Public Health Assessment

Final Release

CURTIS PAPER

MILFORD, HUNTERDON COUNTY, NEW JERSEY

EPA FACILITY ID: NJD057143984

Prepared by the
New Jersey Department of Health and Senior Services

JANUARY 27, 2011

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR's Cooperative Agreement Partner pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR's Cooperative Agreement Partner has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR's Cooperative Agreement Partner addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR's Cooperative Agreement Partner which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Summary

Introduction

On September 3, 2008, the United States Environmental Protection Agency (USEPA) proposed to add the Curtis Specialty Papers site, Hunterdon County, New Jersey, to the National Priorities List (NPL). On September 23, 2009, USEPA listed the site as final on the NPL. The New Jersey Department of Health and Senior Services (NJDHSS), in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR), prepared the following public health assessment to review environmental data obtained from the site, to evaluate potential human exposure to contaminants, and to determine whether the exposures are of public health concern.

The Milford Mill operated on the site for approximately 90 years and in July 2003 shut down its operations and left the facility abandoned and unsecured. Quequacommissacong Creek, officially known as Hakihokake Creek, is located on the site. The exposed population includes individuals (including children) accessing the site and recreational users of adjoining parklands and the Delaware River. Trespassers have accessed the site in the past despite the presence of fencing around the mill buildings. Direct observations made during the recent USEPA removal action indicate persons continue to access the site. For purposes of this public health assessment, the 109 acre site is divided into three areas: Site-wide surface soil, surface soil in the Quequacommissacong Creek Area and sediment in the Quequacommissacong Creek Area.

NJDHSS and ATSDR's top priority is to ensure that the community around the site has the best information possible to safeguard its health.

Conclusions

The NJDHSS and ATSDR have reached four conclusions in this public health assessment on the Curtis Specialty Papers site:

Conclusion 1

NJDHSS and ATSDR conclude that past, present or future exposures to contaminants in surface soil in at the Curtis Specialty Papers site are not expected to harm people's (trespassers, recreators) health.

Basis for Conclusion	It was concluded that exposure to chromium and PAHs in surface soil is unlikely to cause non-cancer adverse health effects. The cancer health effects from ingestion of contaminated soil were determined to be no different than what is expected from non-site or background exposures to these contaminants.
Next Steps	It is recommended that the USEPA continue to limit trespassers' access to surface soil at the site.
Conclusion 2	*NJDHSS and ATSDR cannot conclude if past, present or future exposures to contaminants in surface soil in the Quequacommissacong Creek Area of the Curtis Specialty Papers site may have harmed, or will harm, people's (trespassers, recreators) health.*
Basis for Conclusion	Based on the maximum concentration of dioxins/furans, PAHs, arsenic and manganese in surface soil, exposure doses indicated that non-cancer adverse health effects are unlikely for adults and children. Based on the maximum concentration of total PCBs detected in the soil, adverse health may be more likely for child exposures to PCBs in soil in the Quequacommissacong Creek Area. However, this estimate was based on the using the highest concentration of PCB detected out of six samples. It is unlikely that this hot spot is accessed each time contact is made with soil in the Quequacommissacong Creek Area. Given the uncertainty because of lack of data, the need for additional sampling is necessary in order to make an assessment of health impacts associated with exposures to soil in this area.
Next Steps	It is recommended that the USEPA fully characterize the nature and extent of contamination in the Quequacommissacong Creek Area, including collecting soil samples from the 0-3 inch depth interval in areas close to residences or other non-fenced areas.
Conclusion 3	*NJDHSS and ATSDR conclude that past, present or future exposures to contaminants in sediment in the Quequacommissacong Creek Area of the Curtis Specialty Papers site are not expected to harm people's (trespassers, recreators) health.*

Basis for Conclusion	Based on maximum concentrations of benzo[a]pyrene, benzo[g,h,i]perylene, phenanthrene, Aroclor-1260 and arsenic detected in sediment, chronic exposure doses calculated for children and adults are unlikely to cause non-cancer adverse health effects. The cancer health effects from ingestion of contaminated sediment were determined to represent no excess cancer risk when compared to background levels.
Conclusion 4	*NJDHSS and ATSDR cannot conclude if past, present or future exposures to surface water or biota in the Quequacommissacong Creek Area of the Curtis Specialty Papers site may have harmed, or will harm, people's (trespassers, recreators) health.*
Basis for Conclusion	Data associated with surface water and biota are not currently available. PCBs have been detected in Quequacommissacong Creek and are known to bioaccumulate in biota. Consumption of contaminated fish can be a significant pathway of exposure for the Curtis Specialty Papers site in the Quequacommissacong Creek Area, due to the possibility of repeated exposures to fish tissue.
Next Steps	It also is recommended that the USEPA fully characterize the nature and extent of contamination in surface water and biota in the Quequacommissacong Creek Area and the Delaware River adjacent to the site.
For More Information	Copies of this report were made available to concerned residents in the vicinity of the site via the township library and the internet. Questions about this public health assessment should be directed to the NJDHSS at (609) 826-4984.

Statement of Issues

On September 3, 2008, the United States Environmental Protection Agency (USEPA) proposed to add the Curtis Specialty Papers site, Hunterdon County, New Jersey, to the National Priorities List (NPL). On September 23, 2009, USEPA listed the site as final on the NPL. Pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act (SARA) of 1986, the federal Agency for Toxic Substances and Disease Registry (ATSDR) is required to conduct public health assessment activities for sites listed or proposed to be added to the NPL. The New Jersey Department of Health and Senior Services (NJDHSS), in cooperation with the ATSDR, prepared the following public health assessment to review environmental data obtained from the site, evaluate potential human exposure to contaminants, and to determine whether the exposures are of public health concern.

Background

Site Description and Operational History

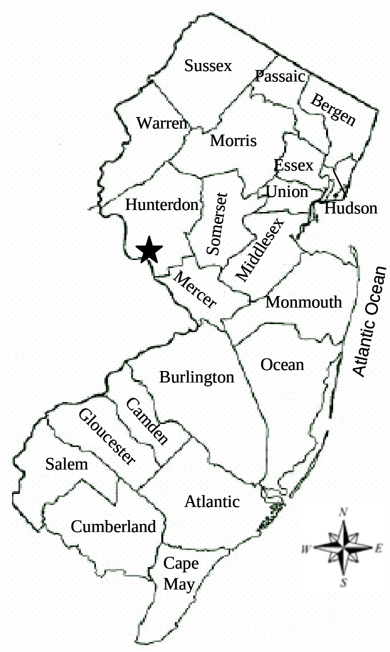

Figure 1: Location of Curtis Specialty Papers site

The Curtis Specialty Papers site is located at 404 Frenchtown Road, Milford Borough and Alexandria Township, Hunterdon County, New Jersey. The site consists of an industrial facility that manufactured paper products, which was in operation from approximately 1907 until July 2003. The site is bordered by the Quequacommissacong Creek to the northwest, the Frenchtown Road to the east, farmland and the Crown Vantage Landfill Superfund site to the south, and the Delaware River to the west. The area surrounding the site is primarily residential with some limited commercial development. There is a railroad right-of-way that runs along the western portion of the site, adjacent to the Delaware River.

The site contains a complex of buildings including the main mill, a coatings facility, a cogeneration power plant, and a wastewater treatment plant. The main mill contains approximately 61 buildings with rooms spanning multiple levels, including a basement. The coatings facility operated from approximately 1935 to 1988; operations included the compounding of coatings and solvent-based resins, the application of coatings to paper products, and recovery of solvents by distillation. An additional 48 acres on an adjacent parcel includes a 14-million gallon aeration lagoon (Sorge, 2001).

The site has been owned and operated by several entities including but not limited to: Riegel Paper Corporation, James River Paper Company, Inc, Crown Vantage, Inc. and Curtis Papers, Inc.

Regulatory and Remedial History

In August 2001, Curtis Papers Inc. submitted a preliminary assessment report and remedial investigation work plan to NJDEP as part of an effort to comply with the Industrial Site Recovery Act (USEPA 2008). The company identified 20 areas of concern (AOCs) at the Curtis Specialty Papers facility. In July 2003, Curtis Papers Inc. shut down the operations. There is no documentation of remedial activities occurring at the AOCs prior to the shutdown. The facility was abandoned and left unsecured. Since the abandonment of the facility, it has been repeatedly vandalized and scavenged for materials (Tetra Tech 2007). In October 2006, New Jersey Department of Environmental Protection (NJDEP) initiated emergency response measures that included securing visible oil and hazardous materials containers, removal of approximately two dozen drums and lab packs from the site, and classifying materials for waste disposal. NJDEP also constructed a fence around a majority of the property to secure the site (Tetra Tech 2007).

In February 2007, NJDEP referred the site to the USEPA for a potential CERCLA removal action. From June 11, 2007 until December 2008, USEPA performed a removal action at the site. This action included removing approximately thirty pallets of containerized waste (i.e., drums, pails, small containers), numerous vats, and radiation sources. In June 2009, the USEPA executed a Settlement Agreement and Administrative Order on Consent with Georgia-Pacific Consumer Products and International Paper for performance of the Remedial Investigation/Feasibility Study. Under the June 2009 Administrative Order, the two companies implemented measures to add to site security and restrict site access (USEPA 2010). Presently, a barbed-wire and chain-link security fence restricts access to the main mill area and the coatings building. Additional fencing restricts access to the aeration basins. A 24-hour security service maintains a presence on site and conducts routine site inspections. In November and December 2009, additional site maintenance activities were implemented, including:

- repairing the fence damaged by trespassers
- replacing the fence and installation of new fence
- placing barricades to restrict access along the trail in the wastewater treatment plant area
- installing signage (e.g., No Trespassing, Hazardous Materials Present)

Currently, there is evidence that people continue to access the site; the exact extent and frequency of access is unknown. Based on a September 2009 site visit, the following areas were cited as being accessed or used for recreational purposes (USEPA 2010):

- angling in the Delaware River adjacent to the former wastewater treatment plant;
- walking, biking, riding all-terrain vehicles (ATVs) or hiking a trail along the top of the Delaware River bank and railroad right-of adjacent to the site along the Delaware River;
- walking and bird watching (predominantly by residents who live along Frenchtown Road);
- angling adjacent to the former coatings facility in Quequacommissacong Creek near its confluence with the Delaware River.

Site Geology and Hydrogeology

Groundwater flow direction is west-southwest, toward the Delaware River. Downstream of this site, 2.9 million people get their drinking water from the River, including a half million people who get water through New Jersey's Delaware and Raritan Canal, just 11 miles downstream, and more who use Pennsylvania's Point Pleasant Pumping Station which is about 10 miles downstream and withdraws 20 million gallons of water per day (USEPA 2008). The pumping station is an interbasin transfer facility that withdraws water from the Delaware River and transfers it to numerous water purveyors for distribution as drinking water. The station obtains water from the North Branch Neshaminy Creek. In the summer months and at times of low flow, water is pumped from the Delaware River at Point Pleasant and diverted into North Branch Neshaminy Creek to maintain water levels within the North Branch of Neshaminy Creek. The information needed to determine the amount of water drawn from the Delaware River at the Point Pleasant pumping station for drinking water only is not available. Another surface water intake used for drinking water purposes is from the Delaware and Raritan Canal in Lambertville, New Jersey, which is approximately 20 miles south of the site. The Delaware River feeds the canal at Bulls Island State Park. United Water, which supplies an estimated 3,400 persons in Lambertville, uses the intake only for emergency purposes. Consequently the public is not affected by the potential contaminants in this portion of the Delaware River (USEPA 2005).

Groundwater is the source for drinking water within a four-mile radius of the site. A portion of the New Jersey population within four miles of the site receives their water from municipal wells. The Milford Water Department and the Frenchtown Water Department serve Milford and Frenchtown, respectively. The two municipal wells in Milford are located approximately one mile from the site, to the northwest, and service approximately 2,000 persons. The two municipal wells in Frenchtown are located 1.5 to 3.5 miles from the site, to the southeast, and service approximately 1,500 persons. The water from these wells is blended (ATSDR 2006). It is believed that all of the drinking water wells (municipal and private) near the site are located upgradient from the area of suspected contamination (USEPA 2005).

Prior ATSDR Involvement

There has not been any prior ATSDR involvement with this site.

Land Use and Demographics

The land use in the area is mixed agricultural, residential, and recreational. Based upon the 2000 United States Census, population demographics indicate that there are approximately 1,800 individuals residing within a one-mile radius of the site (see Figure 2). The closest residence is situated approximately 75 feet from one of the mill buildings. There are about 26 single-family houses beside the site (Hunterdon Democrat).

Site Visit

Representatives of ATSDR and NJDHSS conducted a site visit on October 8, 2009. The main mill area, the coatings facility as well as the Quequacommissacong Creek were observed and are documented in photographs in Appendix A. Staff noted signs of trespassing and vandalism of some building structures, thereby confirming site access in the past. The site security measures such as fencing were observed. Additionally it was noted that access to the Quequacommissacong Creek area from the site and nearby residences would involved a determined effort owning to the presence of the steep gradient between the site and the creek area. At the present time, these conditions have not changed to the extent known.

Community Concerns

In order to gather information on community health concerns at the Curtis Specialty Papers site, the NJDHSS spoke with the Health Officer, Hunterdon County Department of Health. The local health department has reported no community concerns regarding the site (J. Beckley Health Officer, Hunterdon County Department of Health, personal communication, 2009). There have been reports of hikers and four-wheelers and children trespassing on the site. Press articles indicate that security around the site has been increased to 24 hours a day for seven days a week and new lighting and fencing have been put up around the property. Twenty-seven people have signed up to join the USEPA Community Advisory Group for the cleanups at the Crown Vantage Landfill Superfund Site in Alexandria Township and the Curtis Specialty Papers Superfund site (press article). The USEPA's Community Involvement Plan identifies the following key community concerns at the site based on its interviews: the ultimate end-use of the land, health effects related to airborne asbestos and other contaminants on site, property values of residences near the site, future truck traffic, and the possibility of contaminated dust blowing off the site into residential areas.

The Delaware Riverkeeper Network supported the USEPA's decision to add the Curtis Specialty Papers site to the National Priorities List. The network considers this abandoned paper mill site to be an environmental liability for Delaware River ecosystems, the region - particularly river towns - the Hakihokake Creek (also known as Quequacommissacong Creek), the residents in the area - particularly Milford and Alexandria Township - and the public who rely on the Delaware River for water supply, who recreate on and enjoy the river, and who use and enjoy the river as part of their lives (Delaware Riverkeeper 2009).

Environmental Contamination

For this public health assessment, an evaluation of site-related environmental contamination consists of a two-tiered approach. First, maximum concentrations of detected substances are compared to media-specific comparison values known as environmental guideline comparison values (CVs). If concentrations exceed the comparison values, these contaminants are selected for further evaluation. The second evaluation consists of the derivation of an Exposure Point Concentration (explained in detail in the following section) for each contaminant whose maximum value is elevated above the CVs. The Exposure Point Concentrations for contaminants are subsequently compared to the CVs; if they are elevated above the CVs, the contaminants are classified as Contaminants of Concern (COCs).

Environmental Guideline Comparison

The ATSDR chronic Environmental Media Evaluation Guide (EMEG) and Cancer Risk Evaluation Guide (CREG) were selected as the CVs. EMEGs are estimated contaminant concentrations that are not expected to result in adverse non-carcinogenic health effects. CREGs are media-specific comparison values that are used to identify concentrations of cancer-causing substances that are unlikely to result in an increase of cancer rates in an exposed population by 1 in a million over a lifetime. In cases where the ATSDR CVs do not exist, the USEPA Screening Levels (SLs) were used.

A compilation of environmental sample results for the Curtis Specialty Papers site are provided in Tables 1 and 2. Media reviewed included surface soil and sediment. Although surface water samples were collected, there were only two detections of contaminants, and these were below the CVs. Therefore, surface water contaminants were not considered to contribute to the COCs.

As previously mentioned, the maximum concentration levels of contaminants were compared to the environmental guideline CVs. If the concentrations were elevated over the CVs, the contaminant was categorized as a contaminant of potential concern and retained for further analysis.

Surface Soil: In 2001 as part of a preliminary assessment, Curtis Papers Inc. collected surface soil samples (0 – 0.5 foot and 0.5 – 1 foot depth) from several areas at the former paper mill site (Sorge 2001). In 2007, the USEPA collected several surface soil samples (0 – 1 foot depth) at locations previously sampled by the NJDEP as well as additional locations (USEPA 2008). Table 1 presents the combined analytical results from the NJDEP and USEPA sampling events; the range and mean of contaminant concentrations detected are provided. As results for both NJDEP and USEPA surface soil sampling results were combined, the sampling depth for surface soil samples is from 0 – 1 foot depth. It should be noted that the ATSDR considers 0 – 3 inches to be the surface soil (the soil to which people are most likely to be exposed).

Analytical results indicated the presence of polyaromatic hydrocarbons (PAHs - including acenaphthalene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, indeno[c,d]pyrene, naphthalene and phenanthrene), polychlorinated biphenyls (Aroclor-1254 & Aroclor-1260), pesticides/herbicides (4,4'-DDT) and dioxins/furans above their respective environmental guideline CVs. Dioxins and furans were evaluated based on the total toxic equivalency (TEQ) concentration of dioxins and furans. Elevated levels of metals detected in the soil samples included arsenic, chromium, copper, manganese, nickel, thallium and vanadium (see Table 1).

Sediment: A summary of the analytical data for sediment sampling is presented in Table 2. There are no human health-based guidelines available for sediment. As such, the sediment sampling results were compared to soil standards. Levels of PAHs (benzo[a]pyrene, benzo[g,h,i]perylene, and phenanthrene), and Aroclor-1260 and arsenic were present above their environmental guideline CVs.

These contaminants of potential concern (including both surface soil and sediment) generated from the above analyses were retained for further analysis as follows:

<u>Exposure Point Concentration Calculation</u>

Although the maximum concentration of contaminants may be used to identify COC, it would be inappropriate to calculate site health risks based on the single highest concentration. This is more appropriate for assessing acute exposures, rather than chronic exposures. Alternatively, a ‘conservative estimate’ of the average chemical concentration, known as the exposure point concentration (EPC), can be used to effectively represent a concentration at a site. An exposure point is an area location within which an exposed population’s contact with an environmental medium (e.g., air, soil) is assumed to be equally likely (USEPA 2009a).

An EPC is an estimate of the true arithmetic mean concentration of a chemical in a medium at an exposure point. However, because the true arithmetic mean concentration cannot be calculated with certainty from a limited number of measurements, the USEPA recommends that the 95th percentile upper confidence limit (UCL) of the arithmetic mean be used when calculating exposure and risk at that location. To this end, USEPA has recently developed software (ProUCL®) that computes the UCL for a given data set by a variety of alternative statistical approaches and then recommends specific UCL values as being the most appropriate for that particular data set (USEPA 2007).

For this site, the ProUCL® 4.0 was used to estimate the EPCs for those contaminants that were elevated above the CVs. The UCL analysis was not conducted if the number of detections for a contaminant was below 15; in those instances, the EPC for the retained contaminants is estimated to be represented by either the arithmetic average or the maximum contaminant concentration. If the EPC was found to be elevated above the comparison values, it was considered to be a contaminant of concern.

Table 3 lists the COC for the Curtis Specialty Papers site following the ProUCL® analyses as divided into three main sampling areas: Site-wide Surface Soil, Soil near Quequacommissacong Creek and Sediment near Quequacommissacong Creek. Six surface soil samples and eight sediment samples were collected from the eastern bank of Quequacommissacong Creek. There are residences that are in close proximity to this sampling area. For health implications, sediment samples collected from only the Quequacommissacong Creek area will be evaluated as access to this area makes contact with the contaminated sediment most likely. The following table summarizes the COC for the site:

Media	SVOCs	Metals
Site-wide Soil	Acenaphthalene Benzo[g,h,i]perylene Naphthalene Phenanthrene Dioxins/Furans	Arsenic Chromium Copper Nickel Thallium
Soil in the Quequacommissacong Creek Area	Benzo[a]anthracene Benzo[a]pyrene Benzo[b]fluoranthene Benzo[g,h,i]perylene Indeno[c,d]pyrene Phenanthrene Aroclor-1260 and Aroclor-1254 Dioxins/Furans	Arsenic Manganese
Sediment in the Quequacommissacong Creek Area	Benzo[a]pyrene Benzo[g,h,i]perylene Phenanthrene Aroclor-1260	Arsenic

A brief discussion of the toxicological characteristics of the COC is presented in Appendix B.

Discussion

Exposure Pathway Analysis

An exposure pathway is a series of steps starting with the release of a contaminant in a 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. a receptor population.

Generally, the ATSDR considers three exposure 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.

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

Completed pathways

Incidental ingestion of surface soil and sediment are the completed pathways at the Curtis Specialty Papers site.

<u>Past, Present and Future Incidental Ingestion of Site-wide Surface Soil</u>: Surface soil is contaminated with SVOCs and metals. Individuals, including children, may be exposed to contaminants while engaging in outdoor recreational activities on the site. Trespassing occurs year-round (as evidenced by the presence of hikers and signs of vandalism), although the exact extent and frequency is unknown. Surface soils may be incidentally ingested through hand-to-mouth activity by trespassers accessing the site for recreational uses. While there is presently fencing around the main mill area and other portions of the site, there has been evidence and observations of hikers, four-wheelers and children trespassing on the site. Although it is unlikely that the public would utilize the paper mill shoreline for recreational purposes, the possibility of unauthorized access to the site via the river cannot be dismissed.

<u>Past, Present and Future Incidental Ingestion of Soil and Sediment near Quequacommissacong Creek Area</u>: As shown in Figure 3, soil and sediment samples have been collected at the site, including samples from the eastern bank of Quequacommissacong Creek. There are residences in close proximity to the Quequacommissacong Creek area and it is presumed that access was readily available to

this creek in the past and remains accessible to trespassers despite the increased security and additional fencing between the creek and the coatings building.

Potential pathways

Potential pathways identified for the Curtis Specialty Papers Site are ingestion of biota and surface water from the Delaware River, and incidental ingestion of sediment from the Delaware River.

Ingestion of Contaminated Biota from the Delaware River. Biota (e.g., fish, plants) in the Delaware River continue to be exposed to contaminated sediment. Since PCBs bioconcentrate in the fatty tissues of aquatic animals, contaminants of concern may have been introduced into the aquatic food chain. The Delaware River is considered a fishery and supports populations of blueback herring, small-mouth bass, American shad, hickory shad, river herring, and channel catfish. An advisory is in effect for the Delaware River regarding the consumption of striped bass, channel catfish, white sucker, largemouth bass, smallmouth bass and American eel due to PCB, dioxin and mercury contamination (NJDEP 2009). Information obtained from a local professional fishing guide indicates that this area is “heavily fished,” and fishing trips are conducted along the segment of the Delaware River adjacent to the site. Hazardous contaminants, such as PAHs, dioxins, heavy metals, and PCBs have been identified at the site, although contamination of the Delaware River cannot be solely attributable to the Curtis Specialty Papers site. These contaminants have the potential to enter the food chain; as such, this pathway remains a potential pathway of concern.

Ingestion of Surface Water from the Delaware River. There is a drinking water intake (Point Pleasant Pumping Station) serving approximately 96,226 people located on the Pennsylvania side of the Delaware River, approximately 10 miles downstream of the site. Another surface water intake used for drinking water purposes is from the Delaware and Raritan Canal in Lambertville, New Jersey, which is approximately 20 miles south of the site. The water purveyors for both the intakes employ routine water treatment facilities prior to distribution. Although the possibility of the water intakes to be adversely impacted is minimal, it cannot be completely discounted based on the observations that the Delaware River periodically floods parts of the site, potentially increasing the concentration of contaminants in the water. The segment of the Delaware River adjacent to the site is a federally designated recreational river. Activities such as canoeing, tubing, and jet-skiing may result in potential exposures via incidental ingestion to the recreational users of the river. Based on limited data and uncertainties associated with exposures, this was designated as a potential pathway of exposure. Although there is the possibility of contaminated water entering the drinking water intakes, the likelihood of appreciable exposures is low.

Incidental ingestion of Sediments from the Delaware River: Recreational activities associated with the Delaware River (i.e., fishing, boating, rafting) may be associated with an exposure pathway linked to the Curtis Specialty Papers site. Seasonally, activities such as tubing, canoeing, kayaking, the use of small power boats and personal water crafts (i.e., jet-skiing) occur along this stretch of the Delaware River. As stated previously, recreational uses of the Delaware River are intermittent and therefore significant exposures via incidental ingestion of surface water and sediment are unlikely.

NJDEP designated Quequacommissacong Creek as Category One (C1) because of exceptional ecological significance and rated the creek as a good human food chain fishery with 13 different species identified in the stream and an optimal habitat assessment. The creek is protected by NJDEP for propagation of fish and wildlife and recreation (USEPA 2008). Documentation regarding the amount of fish harvested from Quequacommissacong Creek has not been identified. During the August 2007 sampling event, a fisherman was observed fishing within the Quequacommissacong Creek. The fisherman indicated that sunnies and small-mouth bass had been caught in Quequacommissacong Creek and had been eaten (USEPA 2008). Additionally, NJDEP stocks Quequacommissacong Creek (Hakihokake Creek) with trout in the pre-season stocking period in March/April (USEPA 2008). NJDEP identified roads surrounding the area of observed contamination in Quequacommissacong Creek as access locations to fishing areas (USEPA 2008).

Eliminated Pathway

Ingestion of Drinking Water from Off-site Public/Private Wells. Groundwater flow is toward the Delaware River. Groundwater is the source for drinking water within a four-mile radius of the site. Four public supply wells in Milford and Frenchtown service approximately 2,000 and 1,500 persons, respectively. It is estimated that nearly 400 persons utilize private wells within one mile of the site. Public and private wells are believed to be situated upgradient of the area of contamination. It is unlikely that the drinking water is impacted by the site; therefore ingestion of drinking water as an exposure pathway is eliminated at the present time.

Public Health Implications of Completed Pathways

Health Guideline Comparison – Non-Cancer Health Effects

To assess the public health implications of site-specific exposures, estimated exposure doses, derived from site-specific exposure conditions, are compared to dose-based comparison values. To assess non-cancer health effects, ATSDR has developed Minimal Risk Levels (MRLs) for contaminants that are commonly found at hazardous waste sites. An MRL is an estimate of the daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of adverse, non-cancer health effects. MRLs are developed for a route of exposure, i.e., ingestion or inhalation, over a specified time period, e.g., acute (less than 14 days); intermediate (15-364 days); and chronic (365 days or more). MRLs are based largely on toxicological studies in animals and on reports of human occupational (workplace) exposures. MRLs are usually extrapolated doses from observed effect levels in animal toxicological studies or occupational studies, and are adjusted by a series of uncertainty (or safety) factors or through the use of statistical models. In toxicological literature, observed effect levels include:

- no-observed-adverse-effect level (NOAEL); and
- lowest-observed-adverse-effect level (LOAEL).

NOAEL is the highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals. LOAEL is the lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

If site-specific exposure dose estimates exceed the health guideline CV, this dose is compared to the NOAEL or LOAEL. If the site-specific exposures are well below a NOAEL that is based on a human study, the likelihood for adverse health effects in the exposed population would be low. If, however, the NOAEL is based on an animal study, exposure doses near the NOAEL could be of concern because of uncertainty in the relative sensitivity of animals as compared to humans. In the instance where the MRL is derived from a LOAEL, the likelihood of adverse health effects increases as site-specific exposures approach a LOAEL derived from either a human or animal study. For this analysis, relevant literature values and professional judgment is used in weighing what is known and unknown, including uncertainties and data limitations.

If the NOAEL or LOAEL is not available, the BMDL (benchmark dose level) or BMCL (benchmark concentration level) can be used. The BMD or BMC is a dose or concentration that produces a predetermined change in response rate of an adverse effect (called the benchmark response or BMR) compared to background. The BMD or BMC can be used as an alternative to the NOAEL/LOAEL in dose-response assessment. The lower limit of the BMDL or BMCL is a characterization of the dose or concentration corresponding to a specified increase in the probability of a specified response. For example, a $BMDL_{10}$ or $BMCL_{10}$ is the lower confidence limit of the estimated dose corresponding to an increase of 0.10 in the probability of the specified response relative to the probability of that same response at dose zero (ATSDR 2008).

To ensure that MRLs are sufficiently protective, the extrapolated values can be several hundred times lower than the observed effect levels in experimental studies. When MRLs for specific contaminants are unavailable, other health based comparison values such as USEPA Reference Dose (RfD) are used. The RfD is an estimate of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

Incidental Ingestion of Contaminated Soil and Sediment

Trespassers access the site for recreational purposes such as hiking. Exposures are based on ingestion of contaminated media; non-cancer exposure doses were calculated using the following formula:

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

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; and,
BW = body weight (kg)

where the exposure factor =

$$\frac{\text{number of days of exposure per year } x \text{ the number of years of exposure}}{\text{days per year } x \text{ number of years exposed}}$$

Based on the changing accessibilities to the site over the last few years, different trespassing assumptions will be employed to determine the exposure doses for children and adults in contact with site-wide soil to accurately reflect past and present and future exposures.

The duration of exposure was assumed to be 5 days per week for 6 months of the year to capture past exposures to site-wide soil, prior to the installation of the fence in 1997. Since 2007, more strict measures have been taken to limit access to the site; therefore the duration of exposure for present and future exposures was assumed to be 2 days per week for 6 months of the year. For estimating exposures to soil and sediment inthe Quequacommissacong Creek Area, access was assumed to occur 7 days per week for 9 months of the year for past, present and future exposure scenarios.

Based on the USEPA Exposure Factors (USEPA 1997) additional assumptions were used to calculate exposure doses for children and adults as detailed below:

Media	Target Population	Ingestion Rate (mg/day)	No. of Days of Exposure Per Year	Body Weight (kg)
Site-wide Soil (Past)	Child	200	130 days (5 days per week, 6 months per year)	21
	Adult	100		70
Site-wide Soil (Present and Future)	Child	200	52 days (2 days per week, 6 months of the year)	21
	Adult	100		70
Soil/Sediment in the Quequacommissacong Creek Area (Past, Present and Future)	Child	200	273 days (7 days per week, 9 months per year)	21
	Adult	100		70

Tables 4 through 9 present calculated doses, expressed in scientific notation, which is simply a method for expressing either very large or very small numbers. For example, 1,000,000 can be expressed in scientific notation as 1×10^6; and 0.001 can be expressed as 1×10^{-3}, respectively.

Site-wide Soil

Table 4 presents the analysis for exposures to site-wide soil for past exposures and present and future exposure scenarios. Based on the EPC of naphthalene, dioxins/furans, arsenic, copper and nickel detected in surface soil, chronic exposure doses calculated for children and adults were lower than the corresponding health guideline CVs for past, present and future exposures. As such, exposures to these COCs are unlikely to cause non-cancer adverse health effects. Thallium does not have a health guideline CV, therefore health implications for this COC could not be evaluated.

Based on the EPC of chromium in surface soil, chronic exposure doses calculated for children and adults were higher than the corresponding health guideline CVs for past, present and future exposures. There are no health guideline CVs available for acenaphthalene and benzo[g,h,i]perylene. A brief evaluation of non-cancer health implications for these chemicals is presented below.

<u>Chromium:</u> Chromium may occur in several forms; in nature, chromium (III) is much more common than the more toxic chromium (VI) (USEPA 1994; NJDEP 1998). Chromium measured in the soil and sediment sampleswas reported as total chromium. To be conservative, the total chromium was assumed to be in the more toxic chromium (VI) form since the form of chromium in soil is a function of source materials and environmental conditions. It should be noted, however, that this assumption may result in an overestimation of the exposure dose and the potential for health effects. The chronic oral MRL for hexavalent chromium of 0.001 mg/kg/day is based on the health

effect of diffuse epithelial hyperplasia of the duodenum observed in male and female mice chronically exposed to sodium dichromate dihydrate in drinking water for one to two years. An uncertainty factor of 100 and the lowest $BMDL_{10}$ of 0.09 mg/kg/day were used to calculate the chronic oral MRL (ATSDR 2008).

The chronic exposure doses calculated for children were 36 and 14 times lower in the present, future and past exposure scenarios, respectively than the $BMDL_{10}$ of 0.09 mg/kg/day. Due to the fact all chromium detected was assumed to be in the chromium (VI) form, non-cancer adverse health effects for exposures by ingestion to chromium detected in soil are not expected.

PAHs: Acenaphthalene, benzo[g,h,i]perylene and phenanthrene are known as polyaromatic hydrocarbons (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. More commonly they are found in petroleum based products such as coal tar, asphalt, creosote, and roofing tar (ATSDR 1995). In the environment, PAHs are found as complex mixtures of compounds, rarely as single compounds alone.

Based on the EPC of the PAHs detected in the site-wide soil, the chronic exposure doses for children and adults were calculated (see Table 4); no health guideline CVs are available for the PAHs identified as the COC. 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 the doses calculated for the on-site PAHs. Based on the EPC of the acenaphthalene, benzo[g,h,i]perylene and phenanthrene, the calculated chronic child exposure doses (2.9 $x10^{-7}$ mg/kg/day to 9.25 $x10^{-9}$ mg/kg/day) were about 100,000 to 10,000,000 times lower than the lowest reported RfD (i.e., 0.02 mg/kg/day for naphthalene). As such, non-cancer adverse health effects associated with the PAH exposures in the past is unlikely in children and adults for past, present and future exposure scenarios. This determination takes into account that PAHs have similar physical, chemical, and toxicological characteristics.

Soil in the Quequacommissacong Creek Area

As seen in Figure 3, six surface soil samples have been collected from the eastern bank of Quequacommissacong Creek. Some residences are in close proximity to this sampling area and it is presumed that access was readily available to this creek in the past and most likely at the present time too.

The concentration of PCBs detected in these soil samples is as follows: 0.083 mg/kg, 0.120 mg/kg, 2.9 mg/kg, 15 mg/kg, 140 mg/kg and 220 mg/kg. Since only six surface soil samples were collected, the maximum concentration was used as the EPC to provide a conservative estimate of exposure doses.

Based on the EPC of dioxins/furans, arsenic and manganese in surface soil, chronic exposure doses calculated for children and adults were lower than the corresponding health guideline CVs (see Table 5). As such, exposures to these COC are unlikely to cause non-cancer adverse health effects.

There are no health guideline CVs available for benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluroanthene, benzo[g,h,i]perylene, indeno[c,d]pyrene and phenanthrene. A brief evaluation of non-cancer health implications for these chemicals is presented below.

<u>PAHs</u>: Based on the UCL of the PAHs detected in soil, the chronic exposure doses for children and adults were calculated; no health guideline CVs are available for the PAHs identified as the COC (see Table 5). In the absence of chronic oral MRLs for all the PAHs, the chronic oral RfD for naphthalene was used for comparison. The highest child exposure dose calculated for benzo[b]fluoranthene (1.5×10^{-6} mg/kg/day) is four orders of magnitude lower than naphthalene's RfD (2×10^{-2} mg/kg/day). As such, exposures to these contaminants are unlikely to cause non-cancer adverse health effects. As such, non-cancer adverse health effects associated with the PAH exposures in the past is unlikely in children and adults for past, present and future exposure scenarios. This determination takes into account that PAHs have similar physical, chemical, and toxicological characteristics.

Based on EPC of total PCBs in surface soil, chronic exposure doses calculated for children and adults were higher than the corresponding health guideline CVs. A brief evaluation of non-cancer health implications is presented below.

<u>PCBs</u>. Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Animals that ate smaller amounts of PCBs in food over several weeks or months

developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. The chronic oral RfD for Aroclor 1254, one of the PCB congeners, is 2×10^{-5} mg/kg/day, and is based on inflammation of eyelids, distorted growth of fingers, and suppressed immune response in monkeys (ATSDR 2000). A LOAEL of 5×10^{-3} mg/kg/day and an uncertainty factor of 300 were used to calculate the oral RfD.

Based on the EPC of total PCBs detected in the soil, the exposure dose calculated for children (9.7×10^{-4} mg/kg/day) and adults (1.2×10^{-4} mg/kg/day) exceeded the RfD (2×10^{-5} mg/kg/day) (see Table 5). The maximum exposure doses were about 5 and 42 times lower than the LOAEL for children and adults, respectively. While adverse health effects are not expected for adults, they may be possible for child exposures to PCBs in soil in the Quequacommissacong Creek Area. However, it must be noted that this estimate was based on the using the highest concentration of PCB (220 mg/kg) detected out of six samples. It is unlikely that this hot spot is accessed each time contact is made with soil in the Quequacommissacong Creek Area. However, this assessment highlights the need for additional data to better estimate the health impacts.

ATSDR develops CVs for acute (14 days or less), intermediate (15–365 days), and chronic (365 days or more) exposures. Given the fact that PCBs were detected in levels as high as 220 mg/kg, the possibility for acute effects to occur was evaluated.. However, health guideline CVs based on acute exposures are unavailable for PCBs. Hepatic effects are noted in female rats at 0.5 mg/kg/day following a four day exposure (ATSDR 2000). This dose is approximately 500 times higher that the calculated exposure dose for children (9.7×10^{-4} mg/kg/day); therefore acute health effects are not expected.

Sediment in the Quequacommissacong Creek Area

Since only eight sediment samples were collected, the maximum concentration was used as the EPC to provide a conservative estimate of exposure doses.

Based on the EPC of Aroclor-1260 and arsenic detected in sediment, chronic exposure doses calculated for children and adults were lower than the corresponding health guideline CVs (see Table 6). As such, exposures to these contaminants are unlikely to cause non-cancer adverse health effects.

In the absence of chronic oral MRLs for benzo[a]pyrene, benzo[g,h,i]perylene and phenanthrene, the chronic oral RfD for naphthalene was used for comparison. The highest child exposure dose calculated for phenanthrene (3.5×10^{-7} mg/kg/day) is five orders of magnitude lower than naphthalene's RfD (2×10^{-2} mg/kg/day). As such, exposures to these contaminants are unlikely to cause non-cancer adverse health effects. This determination takes into account that PAHs have similar physical, chemical, and toxicological characteristics.

Health Guideline Comparison – Cancer Health Effects

Site-specific lifetime excess cancer risk (LECR) indicates the cancer potential of contaminants and are usually expressed in terms of excess cancer cases in an exposed population. LECR for adults are 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., $(mg/kg/day)^{-1}$.

The United States Department of Health and Human Services (USDHHS) cancer class is presented in Tables 7-9. The cancer classes are defined as follows:

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

The NJDHSS use the following cancer risk descriptions for health assessments:

Public Health Assessment/Health Consultation Risk Description for New Jersey

LECR	Risk Description
10^{-3} to = 10^{-1}	Increase
10^{-4} to < 10^{-3}	Low increase
10^{-6} to < 10^{-4}	Very low increase
< 10^{-6}	No expected increase

Incidental Ingestion of Contaminated Soil and Sediment

Exposure doses were calculated using the following formula:

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

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;
BW = body weight (kg); and

where the exposure factor:

$$EF = \frac{\text{number of days of exposure per year } x \text{ the number of years of exposure}}{\text{days per year } x 70 \text{ years}}$$

Based on the USEPA Exposure Factors (USEPA 1997) and site-specific conditions, the following assumptions were used to calculate the exposure doses and the corresponding LECRs:

Media	Target Population	Ingestion Rate (mg/day)	No. of Days of Exposure Per Year	Years Exposed	Body Weight (kg)
Site-wide Soil (Past)	Adult	100	130 days (5 days per week, 6 months per year)	30	70
Site-wide Soil (Present and Future)			52 days (2 days per week, 6 months per year)		
Soil/Sediment in the Quequacommissacong Creek Area (Past, Present and Future)			273 days (7 days per week, 9 months per year)		

The USDHSS cancer classification of the COC detected in the soil are presented in Tables 7-9. Acenaphthalene, benzo[g,h,i]perylene, dibenzofuran, phenanthrene, chromium, copper, manganese, nickel and thallium are not classified as carcinogens.

Site-wide Soil

Table 7 presents the cancer risk analysis for exposures to site-wide soil for past exposures and present and future exposure scenarios. The LECR for naphthalene was not calculated as there is no cancer slope factor available to quantify the dose.

Based on the EPC for dioxins/furans, the LECR was calculated to be approximately six and two cancer cases per 1,000,000 individuals for past and present and future exposures, respectively. These calculated LECRs are considered a very low increased risk when compared to the background risk for all or specific cancers.

Based on the EPC for arsenic, the LECR was calculated be approximately five and two cancer cases per 1,000,000 individuals for past and present and future exposures, respectively (see Table 7). These are considered a very low increased risk when compared to the background risk for all or specific cancers.

As measures of probability, individual LECRs can be added. Based on EPC of the contaminants of concern, cumulative ingestion exposures indicated a cancer risk of approximately two excess cancer cases per 1,000,000 individuals, representing a very low increased risk when compared to the background risk for all or specific cancers.

Soil in the Quequacommissacong Creek Area

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 8).

Based on the EPC for PAHs detected in soil around residential areas, the risk for individuals in contact with soil was approximately one excess cancer case per 1,000,000 individuals at the maximum soil contaminant levels (see Table 8). This represents a very low increased risk when compared to the background risk for all or specific cancers.

Based on EPC for PCBs in soil, the LECR was calculated to be approximately two excess cancer cases per 10,000 individuals (see Table 8). At the mean contaminant level, this was calculated to be approximately six excess cancer cases per 100,000 individuals, as written in parenthesis in Table 8. Both these scenarios represent a low to very low increase in cancer risk compared to background levels.

Based on the EPC and mean dioxins/furans in soil, the LECR was calculated to be approximately four and one excess cancer cases per 100,000 individuals, respectively (see Table 8). Both these scenarios represent a very low increase in cancer risk compared to background levels.

Based on the EPC for arsenic in soil, the LECR was calculated to be approximately three excess cancer cases per 1,000,000 individuals (see Table 8). At the mean contaminant level, this was calculated to be approximately two excess cancer cases per 1,000,000 individuals. These represent a very low increased risk when compared to the background risk for all or specific cancers.

As measures of probability, individual LECRs can be added. Based on EPC of the contaminants of concern, cumulative ingestion exposures indicated a cancer risk of approximately two excess cancer cases per 10,000 individuals.

Sediment in the Quequacommissacong Creek Area

Based on the EPC and mean PAH in sediment, the risk for individuals in contact with the sediment was calculated to be approximately four and two excess cancer cases per 10,000,000 individuals, respectively (see Table 9). These do not represent an excess cancer risk.

Based on the EPC and mean total PCBs in soil, the LECR was calculated to be approximately three and one excess cancer cases per 1,000,000 individuals, respectively (see Table 9). These represent a very low increased risk when compared to the background risk for all or specific cancers.

Based on the EPC and mean arsenic in sediment, the risk for individuals in contact with the sediment was calculated to be approximately three and two excess cancer cases per 1,000,000 individuals, respectively (see Table 9). These represent a very low increased risk when compared to the background risk for all or specific cancers.

As measures of probability, individual LECRs can be added. Based on EPC of the contaminants of concern, cumulative ingestion exposures indicated a cancer risk of approximately six excess cancer cases per 1,000,000 individuals. This represents a very low increased risk when compared to the background risk for all or specific cancers.

The LECRs presented in this report are based on site-specific assumptions that may not be representative of actual individual exposures.

Health Outcome Data

Based on a review of data available from the USEPA and NJDEP, completed exposure pathways exist for the Curtis Specialty Papers site. These pathways are from incidental ingestion exposures to site-wide soil and soil in the Quequacommissacong Creek area. Identification of an exposed population is difficult as the population accessing these areas may not necessarily reside in the community in close proximity to the site. NJDHSS and ATSDR will not review health outcome data as due to the small number of individuals exposed since an evaluation of available health data is unlikely to produce interpretable results.

Child Health Considerations

The NJDHSS and ATSDR recognize 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 types of exposures to hazardous substances. Their lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of 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 NJDHSS and ATSDR evaluated the potential risk for children residing in the area who were exposed to site contaminants. Although the exposures doses calculated for children based on the EPC of total PCBs detected in the soil near Quequacommissacong Creek exceeded the health guideline CVs, likelihood of adverse non-cancer health effects in children were determined to be low. However, it must be noted that this estimate was based on using the highest concentration of PCB detected out of six samples. It is unlikely that this hot spot is accessed each time contact is made with soil in the Quequacommissacong Creek Area. However, this assessment highlights the need for additional data to better estimate the health impacts.

The potential cancer health effects associated with exposure to site-related contaminants were evaluated. Based on the EPC of total PCBs detected, a "low" increased risk of cancer effects for area residents, including children, was determined.

Public Comment

The public comment period for this public health assessment was from November 22 to December 20, 2010. No comments were received during this period.

Conclusions

Based on observed activity patterns at the site and the results of NJDHSS evaluation of the USEPA sampling results, NJDHSS and ATSDR reached the following conclusions:

NJDHSS and ATSDR conclude that past, present or future exposures to contaminants in surface soil in Site-wide Soil at the Curtis Specialty Papers site are not expected to harm people's (trespassers, recreators) health. It was concluded that exposure to chromium and PAHs in surface soil is unlikely to cause non-cancer adverse health effects. The cancer health effects from ingestion of contaminated soil were determined to represent a very low increase in cancer risk compared to background levels.

NJDHSS and ATSDR cannot conclude if past, present or future exposures to contaminants in surface soil in the Quequacommissacong Creek Area of the Curtis Specialty Papers site may have harmed, or will harm, people's (trespassers, recreators) health. The evaluation in this area is based on six surface soil results. Based on the EPC of dioxins/furans, PAHs, arsenic and manganese in surface soil, chronic exposure doses calculated for children and adults indicate that non-cancer adverse health effects are unlikely. Based on the maximum concentration of total PCBs detected in the soil, adverse health may be more likely for child exposures to PCBs in soil in the Quequacommissacong Creek Area. However, this estimate was based on using the highest concentration of PCBs detected out of six samples. It is unlikely that this hot spot is accessed each time contact is made with soil in the Quequacommissacong Creek Area. Given the uncertainty because of the lack of data, the need for additional sampling is necessary in order to make an assessment of health impacts associated with exposures to soil in this area.

NJDHSS and ATSDR conclude that past, present or future exposures to contaminants in sediment in the Quequacommissacong Creek Area of the Curtis Specialty Papers site are not expected to harm people's (trespassers, recreators) health. Based on maximum concentrations of benzo[a]pyrene, benzo[g,h,i]perylene, phenanthrene, Aroclor-1260 and arsenic detected in sediment, chronic exposure doses calculated for children and adults are unlikely to cause non-cancer adverse health effects. The cancer health effects from ingestion of contaminated sediment were determined to represent no excess cancer risk when compared to background levels.

NJDHSS and ATSDR cannot conclude if past, present or future exposures to surface water or biota in the Quequacommissacong Creek Area of the Curtis Specialty Papers site may have harmed, or will harm, people's (trespassers, recreators) health. Data associated with surface water and biota are not currently available. PCBs have been detected in Quequacommissacong Creek and are known to bioaccumulate in biota. Consumption of contaminated fish can be a significant pathway of exposure for the Curtis Specialty Papers site in the Quequacommissacong Creek Area, due to the possibility of repeated exposures to fish tissue. Discharge pipes at the site lead into the banks of Quequacommissacong Creek, which routinely floods. The Quequacommissacong Creek discharges into the Delaware River and both locations are popular for fishing. The Delaware River is used for seasonal recreational activities such as swimming and boating.

Recommendations

1. It is recommended that the USEPA continue to limit trespassers' access to surface soil at the Curtis Specialty Papers site.

2. It is recommended that the USEPA continue to limit access to the surface soil and sediment in the Quequacommissacong Creek Area of the site. It is also recommended that the USEPA fully characterize the nature and extent of contamination in the Quequacommissacong Creek Area, including collecting soil samples from the 0-3 inch depth interval in areas close to residences or other non-fenced areas.

3. It is recommended that the USEPA continue to limit access to surface water and biota in the Quequacommissacong Creek Area of the site. It also is recommended that the USEPA fully characterize the nature and extent of contamination in surface water, sediment and biota in the Quequacommissacong Creek Area and the Delaware River adjacent to the site.

Public Health Action Plan (PHAP)

The purpose of a PHAP is to ensure that this health assessment not only identifies public health hazards, but also 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 ATSDR and NJDHSS to follow up on this plan to ensure that it is implemented. The public health actions to be implemented by the NJDHSS and the ATSDR are as follows:

Public Health Actions Undertaken

1. The NJDHSS and ATSDR reviewed available environmental data and other relevant information for the Curtis Specialty Papers site to determine human exposure pathways and public health issues.

2. The USEPA, under a Settlement Agreement and Administrative Order on Consent with Georgia-Pacific Consumer Products and International Paper, oversaw the installation of barbed-wire and chain-link security fencing that restricts access to the main mill area and the coatings building. Additional fencing restricts access to the aeration basins. A 24-hour security service maintains a presence on site and conducts routine site inspections. In November and December 2009, additional site maintenance activities were implemented, including: repairing the fence damaged by trespassers, replacing the fence and installation of new fence, placing barricades to restrict access along the trail in the wastewater treatment plant area, installing signage (e.g., No Trespassing, Hazardous Materials).

Public Health Actions Planned

1. The NJDHSS and ATSDR will identify organizations, groups and businesses that may plan activities on or near the site for recreational, environmental or conservation activities. These organizations, including fishermen, will be contacted to schedule educational outreach in order to inform them of the potential health risks associated with the site.

2. Copies of this public health assessment will be provided to local health and public officials, as well as other interested parties in the vicinity of the site. Copies will also be available at the township library and/or the Internet.

3. The ATSDR and the NJDHSS will review and evaluate any community health concerns that may arise with the commencement of site remediation. A public availability session to gather community concerns and comments will be held in the future during the public comment period.

4. New environmental, toxicological, or health outcome data, or the results of implementing the recommendations and proposed actions, may determine the need for additional actions at this site. The ATSDR and the NJDHSS will re-evaluate and expand the PHAP as warranted.

5. As site conditions change, public health implications and the potential for completed human exposure pathways will be reevaluated and the current designated hazard category will be reconsidered.

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Certification

This public health assessment 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. This public health assessment is in accordance with approved methodology and procedures existing at the time it was initiated.

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

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Table 1: Environmental Guideline Screening of Contaminants detected in Surface Soil (0 – 1 feet depth) at the Curtis Specialty Papers Site (sampling dates: August 2007 and June 2008))

Contaminants	No. of Samples Detected	Detection Range (mg/kg)	Mean (mg/kg)	Environmental Guideline CV[a] (mg/kg)	COPC[b]
Volatile Organic Compounds					
Methylene Chloride	26	ND[c] - 0.462	0.99	90 (CREG[d])	No
Tetrachloroethene	5	ND - 0.311	0.122	500 (RMEG[e])	No
Toluene	11	ND - 7.91	1.87	1,000 (EMEG[f])	No
Semi Volatile Organic Compounds					
Bis(2-ethylhexyl)phthalate	12	ND - 3.5	0.797	50 (CREG)	No
Acenaphthalene	5	ND - 0.14	0.082	NA[g]	**Yes**
Acenaphthene	7	ND - 12.6	2.185	3,000 (RMEG)	No
Anthracene	25	ND - 16.8	0.977	17,000 (EPA SL[h])	No
Benzo[a]anthracene	41	ND - 41.8	1.52	0.15 (EPA SL)	**Yes**
Benzo[a]pyrene	42	ND - 39.5	1.58	0.1 (CREG)	**Yes**
Benzo[b]fluroanthene	45	ND - 48.7	1.73	0.15 (EPA SL)	**Yes**
Benzo[g,h,i]perylene	38	ND - 23.4	1.20	NA	**Yes**
Benzo[k]fluroanthene	44	ND - 19	0.908	1.5 (EPA SL)	**Yes**
Chrysene	42	ND - 43.6	1.77	15 (EPA SL)	**Yes**
Dibenzo[a,h]anthracene	25	ND - 10.7	0.718	0.015 (EPA SL)	**Yes**

Table 1: (Cont'd.) Environmental Guideline Screening of Contaminants detected in Surface Soil (0 – 1 feet depth) at the Curtis Specialty Paper Site (sampling dates: August 2007 and June 2008)

Contaminants	No. of Samples Detected	Detection Range (mg/kg)	Mean (mg/kg)	Environmental Guideline CV[a] (mg/kg)	COPC[b]
Semi Volatile Organic Compounds -con't-					
Dibenzofuran	5	ND - 4.98	1.10	78 (EPA SL)	No
Di-n-butylphthalate	8	ND - 2.4	0.445	5,000 (RMEG)	No
Fluoranthene	49	ND - 101	3.28	2,300 (EPA SL)	No
Fluorene	8	ND - 8.4	1.35	2,300 (EPA SL)	No
Indeno(cd)pyrene	37	ND - 22.6	1.08	0.15 (EPA SL)	**Yes**
Naphthalene	7	ND - 4.85	0.793	3.9 (EPA SL)	**Yes**
Phenanthrene	40	ND - 72.3	2.62	NA	**Yes**
Pyrene	49	ND - 71	2.41	1,700 (EPA SL)	No
Aroclor-1260 and Aroclor-1254	50	ND - 220	8.03	0.4 (CREG)	**Yes**
4-4'-DDT	30	ND - 79	2.66	1.7 (EPA SL)	**Yes**
4-4'-DDD	9	ND - 0.54	0.077	2 (EPA SL)	No
4-4'-DDE	25	ND - 0.74	0.046	1.4 (EPA SL)	No
Endrin	4	ND - 0.48	0.125	20 (EMEG)	No
gamma chlordane	4	ND - 0.0038	0.002	2 (CREG)	No
Dioxins/Furans (ng/g)	18	ND – 0.0617	0.0104	0.0045 (EPA SL)	**Yes**

Table 1: (Cont'd.) Environmental Guideline Screening of Contaminants detected in Surface Soil (0 – 1 feet depth) at the Curtis Specialty Paper Site (sampling dates: August 2007 and June 2008)

Contaminants	No. of Samples Detected	Detection Range (mg/kg)	Mean (mg/kg)	Environmental Guideline CV[a] (mg/kg)	COPC[b]
Metals					
Aluminum	51	808 – 15,700	8,544	50,000 (EMEG)	No
Arsenic	36	1.4 - 79	9.88	0.5 (CREG)	**Yes**
Barium	48	24.7 - 307	96	10,000 (EMEG)	No
Beryllium	32	0.33 - 2.6	0.79	100 (EMEG)	No
Cadmium	33	0.09 – 5.1	1.28	10 (EMEG)	No
Chromium	56	1.9 – 28,900	549	280 (EPA SL)	**Yes**
Cobalt	50	0.47 – 13.2	7.64	500 (EMEG)	No
Copper	57	4.9 – 24,400	570	500 (EMEG)	**Yes**
Lead	57	6.5 - 397	72	400 (EPA)	No
Manganese	11	314 – 6,740	1,179	3,000 (EMEG)	**Yes**
Mercury	26	0.057 - 1.9	0.31	23 (EPA SL)	No
Nickel	57	8.1 - 18,000	350	1,000 (RMEG)	**Yes**
Thallium	4	1.6 - 18	6	6.3 (EPA SL)	**Yes**
Vanadium	51	7.7 – 717	89	200 (EMEG)	**Yes**
Zinc	57	7.9 – 5,970	466	20,000 (EMEG)	No

[a]Comparison Value; [b]Contaminant of Potential Concern; [c]Non Detect; [d]Cancer Risk Evaluation Guide; [e]Reference Dose Media Evaluation Guide; [f]Environmental Media Evaluation Guide; [g]Not Available; [h]USEPA Screening Level

Table 2: Environmental Guideline Screening of Contaminants detected in Sediment at the Curtis Specialty Paper Site (sampling dates: August 2007, April 2008 and June 2008)

Contaminants	No. of Samples Detected	Detection Range (mg/kg)	Mean (mg/kg)	Environmental Guideline CV[a] (mg/kg)	COPC[b]
Volatile Organic Compounds					
Acetone	1	ND - 0.0079	0.0079	50,000 (RMEG[c])	No
Semi Volatile Organic Compounds					
Bis(2-ethylhexyl)phthalate	1	ND - 0.3	0.3	50 (CREG[d])	No
Benzo[a]anthracene	15	ND[e] - 0.13	0.082	0.15 (EPA SL[f])	No
Benzo[b]fluroanthene	13	ND - 0.11	0.082	0.15 (EPA SL)	No
Benzo[k]fluroanthene	13	ND - 0.11	0.078	1.5 (EPA SL)	No
Benzo[a]pyrene	15	ND - 0.13	0.089	0.1 (CREG)	**Yes**
Chrysene	15	ND - 0.13	0.087	15 (EPA SL)	No
Indeno[c,d]pyrene	9	ND - 0.093	0.064	0.15 (EPA SL)	No
Benzo[g,h,i]perylene	11	ND - 0.089	0.067	NA[g]	**Yes**
Fluroanthene	15	ND - 0.28	0.17	2,300 (EPA SL)	No
Phenanthrene	14	ND - 0.21	0.087	NA	**Yes**
Pyrene	15	ND - 0.19	0.126	1,700 (EPA SL)	No
Aroclor-1248	1	ND - 0.14	0.14	0.4 (CREG)	No
Aroclor-1260	10	ND – 3.3	0.35	0.4 (CREG)	**Yes**

Table 2: (Cont'd.) Environmental Guideline Screening of Contaminants detected in the Sediment at the Curtis Specialty Paper Site

Contaminants	No. of Samples Detected	Detection Range (mg/kg)	Mean (mg/kg)	Environmental Guideline CV (mg/kg)	COPC
Semi Volatile Organic Compounds – con't-					
Aroclor-1254	1	ND - 0.13	0.13	0.4 (CREG)	No
4,4'-DDT	1	ND - 0.72	0.72	1.7 (EPA SL)	No
Dioxins/Furans (ng/g)	20	ND – 0.0036	0.00076	0.0045 (EPA SL)	No
Metals (mg/kg)					
Aluminum	20	ND – 13,800	6,030	50,000 (EMEG)	No
Arsenic	20	ND – 4.4	2.61	0.5 (CREG)	**Yes**
Barium	20	ND - 130	57.7	10,000 (EMEG)	No
Beryllium	11	ND – 1.3	0.76	100 (EMEG)	No
Cadmium	14	ND – 2.3	0.58	10 (EMEG)	No
Chromium	20	ND – 26.1	13.0	280 (EPA SL)	No
Cobalt	20	ND – 15.9	7.91	500 (EMEG)	No
Copper	20	ND - 36	15.6	500 (EMEG)	No
Lead	20	ND – 46.8	22.2	400 (EPA)	No
Manganese	20	ND – 1,300	412	3,000 (EMEG)	No
Mercury	4	ND – 0.18	0.102	23 (EPA SL)	No
Nickel	20	ND – 34.2	17.4	1,000 (RMEG)	No

Table 2: (Cont'd.)Environmental Guideline Screening of Contaminants detected in Sediment at the Curtis Specialty Paper Site (sampling dates: August 2007, April 2008 and June 2008)

Contaminants	No. of Samples Detected	Detection Range (mg/kg)	Mean (mg/kg)	Environmental Guideline CV (mg/kg)	COPC
Metals – con't-					
Silver	12	ND – 3.7	2.31	390 (EPA SL)	No
Vanadium	20	ND – 22.3	13.1	200 (EMEG)	No
Zinc	20	ND - 419	145	20,000 (EMEG)	No

[a]Comparison Value; [b]Contaminant of Potential Concern; [c]Reference Dose Media Evaluation Guide; [d]Cancer Risk Evaluation Guide; [e]Non Detect; [f]USEPA Screening Level; [g]Not Available

Table 3: Selection of the Contaminants of Concern at the Curtis Specialty Paper Site

Contaminants	Exposure Point Concentration (mg/kg)	Method of Calculation	Environmental Guideline CV (mg/kg)	COC[a]
Site-wide Surface Soil				
Acenaphthalene	0.14	Maximum[b]	NA[c]	**Yes**
Benzo[a]anthracene	0.00587	UCL[d]	0.15 (EPA SL[e])	No
Benzo[a]pyrene	0.00586	UCL	0.1 (CREG[f])	No
Benzo[b]fluroanthene	0.00678	UCL	0.15 (EPA SL)	No
Benzo[g,h,i]perylene	0.00401	UCL	NA	**Yes**
Benzo[k]fluroanthene	0.00297	UCL	1.5 (EPA SL)	No
Chrysene	0.00655	UCL	15 (EPA SL)	No
Dibenzo[a,h]anthracene	0.00213	UCL	0.015 (EPA SL)	No
Indeno[c,d]pyrene	0.00363	UCL	0.15 (EPA SL)	No
Naphthalene	4.85	Maximum	3.9 (EPA SL)	**Yes**
Phenanthrene	0.011	UCL	NA	**Yes**
Aroclor-1260 and Aroclor-1254	0.0356	UCL	0.4 (CREG)	No
4-4'-DDT	0.0147	UCL	1.7 (EPA SL)	No
Dioxins/Furans	0.0000204	UCL	0.0000045 (EPA SL)	**Yes**
Arsenic	14.1	UCL	0.5 (CREG)	**Yes**
Chromium	3,005	UCL	280 (EPA SL)	**Yes**
Copper	2,715	UCL	500 (EMEG)	**Yes**
Manganese	1,179	Mean	3,000 (RMEG)	No
Nickel	1,862	UCL	1,000 (RMEG)	**Yes**
Thallium	18	Maximum	6.3 (EPA SL)	**Yes**
Vanadium	121	UCL	200 (EMEG)	No
Soil near Quequacommissacong Creek (6 samples)				
Benzo[a]anthracene	0.20	Maximum	0.15 (EPA SL)	**Yes**
Benzo[a]pyrene	0.31	Maximum	0.1 (CREG)	**Yes**

Table 3: (Cont'd.) Selection of the Contaminants of Concern at the Curtis Specialty Paper Site

Contaminants	Exposure Point Concentration (mg/kg)	Method of Calculation	Environmental Guideline CV (mg/kg)	COC[a]
Soil near Quequacommissacong Creek – con't-				
Benzo[b]fluroanthene	0.33	Maximum	0.15 (EPA SL)	**Yes**
Benzo[g,h,i]perylene	0.26	Maximum	NA	**Yes**
Indeno[c,d]pyrene	0.28	Maximum	0.15 (EPA SL)	**Yes**
Phenanthrene	0.23	Maximum	NA	**Yes**
Aroclor-1260 and Aroclor-1254	220	Maximum	0.4 (CREG)	**Yes**
Dioxins/Furans	0.0000617	Maximum	0.0000045 (EPA SL)	**Yes**
Arsenic	3.9	Maximum	0.5 (CREG)	**Yes**
Manganese	6,740	Maximum	3,000 (RMEG)	**Yes**
Sediment near Quequacommissacong Creek (8 samples)				
Benzo[a]pyrene	0.120	Maximum	0.1 (CREG)	**Yes**
Benzo[g,h,i]perylene	0.085	Maximum	NA	**Yes**
Phenanthrene	0.110	Maximum	NA	**Yes**
Aroclor-1260	3.30	Maximum	0.4 (CREG)	**Yes**
Arsenic	4.3	Maximum	0.5 (CREG)	**Yes**

[a]Contaminant of Concern; [b]Maximum was used due to low no. of detected samples; [c]Not Available; [d]95% Upper Confidence Limit; [e]USEPA Screening Levels; [f]Cancer Risk Evaluation Guide

Table 4: Comparison of Calculated Exposure Doses with Non-Cancer Health Guideline CV based on Exposure Point Concentrations in Site-wide Surface Soil at the Curtis Specialty Paper Site - cont-

Contaminants of Concern	Exposure Point Concentration (mg/kg)	Exposure Dose (mg/kg-day)			Health Guideline CV (mg/kg-day)	Potential for Non-cancer Effects
		Time Period	Child[a]	Adult[b]		
Acenaphthalene	0.14	Pres/Future[c]	1.2×10^{-7}	1.4×10^{-8}	NA[e]	No
		Past[d]	2.9×10^{-7}	3.6×10^{-8}		
Benzo[g,h,i]perylene	4.01×10^{-3}	Pres/Future	3.4×10^{-9}	4.1×10^{-10}	NA	No
		Past	8.4×10^{-9}	1.0×10^{-9}		
Naphthalene	4.85	Pres/Future	4.1×10^{-6}	4.9×10^{-7}	2×10^{-2} (MRL[f])	No
		Past	1.0×10^{-5}	1.2×10^{-6}		
Phenanthrene	0.011	Pres/Future	9.2×10^{-9}	1.1×10^{-9}	NA	No
		Past	2.3×10^{-8}	2.8×10^{-9}		
Dioxins/Furans	2.04×10^{-5}	Pres/Future	1.7×10^{-11}	2.8×10^{-12}	1×10^{-9} (MRL)	No
		Past	4.3×10^{-11}	5.2×10^{-12}		
Arsenic	14.1	Pres/Future	1.2×10^{-5}	1.4×10^{-6}	3×10^{-4} (MRL)	No
		Past	3.0×10^{-5}	3.6×10^{-6}		

[a]Child exposure scenario: 200 mg/day ingestion rate and 21 kg body weight; [b]Adult exposure scenario: 100 mg/day ingestion rate and 70 kg body weight; [c]Pres/Future exposure duration assumption: 2 days/week, 6 months/year; [d]Past exposure duration assumption: 5 days/week, 6 months/year; [e]Not Available; [f]Minimal Risk Level

Table 4: - Cont - Comparison of Calculated Exposure Doses with Non-Cancer Health Guideline CV based on Exposure Point Concentrations in Site-wide Surface Soil at the Curtis Specialty Paper Site

Contaminants of Concern	Exposure Point Concentration (mg/kg)	Exposure Dose (mg/kg-day)			Health Guideline CV (mg/kg-day)	Potential for Non-cancer Effects
		Time Period	Child[a]	Adult[b]		
Chromium	3,005	Pres/Future[c]	2.5×10^{-3}	3.1×10^{-4}	1×10^{-3} (MRL[g])	No
		Past[d]	6.3×10^{-3}	7.7×10^{-4}		
Copper	2,715	Pres/Future	2.3×10^{-3}	2.8×10^{-4}	4×10^{-2} (EPA RfD[h])	No
		Past	5.7×10^{-3}	6.9×10^{-4}		
Nickel	1,862	Pres/Future	1.6×10^{-3}	1.9×10^{-4}	2×10^{-2} (EPA RfD)	No
		Past	3.9×10^{-3}	4.8×10^{-4}		
Thallium	18	Pres/Future	1.5×10^{-5}	1.8×10^{-6}	NA	NA
		Past	3.8×10^{-5}	4.6×10^{-6}		

[a]Child exposure scenario: 200 mg/day ingestion rate and 21 kg body weight; [b]Adult exposure scenario: 100 mg/day ingestion rate and 70 kg body weight; [c]Pres/Future exposure duration assumption: 2 days/week, 6 months/year; [d]Past exposure duration assumption: 5 days/week, 6 months/year; [f]Minimal Risk Level; [g]MRL is based on Hexavalent Chromium; [h]Reference Dose

Table 5: Comparison of Calculated Exposure Doses with Non-Cancer Health Guideline CV based on contaminant concentrations in Surface Soil Samples near Quequacommissacong Creek at the Curtis Specialty Paper Site

Contaminants of Concern	Exposure Point Concentration (mg/kg)	Exposure Dose (mg/kg-day)		Health Guideline CV (mg/kg-day)	Potential for Non-cancer Effects
		Child[a]	Adult[b]		
Benzo[a]anthracene	0.20	8.8×10^{-7}	1.1×10^{-7}	NA[c]	No
Benzo[a]pyrene	0.31	1.4×10^{-6}	1.7×10^{-7}	NA	No
Benzo[b]fluroanthene	0.33	1.5×10^{-6}	1.8×10^{-7}	NA	No
Benzo[g,h,i]perylene	0.26	1.1×10^{-6}	1.4×10^{-7}	NA	No
Indeno[c,d]pyrene	0.28	1.2×10^{-6}	1.5×10^{-7}	NA	No
Phenanthrene	0.23	1.0×10^{-6}	1.2×10^{-7}	NA	No
Aroclor-1260 and Aroclor-1254	220	9.7×10^{-4}	1.2×10^{-4}	2×10^{-5} (MRL[d])	**Yes**
Dioxins/Furans	0.0000617	2.7×10^{-10}	3.3×10^{-11}	1×10^{-9} (MRL)	No
Arsenic	3.9	1.7×10^{-5}	2.1×10^{-6}	3×10^{-4} (MRL)	No
Manganese	6,740	3.0×10^{-2}	3.6×10^{-3}	5×10^{-2} (RfD[e])	No

[a]Child exposure scenario: 7 days/week, 9 months/year, 200 mg/day ingestion rate and 21 kg body weight; [b]Adult exposure scenario: 7 days/week, 9 months/year, 100 mg/day ingestion rate and 70 kg body weight; [c]Not Available; [d]Minimal Risk Level; [e]Reference Dose

Table 6: Comparison of Calculated Exposure Doses with Non-Cancer Health Guideline CV based on contaminant concentrations in Sediment near Quequacommissacong Creek at the Curtis Specialty Paper Site

Contaminants of Concern	Exposure Point Concentration (mg/kg)	Exposure Dose (mg/kg-day)		Health Guideline CV (mg/kg-day)	Potential for Non-cancer Effects
		Child[a]	Adult[b]		
Benzo[a]pyrene	0.120	$3.0\ 10^{-7}$	3.6×10^{-8}	NA[c]	No
Benzo[g,h,i]perylene	0.085	2.5×10^{-7}	3.1×10^{-8}	NA	No
Phenanthrene	0.11	3.5×10^{-7}	4.2×10^{-8}	NA	No
Aroclor-1260	3.3	1.5×10^{-5}	1.8×10^{-6}	2×10^{-5} (MRL[d])	No
Arsenic	4.3	1.9×10^{-5}	2.3×10^{-6}	3×10^{-4} (MRL)	No

[a]Child exposure scenario: 7 days/week, 9 months/year, 200 mg/day ingestion rate and 21 kg body weight; [b]Adult exposure scenario: 7 days/week, 9months/year, 100 mg/day ingestion rate and 70 kg body weight; [c]Not Available; [d]Minimal Risk Level

Table 7: Calculated LECR associated with contaminants detected in Site-wide Surface Soil at the Curtis Specialty Paper Site

Contaminants of Concern	Exposure Point Concentration (mg/kg)	DHSS Cancer Class[a]	Exposure Dose (mg/kg-day)		CSF[d] (mg/kg-day)$^{-1}$	LECR[e]	
			Past[b]	Present and Future[c]		Past	Present and Future
Acenaphthalene	0.14	3[f]	NA[g]	NA	NA	-	-
Benzo[g,h,i]perylene	0.00401	3	NA	NA	NA	-	-
Naphthalene	4.85	2[h]	NA	NA	NA	-	-
Phenanthrene	0.011	3	NA	NA	NA	-	-
Dioxins/Furans	0.0000204	1	4.5×10^{-12}	1.8×10^{-12}	1.3×10^{5}	5.8×10^{-7}	2.3×10^{-7}
Arsenic	14.1	1	3.1×10^{-6}	1.2×10^{-6}	1.5	4.6×10^{-6}	1.9×10^{-6}
Chromium	3,005	3	NA	NA	NA	-	-
Copper	2,715	3	NA	NA	NA	-	-
Nickel	1,862	2[h]	NA	NA	NA	-	-
Thallium	18	3	NA	NA	NA	-	-

[a]Department of Health and Human Services Cancer Class: 1 = known human carcinogen; 2 = reasonably anticipated to be a carcinogen; 3 = not classified; [b]Exposure scenario: 5 days/week, 6 months/year, 100 mg/day ingestion rate, 70 kg body weight and 30 year exposure duration; [c]Exposure scenario: 2 days/week, 6 months/year, 100 mg/day ingestion rate, 70 kg body weight and 30 year exposure duration; [d]Cancer Slope Factor; [e]Lifetime Excess Cancer Risk; [f]not carcinogenic therefore no cancer risk calculation was derived; [g]Not Applicable; [h]CSF not available

Table 8: Calculated LECR associated with the contaminants detected in Soil near Quequacommissacong Creek at the Curtis Specialty Paper Site

Contaminants of Concern	Exposure Point Concentration (mg/kg)		DHSS Cancer Class[a]	Potency Factor[b]	BaP Equiv.	Total BaP Equiv.	Maximum Exposure Dose[c] (mg/kg-day)	CSF[d] $(mg/kg\text{-}day)^{-1}$	LECR[e]
	Max.	Mean							
Benzo[a]anthracene	0.20	0.14	2	0.1	0.02				
Benzo[a]pyrene	0.31	0.183	2	1	0.31				
Benzo[b]fluroanthene	0.33	0.155	2	0.1	0.033				
Benzo[g,h,i]perylene	0.26	0.195	3[f]	NA[g]	NA	0.371	1.7×10^{-7}	7.3	1.2×10^{-6}
Indeno[c,d]pyrene	0.28	0.205	2	0.1	0.028				
Phenanthrene	0.23	0.126	3	NA	NA				
Aroclor-1260 and Aroclor-1254	220	63.02	2	NA	NA	NA	1.0×10^{-4} (2.9×10^{-5})	2	2.0×10^{-4} (5.8×10^{-5})[h]
Dioxins/Furans	0.0000617	0.0000199	1	NA	NA	NA	2.8×10^{-11} (9.1×10^{-12})	1.4×10^{6}	4.0×10^{-5} (1.3×10^{-5})
Arsenic	3.9	2.28	1	NA	NA	NA	1.8×10^{-6} (1.1×10^{-6})	1.5	2.7×10^{-6} (1.6×10^{-6})
Manganese	6,740	1,625	3	NA	NA	NA	-	-	-

[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]Exposure scenario: 7 days/week, 9 months/year, 100 mg/day ingestion rate, 70 kg body weight; [d]Cancer Slope Factor; [e]Lifetime Excess Cancer Risk; [f]not carcinogenic therefore no cancer risk calculation was derived; [g]Not Available; [h]cancer estimate based on mean contaminant concentration

Table 9: Calculated LECR associated with the contaminants detected in Sediment near Quequacommissacong Creek at the Curtis Specialty Paper Site

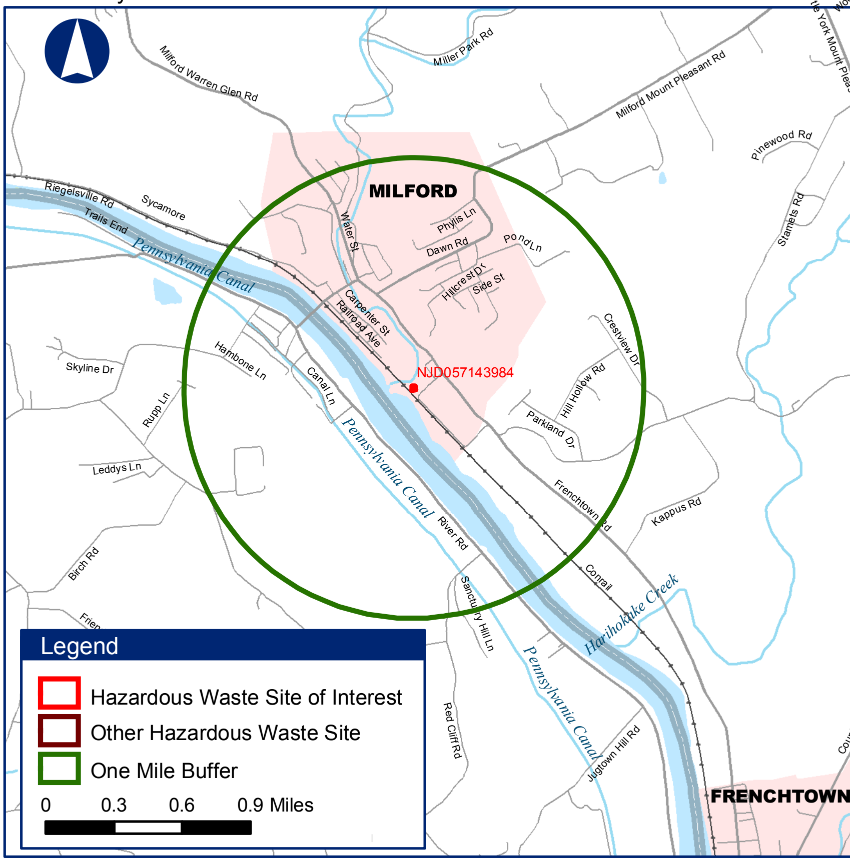
Contaminants of Concern	Exposure Point Concentration (mg/kg)		DHSS Cancer Class[a]	Potency Factor[b]	BaP Equiv.	Total BaP Equiv.	Maximum Exposure Dose[c] (mg/kg-day)	CSF[d] $(mg/kg\text{-}day)^{-1}$	LECR[e]
	Max.	Mean							
Benzo[a]pyrene	0.12	0.0678	1	1	0.12				
Benzo[g,h,i]perylene	0.085	0.0577	3[f]			0.12	5.5×10^{-8} (3.1×10^{-8})	7.3	4×10^{-7} (2.3×10^{-7})[g]
Phenanthrene	0.11	0.0788	3						
Aroclor-1260	3.3	1.12	2	NA	NA	NA	1.52×10^{-6} (5.14×10^{-7})	2	3.0×10^{-6} (1.0×10^{-6})
Arsenic	4.3	2.58	1	NA	NA	NA	1.97×10^{-6} (1.18×10^{-6})	1.5	3.0×10^{-6} (1.8×10^{-6})

[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]Exposure scenario: 7 days/week, 9 months/year, 100 mg/day ingestion rate, 70 kg body weight; [d]Cancer Slope Factor; [e]Lifetime Excess Cancer Risk; [f]not carcinogenic therefore no cancer risk calculation was derived; [g]cancer estimate based on mean contaminant concentration

Curtis Paper Inc.

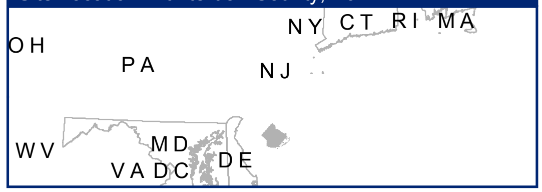
Milford, NJ

EPA Facility ID: NJD057143984



Base Map Source: Geographic Data Technology, May 2005.
Site Boundary Data Source: ATSDR Geospatial Research, Analysis, and Services Program, Current as of Generate Date (bottom left-hand corner).
Coordinate System (All Panels): NAD 1983 StatePlane New Jersey FIPS 2900 Feet

Site Location: Hunterdon County, NJ



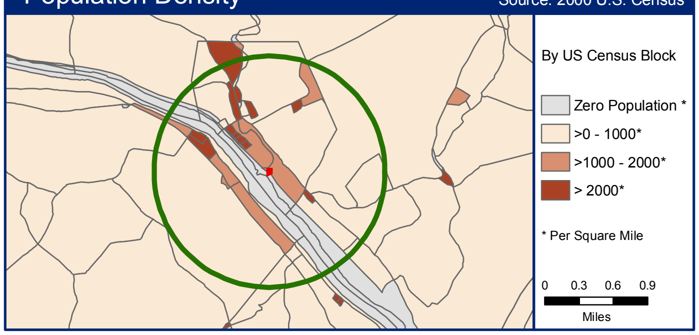
Demographic Statistics
Within One Mile of Site*

Total Population	1,779
White Alone	1,738
Black Alone	8
Am. Indian & Alaska Native Alone	3
Asian Alone	8
Native Hawaiian & Other Pacific Islander Alone	4
Some Other Race Alone	1
Two or More Races	18
Hispanic or Latino**	33
Children Aged 6 and Younger	148
Adults Aged 65 and Older	233
Females Aged 15 to 44	336
Total Housing Units	709

Demographics Statistics Source: 2000 U.S. Census
* Calculated using an area-proportion spatial analysis technique
** People who identify their origin as Hispanic or Latino may be of any race.

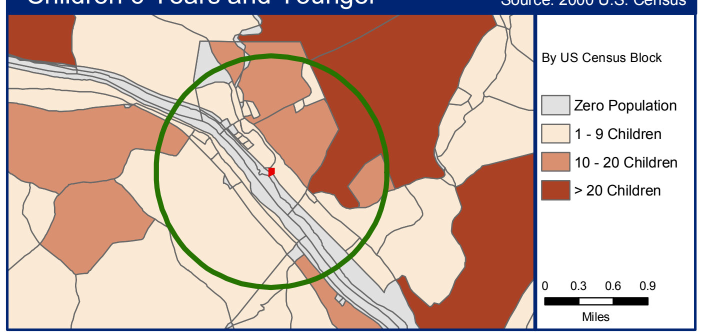
Population Density

Source: 2000 U.S. Census



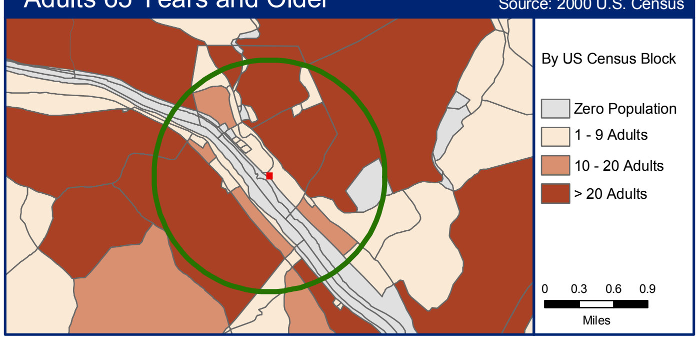
Children 6 Years and Younger

Source: 2000 U.S. Census



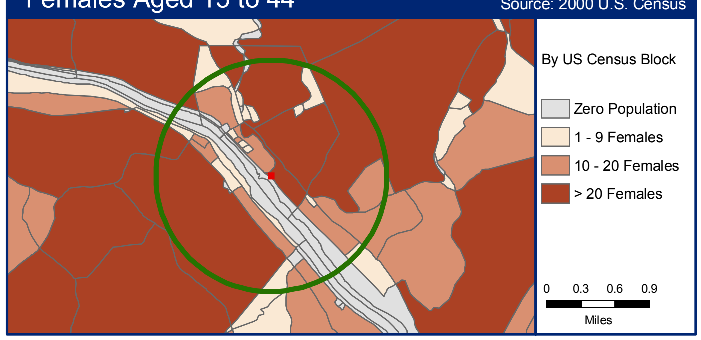
Adults 65 Years and Older

Source: 2000 U.S. Census



Females Aged 15 to 44

Source: 2000 U.S. Census



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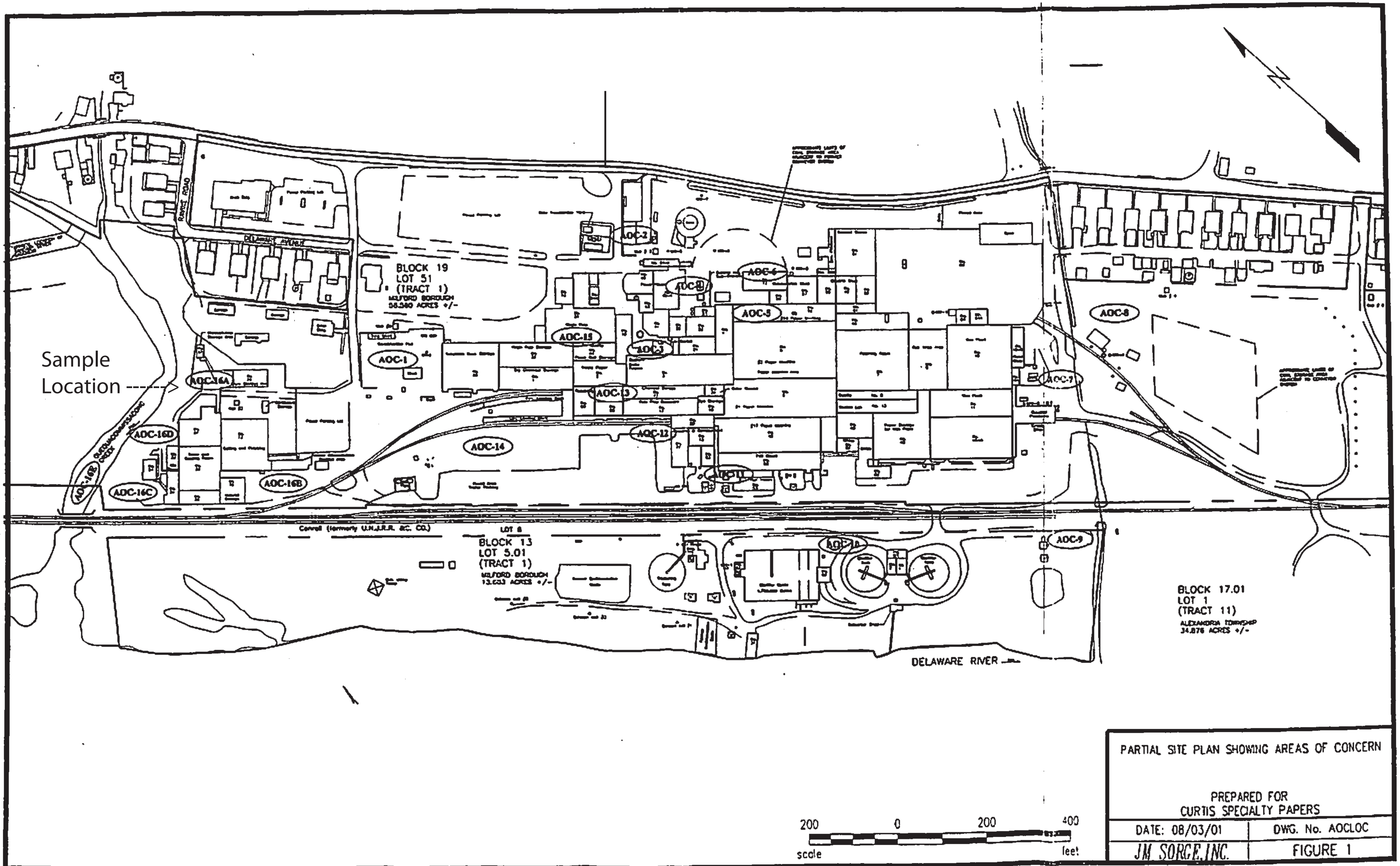

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Figure 3: Surface Soil Sampling Location close to Residences at the Curtis Paper Site

Appendix A

Photographs from Site Visit

Curtis Specialty Papers site as viewed from Frenchtown Road

Fencing around the Curtis Specialty Papers site

Former Coatings Building

View of the Delaware River as observed from the walking trail

Fencing around the Main Mill area

Quequacommissacong Creek near the Coatings Building at a 10-foot drop

Confluence of Quequacommissacong Creek and Delaware River as viewed from the walking trail

Examples of vandalism of the fence

Appendix B

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.

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 DHHS, and the EPA have determined that inorganic arsenic is a human carcinogen

Chromium Chromium is a naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases. Chromium is present in the environment in several different forms: chromium (0), chromium (III), and chromium (VI). No taste or odor is associated with chromium compounds. The metal chromium, which is the chromium (0) form, is used for making steel. Chromium (VI) and chromium (III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

Chromium enters the air, water, and soil mostly in the chromium (III) and chromium (VI) forms. In air, chromium compounds are present mostly as fine dust particles which eventually settle over land and water. Chromium can strongly attach to soil and only a small amount can dissolve in water and move deeper in the soil to underground water. Fish do not accumulate much chromium from water.

Breathing high levels of chromium (VI) can cause nasal irritation, such as runny nose, nosebleeds, and ulcers and holes in the nasal septum. Ingesting large amounts of chromium (VI) can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death. Skin contact with certain chromium (VI) compounds can cause skin ulcers. Allergic reactions consisting of severe redness and swelling of the skin have been noted.

Several studies have shown that chromium (VI) compounds can increase the risk of lung cancer. Animal studies have also shown an increased risk of cancer. The WHO has determined that chromium (VI) is a human carcinogen. The DHHS has determined that certain chromium (VI) compounds are known to cause cancer in humans. The EPA has determined that chromium (VI) in air is a human carcinogen.

It is unknown whether exposure to chromium will result in birth defects or other developmental effects in people. Birth defects have been observed in animals exposed to chromium(VI). It is likely that health effects seen in children exposed to high amounts of chromium will be similar to the effects seen in adults.

Copper. High levels of copper can be harmful. Breathing high levels of copper can cause irritation of nose and throat. Ingesting high levels of copper can cause nausea, vomiting, and diarrhea. Very-high doses of copper can cause damage to liver and kidneys, and can even cause death.

Exposure to high levels of copper will result in the same type of effects in children and adults. We do not know if these effects would occur at the same dose level in children and adults. Studies in animals suggest that the young children may have more severe effects than adults, but we don't know if this would also be true in humans. There are a very small percentage of infants and children who are unusually sensitive to copper.

Birth defects or other developmental effects of copper in humans are unknown. Animal studies suggest that high levels of copper may cause a decrease in fetal growth.

The most likely human exposure pathway is through drinking water, especially if the water is corrosive and copper pipes are used for plumbing. One of the most effective ways to reduce copper exposure is to let the water run for at least 15 seconds first thing in the morning before drinking or using it. This reduces the levels of copper in tap water dramatically.

Copper is found throughout the body; in hair, nails, blood, urine, and other tissues. High levels of copper in these samples can show copper exposures. However, these tests can not predict occurrence of harmful effects. Tests to measure copper levels in the body require special equipment.

Human carcinogenicity of copper is unknown. The EPA has determined that copper is not classifiable as to human carcinogenicity.

Manganese Manganese is a naturally occurring metal that is found in many types of rocks. Pure manganese is silver-colored, but does not occur naturally. It combines with other substances such as oxygen, sulfur, or chlorine. Manganese occurs naturally in most foods and may be added to some foods.

Manganese is used principally in steel production to improve hardness, stiffness, and strength. It may also be used as an additive in gasoline to improve the octane rating of the gas. Manganese can be released to the air, soil, and water from the manufacture, use, and disposal of manganese-based products. Manganese cannot break down in the environment. It can only change its form or become attached to or separated from particles. The chemical state of manganese and the type of soil determine how fast it moves through the soil and how much is retained in the soil. The manganese-containing gasoline additive may degrade in the environment quickly when exposed to sunlight, releasing manganese.

The most common health problems in workers exposed to high levels of manganese involve the nervous system. These health effects include behavioral changes and other nervous system effects, which include movements that may become slow and clumsy. This combination of symptoms when sufficiently severe is referred to as "manganism". Other less severe nervous system effects such as slowed hand movements have been observed in some workers exposed to lower concentrations in the work place. Nervous system and reproductive effects have been observed in animals after high oral doses of manganese. The USEPA concluded that existing scientific information cannot determine whether or not excess manganese can cause cancer.

Studies in children have suggested that extremely high levels of manganese exposure may produce undesirable effects on brain development, including changes in behavior and decreases in the ability to learn and remember. We do not know for certain that these changes were caused by manganese alone. We do not know if these changes are temporary or permanent. We do not know whether children are more sensitive than adults to the effects of manganese, but there is some indication from experiments in laboratory animals that they may be.

Studies of manganese workers have not found increases in birth defects or low birth weight in their offspring. No birth defects were observed in animals exposed to manganese.

Nickel. Nickel is a very abundant natural element. Pure nickel is a hard, silvery-white metal and can be combined with other metals, such as iron, copper, chromium, and zinc, to form alloys. These alloys are used to make coins, jewelry, and items such as valves and heat exchangers. Most nickel is used to make stainless steel. Nickel can combine with other elements such as chlorine, sulfur, and oxygen to form nickel compounds. Many nickel compounds dissolve fairly easy in water and have a green color. Nickel compounds are used for nickel plating, to color ceramics, to make some batteries, and as substances known as catalysts that increase the rate of chemical reactions.

The most common harmful health effect of nickel in humans is an allergic reaction. Approximately 10-20% of the population is sensitive to nickel. People can become sensitive to nickel through contact with the skin for a long time. Once sensitized to nickel, further contact may produce skin. Less frequently, sensitive individuals may have asthma attacks following exposure to nickel. Some sensitized people react when they consume food or water containing nickel or breathe dust containing it. Long term occupational inhalation exposures have resulted in chronic bronchitis and reduced lung function. Ingestion of water containing high amounts of nickel caused stomach ache and adverse effects on blood and kidneys. Damage to the lung and nasal cavity has been observed in rats and mice breathing nickel compounds. Eating or drinking large amounts of nickel has caused lung disease in dogs and rats and has affected the stomach, blood, liver, kidneys, and immune system in rats and mice, as well as their reproduction and development.

Cancers of the lung and nasal sinus have resulted from occupational exposures to dust containing high levels of nickel. The DHHS has determined that nickel metal may reasonably be anticipated to be a carcinogen and that nickel compounds are known human carcinogens. The IARC has determined that some nickel compounds are carcinogenic to humans and that metallic nickel may possibly be carcinogenic to humans. The EPA has determined that nickel refinery dust and nickel subsulfide is human carcinogens.

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 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).

Polychlorinated biphenyls (PCBs) PCBs are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known anthropogenic sources of PCBs. PCBs can exist as oily liquids, solids or vapor in air. Many commercial PCB mixtures are known by the trade name Aroclor. The majority of PCBs were used in dielectric fluids for use in transformers, capacitors, and other electrical equipment. Since PCBs build up in the environment and can cause harmful health effects, PCB production was stopped in the U.S. in 1977.

PCBs enter the environment during their manufacture, use, and disposal. PCBs can accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water. The most commonly observed health effects associated with exposures to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals administered with large PCB dose for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The DHHS has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the IARC have determined that PCBs are probably carcinogenic to humans.

2,3,7,8-Tetrachlorodibenzo-p-Dioxin 2,3,7,8- Tetrachlorodibenzo-p-Dioxin (2,3,7,8-TCDD) belongs to a family of 75 chemically related compounds commonly known as chlorinated dioxins (CDD). It is one of the most toxic of the CDDs and is the one most studied. 2,3,7,8-TCDD is odorless and the odors of the other CDDs are not known.

2,3,7,8-TCDD may be formed during the chlorine bleaching process at pulp and paper mills. CDDs are also formed during chlorination by waste and drinking water treatment plants. They can occur as contaminants in the manufacture of certain organic chemicals. CDDs are released into the air in emissions from municipal solid waste and industrial incinerators.

When released into the air, some CDDs may be transported long distances, even around the globe. CDD concentrations may build up in the food chain, resulting in measurable levels in animals. Eating food, primarily meat, dairy products, and fish, makes up more than 90% of the intake of CDDs for the general population.

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, discoloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people.

In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure. In many species of animals, 2,3,7,8-TCDD weakens the immune system and causes a decrease in the system's ability to fight bacteria and viruses. In other animal studies, exposure to 2,3,7,8-TCDD has caused reproductive damage and birth defects. The offspring of animals exposed to 2,3,7,8-TCDD during pregnancy often had severe birth defects including skeletal deformities, kidney defects, and weakened immune responses.

Several studies suggest that exposure to 2,3,7,8-TCDD increases the risk of several types of cancer in people. Animal studies have also shown an increased risk of cancer from exposure to 2,3,7,8-TCDD. The World Health Organization (WHO) has determined that 2,3,7,8-TCDD is a human carcinogen. The US Department of Health and Human Services (DHHS) has determined that 2,3,7,8-TCDD may reasonably be anticipated to cause cancer. Very few studies have looked at the effects of CDDs on children. Chloracne has been seen in children exposed to high levels of CDDs. It is not known that CDDs affect the ability of people to have children or if it causes birth defects, but given the effects observed in animal studies, this cannot be ruled out.

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.