetime risk of being diagnosed with cancer in the United States is 46 per 100 individuals for males, and 38 per 100 for females; the lifetime risk of being diagnosed with any of several common types of cancer ranges approximately between 1 in 100 and 10 in 100 (SEER 2005). Typically, health guideline CVs developed for carcinogens are based on a lifetime risk of one excess cancer case per 1,000,000 individuals. ATSDR considers estimated cancer risks of less than one additional cancer case among one million persons exposed as insignificant or no increased risk (expressed exponentially as 10^{-6}).

According to the United States Department of Health and Human Services (USDHHS), the cancer class of contaminants detected at a site is as follows:

1 = Known human carcinogen
2 = Reasonably anticipated to be a carcinogen
3 = Not classified

Ingestion – Soil and Sediment

The cancer class of the COCs detected in the surface soil and sediment are given in Table 12. The PAHs detected in the surface soil and sediment of the Sayen Garden are classified as "reasonably anticipated to be a carcinogen" by the United States Department of Health and Human Services (USDHHS). Exposure doses were calculated using the following formula:

$$\textit{Cancer Exposure Dose (mg/kg/day)} = \frac{C \times IR \times EF}{BW} \times \frac{ED}{AT}$$

where C = concentration of contaminant in soil (mg/kg);
IR = soil ingestion rate (kg/day);
EF = exposure factor representing the site-specific exposure scenario;
ED = exposure duration (year);
BW = body weight (kg); and,
AT = averaging time (year).

The USEPA has developed a relative potency estimate approach for PAHs (USEPA 1993). Using this approach, the cancer potency of carcinogenic PAHs can be estimated based on their relative potency with reference to benzo[a]pyrene. For each of the carcinogenic PAHs, the benzo[a]pyrene equivalence was calculated by multiplying the maximum concentration detected with the cancer potency factor. The total benzo[a]pyrene equivalence was then obtained by summing each of the individual benzo[a]pyrene equivalences (see Table 12).

Based on previously described exposure assumptions, LECR were calculated by multiplying the exposure dose by the cancer slope factor. The cancer slope factor is defined as the slope of the dose-response curve obtained from animal and/or human cancer studies and is expressed as the inverse of the daily exposure dose, i.e., $(mg/kg/day)^{-1}$. Based on 95% UCL of the mean and using conservative exposure parameters, the calculated LECRs were about seven additional cancer cases among one million persons exposed, which may be considered a very small increased risk compared to the lifetime risk of being diagnosed with cancer in the United States of 46 per 100 for males, and 38 per 100 for females (SEER 2005). In addition, the PAHs were not identified as the on-site COCs of the Mercer Rubber Company site (ATSDR 2007).

Lead and Lead Compounds are listed in the Eleventh Edition of the Report on Carcinogens as "reasonably anticipated to be human carcinogens" (NTP 2007). The USEPA has determined that data from human studies are inadequate for evaluating the carcinogenicity of lead, but there is sufficient data from animal studies which demonstrate that lead induces renal tumors in experimental animals (USEPA 1986, 1989). In addition, there are some animal studies which have shown evidence of tumor induction at other sites (i.e., cerebral gliomas; testicular, adrenal, prostate, pituitary, and thyroid tumors). A cancer slope factor has not been derived for inorganic lead or lead compounds, so no estimation of LECR can be made for lead exposure.

Incidental Ingestion - Surface Water

LECRs associated with ingestion of the unnamed creek water during outdoor recreational activities were evaluated (see Table 13). Based on 95% UCL of the mean, the calculated LECRs were about one additional cancer case among ten billion persons exposed which is considered insignificant or no increased risk.

The cancer risk associated with lead exposure was discussed earlier in this section.

Child Health Considerations

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination in their environment. Children are at greater risk than adults from certain kinds of exposures to hazardous substances because they eat and breathe more than adults (on a pound for pound basis). They also play outdoors and often bring food into contaminated areas. They are shorter than an adult, which means they breathe dust, soil, and heavy vapors closer to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most important, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

The area surrounding the Mercer Rubber Company site is residential with wooded areas along the unnamed creek. Although the former Mercer Rubber Company employees and/or long-time area residents indicated that manufacturing process wastes (liquid and solid) were dumped in the Sayen Garden areas, an evaluation off-site environmental sampling data did not indicate health risks (exceeding the background risk) associated with the use of these areas by residents including children.

Conclusions

In October 2006 and March 2007, the NJDEP conducted environmental sampling of off-site areas. Contaminants of concern identified were PAHs in the surface soil and sediments and metals in the surface water. Incidental ingestion of soil, sediment and surface water were identified as the completed exposure pathways.

An evaluation of past, current and future exposures to contaminants detected at the off-site areas did not indicate non-cancer health concerns. Using conservative exposure parameters, the calculated LECR for exposure to PAHs was about seven additional cancer cases among one million persons exposed, which may be considered a very small risk compared to the lifetime risk of being diagnosed with cancer. In addition,

the concentrations of PAHs detected in the soil and sediment collected from the Sayen Garden area are not unusual compared to what is typically found in the sediment of waterways due to runoff from a developed area. As such, the off-site areas pose ***No Public Health Hazard*** to area residents including children.

Recommendations

The NJDHSS and ATSDR do not propose any exposure related follow-up and/or recommendations for the off-site areas of the Mercer Rubber Company site.

Public Health Action Plan

The Public Health Action Plan (PHAP) for the former Mercer Rubber Company site contains a description of the actions to be taken by the NJDHSS and/or ATSDR at or in the vicinity of the site subsequent to the completion of this health consultation. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included is a commitment on the part of the NJDHSS and ATSDR to follow up on this plan to ensure that it is implemented. The public health actions to be implemented by NJDHSS and ATSDR are as follows:

Public Health Actions Taken

1. Available environmental data and other relevant information associated with the off-site areas of the Mercer Rubber Company site have been reviewed and evaluated to determine human exposure pathways and public health issues.

2. In cooperation with the ATSDR, the NJDHSS attended a public meeting (sponsored by the NJDEP) in January 2007 to provide health related information regarding the October 2006 sampling results.

Public Health Actions Planned

1. The NJDHSS will prepare a Citizen's Guide for the Mercer Rubber site which will be made available to residents, the Hamilton Township Department of Health, and local repositories.

2. Copies of this report will be made available to concerned area residents via the township library and the internet.

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CERTIFICATION

The health consultation for the Mercer Rubber Company site, Mercer County, New Jersey was prepared by the New Jersey Department of Health and Senior Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

Gregory V. Ulirsch, MS, PhD
Technical Project Officer, CAT, SPAB, DHAC
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The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Alan Yarbrough
Team Leader, CAT, SPAB, DHAC
Agency for Toxic Substances and Disease Registry

Table 1: Results of shallow soil samples[a] collected from an area located to the north of Sayen House near Mercer Rubber Company site

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Semi Volatile Organic Compounds (SVOCs)					
Benzaldehyde	5	0.08	0.03	5,000 (RMEG[e])	No
Acetophenone	3	0.06	0.02	5,000 (RMEG)	No
Acenaphthylene	2	0.05	0.01	NA[f]	- [g]
Acenaphthene	3	0.11	0.03	3,000 (RMEG)	No
Dibenzofuran	1	0.04	0.005	NA	-
Fluorene	3	0.1	0.02	2,000 (RMEG)	No
Phenanthrene	8	1.3	0.33	NA	-
Anthracene	3	0.15	0.04	20,000 (RMEG)	No
Carbazole	3	0.2	0.04	32 (RBC[h])	No
Fluoranthene	8	2.5	0.67	2,000 (RMEG)	No
Pyrene	8	1.5	0.42	2,000 (RMEG)	No
Butylbenzylphthalate	5	0.41	0.07	10,000 (RMEG)	No
Benzo[a]anthracene	8	0.67	0.20	0.87 (RBC)	No
Chrysene	8	0.85	0.27	87 (RBC)	No
Bis(2-ethylhexyl)phthalate	6	1.1	0.18	46 (RBC)	No
Benzo[b]fluoranthene	8	0.69	0.26	0.87 (RBC)	No
Benzo([k]fluoranthene	8	0.82	0.26	8.7 (RBC)	No
Benzo[a]pyrene	8	0.68	0.21	0.1 (CREG[i])	**Yes**

Table 1: (Cont'd)

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Semi Volatile Organic Compounds (SVOCs)					
Indeno[1,2,3-cd]pyrene	8	0.31	0.09	0.87 (RBC)	No
Dibenz[a,h]anthracene	2	0.1	0.02	0.087 (RBC)	**Yes**
Benzo[g,h,i]perylene	7	0.34	0.09	NA	-
Pesticides					
Heptachlor epoxide	4	0.02	0.01	0.08 (CREG)	No
Dieldrin	4	0.04	0.01	3 (EMEG[j])	No
4,4'-DDE	7	0.05	0.02	2 (CREG)	No
Endosulfan sulfate	2	0.01	0.002	100 (EMEG)	No[k]
4,4'-DDT	7	0.04	0.02	2 (CREG)	No
Endrin ketone	2	0.01	0.002	20 (EMEG)	No[l]
Endrin aldehyde	3	0.01	0.003	20 (EMEG)	No[l]
alpha-Chlordane	5	0.09	0.02	30 (EMEG)	No[m]
gamma-Chlordane	5	0.04	0.01	30 (EMEG)	No[m]
Metals					
Aluminum	8	25,200	14,917	100,000 (EMEG[n])	No
Antimony	3	0.84	0.3	20 (RMEG)	No
Arsenic	8	14.6	7.51	20 (EMEG)	No
Barium	8	166	70.25	30,000 (EMEG)	No
Beryllium	8	1.3	0.68	100 (EMEG)	No

Table 1: (Cont'd)

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Metals					
Cadmium	8	0.86	0.48	10 (EMEG)	No
Chromium	8	27.9	17.76	200 (RMEG)	No
Cobalt	8	7.6	4.83	500 (EMEG I)	No
Copper	8	49.5	26.28	500 (EMEG I)	No
Lead	8	430	128.5	400 (RDCSCC[p])	**Yes**
Manganese	8	211	88.55	3,000 (RMEG)	No
Mercury	8	0.28	0.15	14 (RDCSCC)	No
Nickel	8	21.8	12.13	1,000 (RMEG)	No
Selenium	4	1.5	0.64	300 (EMEG)	No
Thallium	6	1.4	0.76	5.5 (RBC)	No
Vanadium	8	45.1	29.93	200 (EMEG I)	No
Zinc	8	345	135	20,000 (EMEG)	No

[a]Number of Samples = 8; [b]milligrams of contaminant per kilograms of soil; [c]Comparison Value; [d]Contaminants of Concern; [e]ATSDR Reference Media Evaluation Guide for chronic exposure for child; [f]Not Available; [g]could not be evaluated due to lack of comparison value; [h]USEPA Region 3 Risk-Based Concentration; [i]ATSDR Cancer Risk Evaluation Guide for chronic exposure; [j]ATSDR Environmental Media Evaluation Guide for chronic exposure for child; [k]Based on Endosulfan; [l]Based on Endrin; [n]ATSDR Environmental Media Evaluation Guide for intermediate exposure for child; [p]NJDEP Residential Direct Contact Soil Cleanup Criteria

Table 2: Results of deep soil samples collected from North of Sayen House near Mercer Rubber Company site

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Volatile Organic Compounds (SVOCs)					
Acetone	8	0.004	0.003	50,000 (RMEG[e])	No
Semi Volatile Organic Compounds (SVOCs)					
Bis(2-ethylhexyl)phthalate	1	0.04	0.0048	46 (RBC[f])	No
Pesticides					
4,4'-DDE	1	0.02	0.002	2 (CREG[g])	No
4,4'-DDT	1	0.01	0.001	2 (CREG)	No
Metals					
Aluminum	8	15,800	9,613	100,000 (EMEG[h])	No
Arsenic	8	3.1	1.47	20 (EMEG[i])	No
Barium	8	32.4	24	30,000 (EMEG)	No
Beryllium	8	0.38	0.24	100 (EMEG)	No
Cadmium	1	0.1	0.01	10 (EMEG)	No
Chromium	8	47.4	15.65	200 (RMEG)	No
Cobalt	8	6.2	2.22	500 (EMEG[h])	No
Copper	8	12.4	7.93	500 (EMEG[h])	No
Lead	8	6.5	4	400 (RDCSCC)	No
Manganese	8	395	59	3,000 (RMEG)	No
Mercury	4	0.02	0.006	14 (RDCSCC)	No
Nickel	8	8.9	6.3	1,000 (RMEG)	No

Table 2: (Cont'd)

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Metals					
Thallium	1	0.59	0.07	5.5 (RBC)	No
Vanadium	8	28.5	18.2	200 (EMEG[h])	No
Zinc	8	26.6	12.25	20,000 (EMEG)	No

[a]Number of Samples = 8; [b]milligrams of contaminant per kilograms of soil; [c]Comparison Value; [d]Contaminants of Concern; [e]ATSDR Reference Media Evaluation Guide for chronic exposure for child; [f]USEPA Region 3 Risk-Based Concentration; [g]ATSDR Cancer Risk Evaluation Guide for chronic exposure; [h]ATSDR Environmental Media Evaluation Guide for intermediate exposure for child; [i]ATSDR Environmental Media Evaluation Guide for chronic exposure for child; [j]NJDEP Residential Direct Contact Soil Cleanup Criteria

Table 3: Results of soil samples[a] collected from the skating pond area near Mercer Rubber Company site

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Volatile Organic Compounds (VOCs)					
Acetone	3	1	0.48	50,000 (RMEG[e])	No
2-Butanone	3	0.18	0.09	30,000 (RMEG)	No
Semi Volatile Organic Compounds (SVOCs)					
Benzaldehyde	2	0.19	0.08	5,000 (RMEG)	No
Phenanthrene	3	0.27	0.14	NA[f]	- [g]
Fluoranthene	4	0.56	0.39	2,000 (RMEG)	No
Pyrene	4	0.54	0.35	2,000 (RMEG)	No
Butylbenzylphthalate	1	0.15	0.03	10,000 (RMEG)	No
Benzo[a]anthracene	3	0.22	0.14	0.87 (RBC[h])	No
Chrysene	4	0.36	0.25	87 (RBC)	No
Bis(2-ethylhexyl)phthalate	3	0.4	0.21	46 (RBC)	No
Benzo[b]fluoranthene	4	0.37	0.26	0.87 (RBC)	No
Benzo[k]fluoranthene	4	0.35	0.21	8.7 (RBC)	No
Benzo[a]pyrene	4	0.27	0.19	0.1 (CREG)	**Yes**
Indeno[1,2,3-cd]pyrene	2	0.16	0.07	0.87 (RBC)	No
Benzo[g,h,i]perylene	2	0.15	0.06	NA	
Pesticides					
4,4'-DDE	3	0.1	0.04	2 (CREG[i])	No
4,4'-DDD	2	1.6	0.408	3 (CREG)	No
4,4'-DDT	3	0.27	0.08	2 (CREG)	No
gamma-Chlordane	1	0.012	0.003	30 (EMEG[j])	No[k]

Table 3: (Cont'd)

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Metals					
Aluminum	4	13600	12,650	100,000 (EMEG[l])	No
Antimony	2	5.3	2.55	20 (RMEG)	No
Arsenic	4	4.3	3.37	20 (EMEG)	No
Barium	4	304	251.7	30,000 (EMEG)	No
Beryllium	4	2.8	2.5	100 (EMEG)	No
Cadmium	4	1.2	0.95	10 (EMEG)	No
Chromium	4	14.3	10.5	200 (RMEG)	No
Cobalt	4	3.6	3.07	500 (EMEG[l])	No
Copper	4	94.3	56.4	500 (EMEG[l])	No
Lead	4	773	351.25	400 (RDCSCC[m])	**Yes**
Manganese	4	22.5	16.57	3,000 (RMEG)	No
Mercury	4	0.66	0.45	14 (RDCSCC)	No
Nickel	4	13	10.32	1,000 (RMEG)	No
Selenium	3	18.2	6.52	300 (EMEG)	No
Vanadium	4	42.6	36.57	200 (EMEG[l])	No
Zinc	4	118	101.97	20,000 (EMEG)	No

[a]Number of Samples = 4; [b]milligrams of contaminant per kilograms of soil; [c]Comparison Value; [d]Contaminants of Concern; [e]ATSDR Reference Media Evaluation Guide for chronic exposure for child; [f]Not Available; [g]could not be evaluated due to lack of comparison value; [h]USEPA Region 3 Risk-Based Concentration; [i]ATSDR Cancer Risk Evaluation Guide for chronic exposure; [j]ATSDR Environmental Media Evaluation Guide for chronic exposure for child; [k]Based on Chlordane; [l]ATSDR Environmental Media Evaluation Guide for intermediate exposure for child; [m]NJDEP Residential Direct Contact Soil Cleanup Criteria

Table 4: Results of surface water samples[a] collected from the Unnamed Creek near the Mercer Rubber Company site

Contaminant	No. of detection	Concentration (µg/L[b])		Environmental Guideline CV[c] (µg/L)	COC[d]
		Max.	Mean of Detected		
Metals					
Aluminum	12	3,310	794.3	20,000 (EMEG[e])	No
Antimony	1	0.6	0.05	4 (RMEG[f])	No
Arsenic	13	10.1	1.7	3 (EMEG[g])	**Yes**
Barium	13	189	92.45	6,000 (EMEG)	No
Beryllium	12	0.3	0.13	20 (EMEG)	No
Cadmium	6	1	0.15	2 (EMEG)	No
Chromium	4	4.5	1.02	30 (RMEG)	No
Cobalt	13	62.2	7.08	100 (EMEG[e])	No
Copper	6	22.9	3.82	100 (EMEG[e])	No
Lead	13	39.9	5.12	15 (NJMCL-AL[h])	**Yes**
Mercury	2	0.3	0.04	2 (NJMCL[i])	No
Nickel	13	21.2	4.33	200 (RMEG)	No
Selenium	10	1.2	0.56	50 (EMEG)	No
Silver	1	10	0.77	50 (RMEG)	No
Thallium	3	25	2.8	2 (NJMCL)	**Yes**
Vanadium	11	5.2	3.75	30 (EMEG[e])	No
Zinc	13	212	42.33	3,000 (EMEG)	No

[a]Number of Samples = 13; [b]micrograms of contaminant per liter of water; [c]Comparison Value; [d]Contaminants of Concern; [e]ATSDR Environmental Media Evaluation Guide for intermediate exposure for child; [f]ATSDR Reference Media Evaluation Guide for chronic exposure for child; [g]ATSDR Environmental Media Evaluation Guide for chronic exposure for child; [h]New Jersey Maximum Contaminant Level for drinking water; [i]New Jersey Maximum Contaminant Level for drinking water

Table 5: Results of shallow sediment samples[a] collected from the Unnamed Creek near Mercer Rubber Company site

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Volatile Organic Compounds (VOCs)					
Acetone	9	0.038	0.012	50,000 (RMEG[e])	No
Methyl tert-Butyl Ether	1	0.0023	0.0002	20,000 (EMEG)	No[f]
2-Butanone	5	0.014	0.004	30,000 (RMEG)	No
Tetrachloroethene	1	0.0035	0.0003	500 (RMEG)	No
Semi Volatile Organic Compounds (SVOCs)					
Naphthalene	1	0.15	0.01	1,000 (RMEG)	No
2-Methylnaphthalene	1	0.2	0.02	2,000 (EMEG[g])	No
Acenaphthylene	2	0.51	0.05	NA[h]	- [i]
Acenaphthene	7	1.1	0.15	3,000 (RMEG)	No
Dibenzofuran	4	0.45	0.06	NA	
Fluorene	7	2.1	0.26	2,000 (RMEG)	No
Phenanthrene	10	7.7	1.74	NA	
Anthracene	9	2.3	0.36	20,000 (RMEG)	No
Carbazole	8	1.1	0.19	32 (RBC[j])	No
Fluoranthene	10	22	3.40	2,000 (RMEG)	No
Pyrene	10	18	2.55	2,000 (RMEG)	No
Benzo[a]anthracene	10	7.3	1.14	0.87 (RBC)	**Yes**
Chrysene	10	9.1	1.43	87 (RBC)	No
Bis(2-ethylhexyl)phthalate	9	15	2.53	46 (RBC)	No

Table 5: (Cont'd)

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Semi Volatile Organic Compounds (SVOCs)					
Benzo[b]fluoranthene	10	14	1.84	0.87 (RBC)	**Yes**
Benzo[k]fluoranthene	10	7.9	1.20	8.7 (RBC)	No
Benzo[a]pyrene	10	8.4	1.23	0.1 (CREG[k])	**Yes**
Indeno[1,2,3-cd]pyrene	9	2.2	0.36	0.87 (RBC)	**Yes**
Dibenz[a,h]anthracene	8	0.84	0.13	0.087 (RBC)	**Yes**
Benzo[g,h,i]perylene	9	2.3	0.37	NA	- [i]
Pesticides					
beta-BHC	1	0.0028	0.0003		
Heptachlor	1	0.0026	0.0002	0.2 (CREG)	No
Aldrin	1	0.0027	0.0002	2 (EMEG)	No
Heptachlor epoxide	3	0.0085	0.0015	0.08 (CREG)	No
Dieldrin	1	0.0083	0.0008	3 (EMEG)	No
4,4'-DDE	2	0.036	0.0038	2 (CREG)	No
4,4'-DDD	6	0.4	0.0390	3 (CREG)	No
4,4'-DDT	3	0.018	0.0042	2 (CREG)	No
Endrin ketone	1	0.0074	0.0007	20 (EMEG)	No[l]
alpha-Chlordane	4	0.015	0.0025	30 (EMEG)	No[m]
gamma-Chlordane	6	0.024	0.0039	30 (EMEG)	No[m]

Table 5: (Cont'd)

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Metals					
Aluminum	11	8,680	6,028.18	100,000 (EMEG)	No[f]
Antimony	1	0.56	0.05	20 (RMEG)	No
Arsenic	11	3.2	1.22	20 (EMEG)	No
Barium	11	64.8	35.99	30,000 (EMEG)	No
Beryllium	11	0.66	0.38	100 (EMEG)	No
Cadmium	8	0.64	0.15	10 (EMEG)	No
Chromium	11	13.7	10.19	200 (RMEG)	No
Cobalt	11	8.1	4.61	500 (EMEG I)	No[f]
Copper	11	74.1	21.87	500 (EMEG)	No[f]
Lead	11	175	30.37	400 (RDCSCC[n])	No
Manganese	11	83.7	48.95	3,000 (RMEG)	No
Mercury	5	0.06	0.01	14 (RDCSCC)	No
Nickel	10	13.5	7.35	1,000 (RMEG)	No
Vanadium	11	28.5	16.13	200 (EMEG I)	No[f]
Zinc	10	93.6	38.12	20,000 (EMEG)	No

[a]Number of Samples = 11; [b]milligrams of contaminant per kilograms of soil; [c]Comparison Value; [d]Contaminants of Concern; [e]ATSDR Reference Media Evaluation Guide for chronic exposure for child; [f]ATSDR Environmental Media Evaluation Guide for intermediate exposure for child; [g]ATSDR Environmental Media Evaluation Guide for chronic exposure for child; [h]Not Available; [i]could not be evaluated due to lack of comparison value; [j]USEPA Region 3 Risk-Based Concentration; [k]ATSDR Cancer Risk Evaluation Guide for chronic exposure; [l]Based on Endrin; [m]Based on Chlordane; [n]NJDEP Residential Direct Contact Soil Cleanup Criteria

Table 6: Results of deep sediment samples[a] collected from the unnamed Creek near Mercer Rubber Company site

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Volatile Organic Compounds (VOCs)					
Acetone	10	0.02	0.0089	50,000 (RMEG[e])	No
Carbon disulfide	1	0.001	0.0001	50 (RMEG)	No
2-Butanone	5	0.012	0.0028	30,000 (RMEG)	No
Semi Volatile Organic Compounds (SVOCs)					
Naphthalene	3	0.13	0.0184	1,000 (RMEG)	No
2-Methylnaphthalene	2	0.063	0.0096	2,000 (EMEG[f])	No
1,1'-Biphenyl	1	0.021	0.0019	3000 (RMEG)	No
Acenaphthylene	5	0.26	0.0358	NA[g]	- [h]
Acenaphthene	5	0.32	0.0667	3,000 (RMEG)	No
Dibenzofuran	2	0.23	0.0291	NA	-
Fluorene	6	0.75	0.1129	2,000 (RMEG)	No
Phenanthrene	9	4.2	0.7957	NA	-
Anthracene	7	0.8	0.1528	20,000 (RMEG)	No
Carbazole	6	0.48	0.0629	32 (RBC[i])	No
Fluoranthene	9	5.9	1.4682	2,000 (RMEG)	No
Pyrene	9	4.6	1.03	2,000 (RMEG)	No
Benzo[a]anthracene	9	2.5	0.57	0.87 (RBC)	**Yes**
Chrysene	9	2.9	0.67	87 (RBC)	No
Bis(2-ethylhexyl)phthalate	8	3.5	0.38	46 (RBC)	No
Benzo[b]fluoranthene	9	3.2	0.72	0.87 (RBC)	**Yes**

Table 6: (Cont'd)

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Semi Volatile Organic Compounds (SVOCs)					
Benzo[k]fluoranthene	9	2.3	0.53	8.7 (RBC)	No
Benzo[a]pyrene	9	2.7	0.6	0.1 (CREG[j])	**Yes**
Indeno(1,2,3-cd)pyrene	8	0.83	0.2	0.87 (RBC)	No
Dibenz[a,h]anthracene	5	0.15	0.03	0.087 (RBC)	**Yes**
Benzo[g,h,i]perylene	8	0.88	0.2	NA	-
Pesticides					
Heptachlor epoxide	2	0.0029	0.0005	0.08 (CREG)	No
4,4'-DDE	2	0.014	0.0025	2 (CREG)	No
4,4'-DDD	5	0.17	0.0178	3 (CREG)	No
4,4'-DDT	3	0.045	0.0056	2 (CREG)	No
alpha-Chlordane	4	0.0045	0.0012	30 (EMEG)	No[k]
gamma-Chlordane	4	0.0058	0.0015	30 (EMEG)	No[k]
Metals					
Aluminum	11	8,140	5,333	100,000 (EMEG)	No[l]
Arsenic	9	7.2	1.38	20 (EMEG)	No
Barium	11	43	27.17	30,000 (EMEG)	No
Beryllium	11	0.54	0.31	100 (EMEG)	No
Cadmium	8	0.49	0.14	10 (EMEG)	No
Chromium	11	13.1	9.47	200 (RMEG)	No

Table 6: (Cont'd)

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Metals					
Cobalt	11	14.7	4.64	500 (EMEG)	No[l]
Copper	11	51.2	14	500 (EMEG)	No[l]
Lead	11	98.1	22.56	400 (RDCSCC)	No
Manganese	11	77.9	49	3,000 (RMEG)	No
Mercury	4	0.07	0.01	14 (RDCSCC[m])	No
Nickel	11	19.4	8.11	1,000 (RMEG)	No
Thallium	1	0.71	0.06	5.5 (RBC)	No
Vanadium	11	21	12.49	200 (EMEG)	No[l]
Zinc	11	148	50.5	20,000 (EMEG)	No

[a]Number of Samples = 11; [b]milligrams of contaminant per kilograms of soil; [c]Comparison Value; [d]Contaminants of Concern; [e]ATSDR Reference Media Evaluation Guide for chronic exposure for child; [f]ATSDR Environmental Media Evaluation Guide for chronic exposure for child; [g]Not Available; [h]could not be evaluated due to lack of comparison value; [i]USEPA Region 3 Risk-Based Concentration; [j]ATSDR Cancer Risk Evaluation Guide for chronic exposure; [k]Based on Chlordane; [l]ATSDR Environmental Media Evaluation Guide for intermediate exposure for child; [m]NJDEP Residential Direct Contact Soil Cleanup Criteria

Table 7: Results of pond sediment samples[a] collected from the Unnamed Creek near Mercer Rubber Company site

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Volatile Organic Compounds (VOCs)					
Acetone	2	0.031	0.004	50,000 (RMEG[e])	No
Toluene	1	0.0013	0.0001	4,000 (RMEG)	No
Semi Volatile Organic Compounds (SVOCs)					
Naphthalene	2	0.13	0.01	1,000 (RMEG)	No
2-Methylnaphthalene	1	0.13	0.01	2,000 (EMEG[f])	No
1,1'-Biphenyl	2	0.23	0.02	3,000 (RMEG)	No
Acenaphthylene	1	0.053	0.004	NA[g]	- [h]
Acenaphthene	2	1.3	0.13	3,000 (RMEG)	No
Dibenzofuran	2	0.21	0.02	NA	
Fluorene	2	0.99	0.11	2,000 (RMEG)	No
Phenanthrene	2	8	0.93	NA	
Anthracene	2	1.3	0.14	20,000 (RMEG)	No
Carbazole	2	0.23	0.04	32 (RBC[i])	No
Fluoranthene	2	13	1.62	2,000 (RMEG)	No
Pyrene	2	18	1.98	2,000 (RMEG)	No
Butylbenzylphthalate	1	0.18	0.01	10,000 (RMEG)	No
Benzo[a]anthracene	2	5.4	0.66	0.87 (RBC)	**Yes**
Chrysene	2	7.2	0.9	87 (RBC)	No
Bis(2-ethylhexyl)phthalate	2	13	1.21	46 (RBC)	No

Table 7: (Cont'd)

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Semi Volatile Organic Compounds (SVOCs)					
Di-n-octylphthalate	1	0.12	0.01	20,000 (EMEG)	No[j]
Benzo[b]fluoranthene	2	4.2	0.74	0.87 (RBC)	**Yes**
Benzo[k]fluoranthene	2	5.4	0.71	8.7 (RBC)	No
Benzo[a]pyrene	2	5.3	0.67	0.1 (CREG[k])	**Yes**
Indeno[1,2,3-cd]pyrene	2	1.6	0.19	0.87 (RBC)	**Yes**
Benzo[g,h,i]perylene	2	1.8	0.22	NA	
Pesticides					
Heptachlor epoxide	1	0.0024	0.0002	0.08 (CREG)	No
4,4'-DDE	2	0.037	0.005	2 (CREG)	No
Endrin	1	0.0056	0.0005	20 (EMEG)	No
4,4'-DDD	2	0.25	0.02	3 (CREG)	No
Endosulfan sulfate	1	0.0071	0.0006	100 (EMEG)	No[l]
4,4'-DDT	2	0.027	0.003	2 (CREG)	No
Endrin ketone	1	0.012	0.001	20 (EMEG)	No[m]
alpha-Chlordane	1	0.014	0.001	30 (EMEG)	No[n]
gamma-Chlordane	2	0.019	0.002	30 (EMEG)	No[n]
Metals					
Aluminum	2	15,100	1,784	100,000 (EMEG)	No[j]
Arsenic	2	3.6	0.46	20 (EMEG)	No

Table 7: (Cont'd)

Contaminant	No. of detections	Concentration (mg/kg[b])		Environmental Guideline CV[c] (mg/kg)	COC[d]
		Max.	Mean		
Metals					
Barium	2	93.6	11.74	30,000 (EMEG)	No
Beryllium	2	0.76	0.11	100 (EMEG)	No
Cadmium	2	1	0.13	10 (EMEG)	No
Chromium	2	28.9	3.45	200 (RMEG)	No
Cobalt	2	12.4	1.76	500 (EMEG)	No[j]
Copper	2	44.7	5.76	500 (EMEG)	No[j]
Lead	2	141	17.75	400 (RDCSCC[p])	No
Manganese	2	155	16.77	3,000 (RMEG)	No
Mercury	2	0.1	0.01	14 (RDCSCC)	No
Nickel	2	17.6	2.34	1,000 (RMEG)	No
Selenium	1	1.5	0.14	300 (EMEG)	No
Thallium	1	1.1	0.1	5.5 (RBC)	No
Vanadium	2	40.5	4.8	200 (EMEG)	No[j]
Zinc	2	250	34.82	20,000 (EMEG)	No

[a]Number of Samples = 2; [b]milligrams of contaminant per kilograms of soil; [c]Comparison Value; [d]Contaminants of Concern; [e]ATSDR Reference Media Evaluation Guide for chronic exposure for child; [f]ATSDR Environmental Media Evaluation Guide for chronic exposure for child; [g]Not Available; [h]could not be evaluated due to lack of comparison value; [i]USEPA Region 3 Risk-Based Concentration; [j]ATSDR Environmental Media Evaluation Guide for intermediate exposure for child; [k]ATSDR Cancer Risk Evaluation Guide for chronic exposure; [l]Based on Endosulfan; [m]Based on Endrin; [n]Based on Chlordane; [p]NJDEP Residential Direct Contact Soil Cleanup Criteria

Table 8: Exposure Pathways Associated with off-site areas of the Mercer Rubber Company Site

Medium	Point of Exposure	Route of Exposure	Receptor Population	Pathway Classification
Surface soil	Off-site waste disposal areas (along unnamed creek, Sayen Gardens)	Ingestion, dermal	Local Residents	Past/Present/Future - Completed
Surface water	Unnamed creek, pond, site runoff			

Table 9: 95% Upper Confidence Limit (UCL) of the Mean calculated by ProUCL 4.0

Contaminant	Number of Samples	Mean of Detected (mg/kg)	Maximum Detected (mg/kg)	Type of Distribution/Non-parametric Method used	95% UCL by ProUCL 4.0 (mg/kg)
Surface Soil					
Benzo[a]pyrene	27	1.1	8.4	97.5% KM[a] (Chebyshev[b])	3.4
Dibenz[a,h]anthracene	19	0.16	0.84	95% KM (Chebyshev)	0.505
Benzo[a]anthracene	15	1.67	7.3	95% KM (Chebyshev)	4.35
Benzo[b]fluoranthene	15	2.26	14.00	95% KM (Chebyshev)	6.5
Indeno[1,2,3-cd]pyrene	13	0.55	2.2	95% KM (Chebyshev)	1.48
Benzo[k]fluoranthene	24	0.55	2.3	95% KM (Chebyshev)	1.12
Lead	13	224.1	773	95% Gamma	358.4
Surface Water					
		(ppb)	**(ppb)**		**(ppb)**
Arsenic	13	1.68	10.1	95% Lognormal	3.46
Lead	13	5.11	39.9	95% Gamma	10.98
Thallium	13	9.1	25	95% KM (Chebyshev)	21.97
Vanadium	13	16.83	50	95% KM (Chebyshev)	65.29

[a]Kaplan-Meier method; [b]Chebyshev inequality-based UCL

Table 10: Comparison of Surface Soil Exposure Dose of the Processing Area with the Health Guideline CVs

Contaminants of Concern	95% UCL (mg/kg)	Maximum Exposure Dose (mg/kg/day)		Health Guideline CV[c] (mg/kg/day)	Potential for Non-cancer Health Effects
		Child[a]	Adult[b]		
Benzo[a]anthracene	4.36	5.93×10^{-6}	8.89×10^{-7}	NA[d]	No
Benzo[b]fluoranthene	6.50	8.84×10^{-6}	1.33×10^{-6}	NA	No
Benzo[a]pyrene	3.40	4.63×10^{-6}	6.94×10^{-7}	NA	No
Indeno[1,2,3-cd]pyrene	1.48	2.01×10^{-6}	3.02×10^{-7}	NA	No
Dibenz[a,h]anthracene	0.51	6.87×10^{-7}	1.03×10^{-7}	NA	No
Benzo[k]fluoranthene	1.13	1.53×10^{-6}	2.3×10^{-7}	NA	No

[a]Child exposure scenario: 2 days/week, 6 month/year, 200 mg/day ingestion rate and 21 kg body weight; [b]Adult exposure scenario: 2 days/week, 6 month/year, 100 mg/day ingestion rate and 70 kg body weight; [c]Comparison Value; [d]Not Available

Table 11: Comparison of Surface Water Exposure Dose with the Health Guideline CVs

Contaminants of Concern	95% UCL (μg/L)	Exposure Dose (mg/kg/day)		Health Guideline CV[c] (mg/kg/day)	Potential for Non-cancer Health Effects
		Child[a]	Adult[b]		
Arsenic	3.46	1.18×10^{-9}	3.53×10^{-10}	0.0003 (MRL[d])	No
Lead	10.98	3.37×10^{-9}	1.12×10^{-9}	NA[e]	-
Thallium	21.97	7.47×10^{-9}	2.24×10^{-9}	0.00007 (RBC[f])	No

[a]Child exposure scenario: 2 days/week, 6 month/year, 50 mL/day ingestion rate and 21 kg body weight; [b]Adult exposure scenario: 2 days/week, 6 month/year, 50 mL/day ingestion rate and 70 kg body weight; [c]Comparison Value; [d]ATSDR Minimal Risk Level; [e]Not Available; [f]USEPA Region 3 Reference Dose Oral

Table 12: Calculated LECR associated with the PAHs detected in the soil and sediment of the Sayen Garden

Contaminants of Concern	95% UCL (mg/kg)	DHHS[a] Cancer Class	Potency Factor[b]	BaP Equiv. (mg/kg)	Total BaP Equiv. (mg/kg)	Exposure Dose[c] (mg/kg/day)	CSF[d] $(mg/kg/d)^{-1}$	LECR[e]
Polycyclic Aromatic Compounds (PAHs)								
Benzo[a]anthracene	4.36	2	0.1	0.43	7.3	9.57×10^{-7}	7.3	7.0×10^{-6}
Benzo[b]fluoranthene	6.50	2	0.1	0.65				
Benzo[a]pyrene	3.40	2	1	3.4				
Indeno[1,2,3-cd]pyrene	1.48	2	0.1	0.15				
Dibenz[a,h]anthracene	0.51	2	5	2.55				
Benzo[k]fluoranthene	1.13	2	0.1	0.11				

[a]Department of Health and Human Services Cancer Class: 1 = known human carcinogen; 2 = reasonably anticipated to be a carcinogen; 3 = not classified; [b]Cancer potency factor relative to benzo[a]pyrene (BaP); [c]Adult exposure scenario: 2 days/week, 6 month/year, 100 mg/day ingestion rate, 70 kg body weight and 30 year exposure duration; [d]Cancer Slope Factor; [e]Lifetime Excess Cancer Risk

Table 13: Calculated Lifetime Excess Cancer Risk (LECR) based on Contaminants detected in the Surface Water

Contaminant	95% UCL (µg/L)	Cancer Exposure Dose (mg/kg/day)[a]	DHHS Cancer Class[b]	CSF[c]	LECR[d]
Arsenic	3.46	1.51×10^{-10}	1	1.5	2.27×10^{-10}
Lead	10.98	4.8×10^{-10}	2	NA[e]	
Thallium	21.97	9.61×10^{-10}	3		

[a]Exposure scenario: 0.05 L/day ingestion rate, 70 kg body weight and 30 year exposure duration; [b]Department of Health and Human Services Cancer Class: 1 = known human carcinogen; 2 = reasonably anticipated to be a carcinogen; 3 = not classified; [c]Cancer Slope Factor; [d]Lifetime Excess Cancer Risk; [e]Not available

Appendix A

Toxicologic Summaries

The toxicological summaries provided in this appendix are based on ATSDR's ToxFAQs (http://www.atsdr.cdc.gov/toxfaq.html). The health effects described in the section are typically known to occur at levels of exposure much higher than those that occur from environmental contamination. The chance that a health effect will occur is dependent on the amount, frequency and duration of exposure, and the individual susceptibility of exposed persons.

Lead Lead is a naturally occurring metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing. Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. People may be exposed to lead by eating food or drinking water that contains lead, spending time in areas where lead-based paints have been used and are deteriorating, and by working in a job or engaging in a hobby where lead is used. Small children are more likely to be exposed to lead by swallowing house dust or soil that contains lead, eating lead-based paint chips or chewing on objects painted with lead-based paint.

Lead can affect many organs and systems in the body. The most sensitive is the central nervous system, particularly in children. Lead also damages kidneys and the reproductive system. The effects are the same whether it is breathed or swallowed. At high levels, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory. Lead may cause anemia, a disorder of the blood. It can also damage the male reproductive system. The connection between these effects and exposure to low levels of lead is uncertain.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead, for example by eating old paint chips, may develop blood anemia, severe stomachache, muscle weakness, and brain damage. A large amount of lead might get into a child's body if the child ate small pieces of old paint that contained large amounts of lead. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, however, lead can affect a child's mental and physical growth. Exposure to lead is more dangerous for young children and fetuses. Fetuses can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead.

The United States Department of Health and Human Services (USDHHS) has determined that two compounds of lead (lead acetate and lead phosphate) may reasonably be anticipated to be carcinogens based on studies in animals. There is inadequate evidence to clearly determine whether lead can cause cancer in people.

Arsenic Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting high levels of inorganic arsenic can result in death. Lower levels of arsenic can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso. Skin contact with inorganic arsenic may cause redness and swelling.

Organic arsenic compounds are used as pesticides, primarily on cotton plants. Organic arsenic compounds are less toxic than inorganic arsenic compounds. Exposure to high levels of some organic arsenic compounds may cause similar effects as those caused by inorganic arsenic.

Several studies have shown that inorganic arsenic can increase the risk of lung cancer, skin cancer, bladder cancer, liver cancer, kidney cancer, and prostate cancer. The World Health Organization (WHO), the USDHHS, and the EPA have determined that inorganic arsenic is a human carcinogen

Polycyclic Aromatic Hydrocarbons (PAHs) Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot. These include benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, benzo(g,h,i)perylene, indeno(1,2,3-cd0pyrene, phenanthrene, and naphthalene

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides. Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people. Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

The US Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens. Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Thallium. Thallium is a bluish-white metal that is found in trace amounts in the earth's crust. It is used mostly in manufacturing electronic devices, switches, and closures, primarily for the semiconductor industry. It also has limited use in the manufacture of special glass and for certain medical procedures. Thallium enters the environment primarily from coal-burning and smelting, in which it is a trace contaminant of the raw materials. Exposure to thallium may occur through eating food contaminated with thallium, breathing workplace air in industries that use thallium, smoking cigarettes, or contact with contaminated soils, water or air.

Exposure to high levels of thallium can result in harmful health effects. A study on workers exposed on the job over several years reported nervous system effects, such as numbness of fingers and toes, from breathing thallium. Studies in people who ingested large amounts of thallium over a short time have reported vomiting, diarrhea, temporary hair loss, and effects on the nervous system, lungs, heart, liver, and kidneys. High exposures can cause death. It is not known what the reproductive effects are from breathing or ingesting low levels of thallium over a long time. Studies in rats exposed to high levels of thallium showed adverse reproductive effects, but such effects have not been seen in people. Animal data suggest that the male reproductive system may be susceptible to damage by low levels of thallium.

The DHHS, IARC, and the EPA have not classified thallium as to its human carcinogenicity. No studies are available in people or animals on the carcinogenic effects of breathing, ingesting, or touching thallium.