Health Consultation

PAPELERA PUERTORRIQUENA, INCORPORATED

UTADO, PUERTO RICO

SEPTEMBER 27, 2010

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

Health Consultation: A Note of Explanation

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

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR or 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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Acronyms

ATSDR	Agency for Toxic Substances and Disease Registry
DHAC	Division of Health Assessment and Consultation
DNAPL	Dense Nonaqueous Phase Liquids
DRO	Division of Regional Operations
EMEG	Environmental Media Evaluation Guides
EPA	Environmental Protection Agency
HRS	Hazard Ranking System
MRL	Minimal Risk Level
NPL	National Priorities List
PA/SI	Preliminary Assessment/Site Investigation
PCE	tetrachloroethylene
PPI	Papelera Puertorriqueña, Inc.
PRASA	Puerto Rico Aqueduct and Sewer Authority
PREQB	Puerto Rico Environmental Quality Board
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RPM	Remedial Project Manager
TCE	trichloroethylene

Summary and Statement of Issues

In response to Environmental Protection Agency's (EPA) 2009 proposed listing and subsequent declaration of Papelera Puertorriqueña, Inc (PPI) to the National Priorities List (NPL), the Agency for Toxic Substances and Disease Registry (ATSDR) evaluated potential exposures to contaminants released by PPI's operations. ATSDR conducted a site visit in September 2009, reviewed site-specific literature, previous sampling data, and evaluated exposures based on available data. The initial objective was to determine if a public health hazard existed which would require immediate action or intervention. Based on evaluation of information gathered during the site visit and screening existing data against the appropriate comparison values, ATSDR concludes that the conditions at PPI do not represent a public health hazard that requires immediate action. Because the data from previous sampling events were limited and most were collected in response to episodic releases, ATSDR deemed it appropriate to evaluate potential acute exposures. ATSDR will evaluate potential chronic exposures, including cancer risks, when more comprehensive data is collected during EPA's Remedial Investigation (RI). ATSDR's findings are contained in this paper and the main conclusions are:

ATSDR defines a public health hazard as sites that have certain physical hazards or evidence of site-related exposure to hazardous substances that could result in adverse health effects.

This determination represents a professional judgment based on critical data which ATSDR has judged sufficient to support a decision. The assignment of this category does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.

- No site-specific immediate public health action is necessary, based on the available data provided. Local health officials are aware of this site and will become involved should site conditions change. Completed exposure pathways exist in surface water, sediment, and soil; potential exposure pathways include: ambient air and groundwater.

In the future, ATSDR will provide an evaluation of exposure pathways as EPA's data becomes available. EPA's projected completion date for its RI is December 31, 2012.

Background

Site Description and History

PPI ─ also known as All Plastics Products, Inc.; Empresas Rios; Puerto Rico Paper, Inc.; and Metropolitan Paper ─ is an active facility located in the downtown area of the municipality of Utuado, Puerto Rico. The PPI building is adjacent to, northeast of, and within 30-40 feet (ft) of the Vivi River (see Figure 2). Many businesses surround the facility, including a funeral home adjacent to and northwest of the facility. Several residences, separated from the facility by the Vivi River, are located along the river bend, to the southwest and within 200 ft from PPI (see Figure 3). At least eight public schools are within 0.5 miles of the facility. The university "Colegio del Este" Utuado Campus, where approximately 527 students attend, is located on site and the Judith A. Vivas Public School is located 0.25 miles from the site on the northwest side (PREQB 2006a).

Encompassing approximately 1.60 acres, PPI is located on a property with very steep inclination towards the Vivi River (see Figure 4). Vegetated areas behind the PPI property (see Figure 5) are located in a 100-year flood plain and the soil present in this area is Vivi loam, a soil with rapid permeability and moderate water availability capacity. There are at least six probable points of entry of discharges from the facility into the Vivi River which flows into the Rio Grande de Arecibo approximately 0.9 miles downstream from the facility (see Figure 2). The Rio Grande de Arecibo flows into the Dos Bocas Lake 7 miles further downstream. The Dos Bocas Dam contains this lake and supplies water to a drinking water intake point for the Puerto Rico Aqueduct and Sewer Authority (PRASA) that is located 6.2 miles downstream of the dam. The PRASA system supplies water to approximately 2,235,000 people (PREQB 2005).

The facilities consist of five four-story, concrete buildings interconnected into one large, E-forming building. The third and fourth floors of the NW, center, and SE Wings are occupied by the university "Colegio del Este," the Puerto Rico Department of Labor, and the "Adminstracion para el Sustento de Menores". All the PPI administrative offices are located in the Central Wing, while manufacturing occurs in the other wings of the PPI building (PREQB 2006a).

PPI has been at this location for approximately 46 years and manufactures paper bags (for example, coffee bags, bags for bakery products, rice bags, etc.), cardboard boxes, and plastic bags (supermarket bags) in different sizes and dimensions. Other paper-based products (for example, greetings cards and paper gift wraps) are stored on site and distributed by PPI. This company began manufacturing paper bags in 1960 under the name of Puerto Rico Paper, Inc., and then in 1981 started manufacturing plastic bags under the name of All Plastic Products, Inc. Currently, PPI is part of the "Empresas Rios" corporation under which the operations of Puerto Rico Paper, Inc., Metropolitan Paper, and All Plastic Products, Inc. occur. In August 2006 PPI employed 65 employees, working in two shifts (PREQB 2005).

Water- and oil-based inks, high-density polyethylene pellets (resin pellets), ethyl acetate, and isopropanol, are among the materials and substances currently used in the manufacturing processes. The inks are purchased in 5-gallon plastic or metal containers, and the oil-based inks are dissolved in ethyl acetate or isopropanol (99 %) prior to their use. Equipment used for labeling bags during manufacturing are prepared using a development process that includes tetrachloroethylene (PCE), butanol, acetic acid, ammonia, aluminum chloride, ammonium thiosulfate, diethanolamine, hydroquinone, monoethalamine, potassium carbonate, sodium bicarbonate, sodium bisulfate, sodium formaldehyde bisulfate, sodium hydroxide, sodium metaborate octahydrate, and triethylene glycol. Other chemicals used by PPI in the past include dichloromethane, ethylene glycol, methanol, methyl isobutyl ketone, methyl ethyl ketone, monoethanolamine, trichloroethylene (TCE), and xylene (PREQB 2006b).

The site was proposed for inclusion on the NPL on April 9, 2009 and was finalized to the NPL on September 23, 2009 based on information about past discharges to the Vivi River and the Hazard Ranking System HRS scores for the soil and surface water exposure pathways (EPA 2009).

Demographics

Available demographic information from the 2000 U.S. Census states that Utuado has a population of 35,336. The residents of the community around the PPI have a low socioeconomic status when compared to the rest of the United States. Only 49.3% of the municipality's population over the age of 25 has completed at least a high school level of education. Further, 63.7% of the county lives below the poverty level. ATSDR calculated demographic information for a one, two, and three mile radius from the site (see Figure 2).

Community Health Concerns

In November 2009 an ATSDR representative from the Division of Health Assessment and Consultation (DHAC) traveled to Puerto Rico to conduct interviews with Utuado residents that lived or worked near the Vivi River, community leaders, and employees of PPI. The intent of these interviews was to assess community members' awareness of the PPI site and to evaluate any concerns related to the site. The entire analysis of individual interview data can be found in Appendix A while a summary of the analysis is presented in this section.

The nine interviewees had diverse perceptions of environmental health issues, and most had vague awareness that the river had been contaminated by PPI. Some that lived or worked near the river were aware that dyes had been spilled into the river.

One of the questions asked of the participants addressed their perception of PPI operations and its potential to adversely impact the environment. The question read, "On a scale of 1-5, (5 being very high and 1 being very low) how concerned do you think the community is about the potential environmental

hazard for Papelera Puertorriqueña?" The responses averaged 2.4. Those interviewed do not perceive the residents of Utuado to be very concerned about PPI's operations potentially polluting the environment.

However, there was concern expressed by interviewees about children wading or swimming in the river next to the plant. One interviewee stated that he had observed swimming, wading, and fishing in the river near the plant. He was also concerned about the impacts of the contamination if it were to reach the reservoir downstream.

Another interviewee said, "Many people are unaware of environmental hazards; they are not aware that contamination in one place affects other places and people. We need to increase the awareness of environmental health issues for the community." Another interviewee affirmed this statement by saying, 'There is a lack of awareness; it's not that they do not care, but that they don't know what is happening."

Discussion

Site Visit

In September 2009, ATSDR representatives from DHAC and the Division of Regional Operations (DRO) traveled to San Juan, Puerto Rico to meet with representatives from the EPA, Caribbean Environmental Protection Division (CEPD), and the Puerto Rico Environmental Quality Board (PREQB). This was an initial site visit during which ATSDR gained information about PPI, its operations and practices, surrounding topography, surrounding community, and other pertinent information required to accurately characterize the site. ATSDR also established relationships with stakeholders that will be necessary to carry out future evaluations as the EPA and PPI conduct required NPL site activities.

ATSDR met with EPA's Remedial Project Manager (RPM) to discuss the general site characteristics, the surrounding community, existing documents not yet shared with DHAC, and future plans for the site. ATSDR received a copy of the draft Statement of Work and the RPM encouraged ATSDR's review and input throughout the RI / Feasibility Study (FS) process. In addition, the RPM provided valuable input regarding the uses of the Vivi River. This river is a primary area of concern because of its close proximity to the site and its history of receiving discharges from PPI operations. Furthermore, the Vivi River flows past PPI eight miles upstream of a dammed lake that provides recreational and fishing activities to the Utuado community. Pascual Velazquez and Frances Segarra of PREQB provided information on their historical activities that have been carried out in response to PPI's practices (PPI Trip Report 2009).

During the visit to PPI's facility ATSDR was informed by PREQB that the company has made an effort to improve their practices and reduce the risk of a release or Resource Conservation and Recovery Act (RCRA) violation. PPI began working with Caribe Environmental Services six months prior to our arrival in an effort to implement some of PREQB's continued requests. PPI indicated that through this concerted effort with Caribe, the company has improved their practices regarding chemical storage, chemical usage, and general cleanliness (PPI Trip Report 2009). Previously, PREQB extensively documented abandoned, unlabeled drums stored throughout the facility. ATSDR observed that PPI has removed many of these drums and appears to be storing chemicals properly. One of the alterations in their practice was the installation of a pump system that transfers all of the facility's waste water and sanitary sewage to three tanks that a contractor empties when necessary. This is an operational improvement, since PREQB has previously documented PPI's septic system working ineffectively and releasing contaminants that eventually reach the Vivi River.

ATSDR was informed that the inks used on PPI's products are now water based. Also, the glues used to construct the bags were said to be a corn starch base mixed with water. PPI also informed ATSDR that TCE has not been used in the developing process since 2002 and that the facility now uses a soap and water mixture to clean the screens and developing plates.

The area surrounding PPI consists of residences and various small businesses (mechanic shop, funeral home, etc.) and ATSDR was informed by PREQB that these may also be potential sources of contamination into the Vivi River. Residences located along the riverside had pipes jutting out of their structures which could be point source discharges onto the banks of the river. It was noted that the Vivi River would be attractive to any children that occupy the residences in the area. Also, Dos Bocas Lake provides plenty of recreational opportunities for the residents of Utuado and is located only eight miles downstream of the PPI facility.

Data Analysis

Past Sampling Events

March 1984 – February 1998:

Visual inspections and reports from nearby residents, PREQB, and PPI employees in the 1980's and mid-1990's revealed a variety of emissions and wastewater discharges that resulted in emergency response actions and environmental investigations.

- In March 1984 personnel from PREQB were informed of an accidental spill from PPI that resulted in a discharge of ink and oil residues into the Vivi River (PREQB 1984).
- In December 1993 PREQB observed the discharge of wastewaters directly from the PPI facility onto the ground in the backyard and beneath the building through holes in the floor. These discharges reached the Vivi River (PREQB 1993).
- In February 1998 PREQB observed inadequate storage and disposition of inks and chemicals, dripping, leaking, and corroded drums, poor ventilation in chemical storage areas, insufficient labeling, inadequate secondary containment, as well as inks flowing into the Vivi River (PREQB 1998a).

March 1998 Sampling Event:

In March 1998, PREQB responded to a report of discharge of solvents (including benzene, toluene, PCE, ethyl benzene, and TCE) into the Vivi River from PPI. The incident occurred at daybreak and a brown liquid was observed flowing into the Vivi River. Eleven people were evacuated and dead fish were observed in the river (PREQB 1998B).

Water samples were collected from two locations; the point of entry of the liquids into the Vivi River, and a point downstream from the PPI facility. Both samples were analyzed for 36 different target compounds. Of these compounds, toluene, PCE, TCE, and ethylbenzene were detected (see Table 1) (PREQB 1998C).

April 2000 Sampling Event:

In April 2000 personnel from the PREQB Arecibo Regional Office conducted a dye test at the PPI facility. Dyes poured into the holes of the floor and sink inside PPI's development room reached the Vivi River. Additionally, holes in the walls and floors were observed to be discharging directly over the ground below the facility and spilled inks were observed on the floors of the facility (PREQB 2000a).

April - June 2000 Sampling Event:

On April 19, May 24, and June 2, 2000 PREQB observed a grayish-white liquid coming from the site and flowing into the Vivi River. Sampling was conducted by Altol Chemical Environmental Laboratory (Alchem Lab, Inc.) under the oversight of the PREQB Arecibo Regional Office. Soil samples were collected from the ground below the development room. Each sample was analyzed for 23 compounds. A toxicity characteristic leaching procedure was used to analyze these samples. TCE, PCE, and 1,2 dichloroethane were detected (PREQB 2000b).

December 2001 Sampling Event:

In December 2001 Alchem Lab, Inc. collected samples from the sludge accumulated inside the septic system (PREQB 2002). Five samples were collected from the septic tank and filtration tanks. Arsenic, benzene, cadmium, chromium, copper, mercury, nickel, lead, silver, and zinc were detected (Altol Chemical 2001).

May 2001 – May 2003:

The PREQB Land Pollution Control Area, Hazardous Wastes Division performed full RCRA Generator Inspections at PPI in May 2001 and May 2003. In May 2001 PPI was found out of compliance with the PREQB Regulation for the Control of Hazardous Solid Waste due to the absence of a contingency plan, storing of hazard waste for more than 90 days, absence of clear 'hazardous waste' signage, open hazardous waste containers, no secondary containment system, no manifest for hazardous waste kept on site, and spent fluorescent lamps generated by PPI (PREQB 2006a).

In May 2003 PREQB observed that the violations observed in May 2001 had been corrected, and that a neutral, mild detergent was being used instead of PCE to clean ink from press rolls (PREQB 2006a).

February 2005 Sampling Event:

On February 1, 2005 the trucking company Servicios Sanitarios Perez was discovered by the Puerto Rico State Police discharging wastewaters into the Rio Grande de Arecibo that were reportedly from PPI. In response to this discharge, personnel from the Water Monitoring Division of the PREQB Water Quality Area collected samples from the Rio Grande de Arecibo on February 2, 2005. Surface water samples were collected from four different locations and analyzed for total metals, turbidity, and dissolved oxygen, and their pH and temperature were recorded. ATSDR was unable to acquire data from this sampling event (PREQB 2006a).

November 2005:

During visual inspections conducted by the PREQB Superfund Preliminary Assessment (PA)/ Site Investigation (SI) Division on November 10 and 22, 2005 personnel observed metal debris scattered throughout the facility, press rolls that dripped ink directly onto the floor, ink stained floors, corroded 55-gallon metal drums lacking secondary containment, stressed vegetation, PVC tubes from the PPI building and septic tank discharging liquids onto the ground and into a concrete ditch, and ink-stained soil surrounding the facility (PREQB 2005).

January – February 2006 Sampling Event:

In January and February 2006 the PREQB Superfund PA/SI conducted a screening investigation of PPI in order to assess conditions at the site and to determine the need for further investigation under Comprehensive Environmental Response, Compensation, and Liabilities Act / Superfund Amendments and Reauthorization Act (PREQB 2006a).

Thirteen surface water samples were collected from six potential points of entry into the Vivi River and one location 0.4 miles downstream from the facility. Three background surface water samples were collected from locations approximately 100 and 200 ft upstream from the facility. Of the analyzed chemicals, cis-1,2-dichlorethene, PCE, and TCE were detected (see Table 2) (PREQB 2006a).

Sixteen grab soil samples, including two background samples, were collected at soil depths ranging from zero to twelve inches. Arsenic, cadmium, chromium, lead, mercury, nickel, silver, thallium, zinc, 1,1,2-trichloro-1,2,2-trichloroethane, TCE, PCE, butyl benzyl phthalate, endosulfan I, endosulfan II, endosulfan sulfate, endrin aldehyde, gamma-chlordane, and aroclor-1254 were detected (see Table 3) (PREQB 2006a).

Thirteen sediment samples were collected from the Vivi River that is adjacent and to the southwest of the site, from the six potential points of entry for discharges from the site, and from a location downstream from the facility. Samples were also collected from the Rio Grande de Arecibo and the concrete ditch that

is adjacent to the southeastern side of the PPI building. Two background samples were collected from locations 100 and 200 ft. upstream from the facility. Chromium, lead, cis-l,2-dichloroethene, PCE, 4-methyl phenol, diethylphathalate, endosulfan I, endosulfan II, endosulfan sulfate, acetone, 2-butanone, aluminum, barium, calcium, cobalt, copper, iron, magnesium, manganese, mercury, nickel, vanadium, zinc, and gamma-chlordane were detected (see Table 3) (PREQB 2006a).

Exposure Pathway Evaluation

Exposure is defined as the contact of an organism with a chemical or physical agent. The magnitude of exposure is determined by measuring or estimating the amount of an agent available at the exchange boundaries (i.e., the lungs, gut, and skin) during a specified time period (EPA 1998).

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

1. Source of contamination
2. Environmental media and transport mechanisms
3. Point of exposure
4. Route of exposure
5. 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. Exposure pathways are used to evaluate specific ways in which people were, are, or will be exposed to environmental contamination in the past, present, and future (ATSDR 2005).

There are many potentially exposed populations to the PPI site contamination (see Figure 1). Anyone who contacts the Vivi River downstream of PPI could be exposed to released contamination, and the Vivi River flows approximately 0.9 mile to converge with the Rio Grande de Arecibo River. The Rio Grande de Arecibo flows 8 miles to Dos Bocas Dam, and Dos Bocas Dam supplies water to a public supply raw water intake pool for the Superaqueduct system located 6.2 miles downstream of Dos Bocas Dam. The system supplies drinking water to a population estimated 2,235,000 people (PREQB 2005). This drinking water system is a treated public water supply that is operated by PRASA and regulated by the PREQB Water Quality Division and therefore ATSDR did not evaluate the municipal water supply and does not consider it to be a potential exposure pathway. Fishing and recreational activities occur at Dos Bocas Lake. However, interviews of Utuado residents have confirmed that wading, swimming, and fishing also occur farther upstream in the Vivi River close to the PPI site. Of note, many businesses and schools are in close proximity to the site, and several residences, separated from the facility by the Viví River, are located along the river bend, 200 feet from PPI (PREQB 2006b).

Based on available data, ATSDR evaluated surface water, soil and sediment as completed exposure pathways. ATSDR considers ambient and indoor air as potential exposure pathways, but data is not currently available for further evaluation.

Figure 1: Exposure Pathway Table

Completed Pathways --

Media	Source	Exposure Point	Exposure Route	Notes
Surface Water	PPI Facility	Vivi River	Inhalation Dermal contact Incidental Ingestion	Community members may be exposed to surface water in the Vivi River while engaging in recreational activities, and domestic tasks.
Soil/Sediment	PPI Facility	Soil in the area near the southeast and southwest perimeter of the PPI facility and sediment along the banks and in the streambed of the Vivi	Inhalation Dermal contact Incidental Ingestion	Community members may be exposed to soil and sediment while engaging in recreational and domestic activities in and around the Vivi River.

Potential Pathways --

Media	Source	Exposure Point	Exposure Route	Notes
Ambient Air	Volatilization from surface water, soil and sediment, fugitive emissions from PPI	Areas near the PPI facility	Inhalation	While there have been documented odor complaints near the PPI facility, no ambient air data is currently available for evaluation.
Indoor Air	Vapor intrusion from soil and groundwater into buildings	Buildings near the PPI facility	Inhalation	No data is currently available to evaluate the potenital for vapor intrusion.

Surface Water:

ATSDR finds that surface water comprises a completed exposure pathway at the PPI site. While other non site-related sources may exist, the exposure source ATSDR evaluated for this pathway was the facility itself. Environmental transport occurs through a variety of mechanisms including over ground flow of discharges from the facility into the Vivi River, flow of discharges through cement ditches into the Vivi River, and potential migration of chemicals in the discharges through the soil and into the Vivi River. These transport mechanisms have been confirmed during visual inspection of the site and based on information about the hydrogeology of the area. The exposure point for the surface water pathway is the Vivi River where residents have been observed engaging in recreational activities and domestic tasks such as washing clothes. The exposure routes for this pathway include skin contact (dermal), inhalation, and incidental ingestion. The potentially exposed population includes employees of PPI, residents, and students at the nearby school.

Surface water has been evaluated at PPI during two separate sampling events. In March 1998 PREQB collected surface water samples from a concrete ditch adjacent to PPI as well as the Vivi River in response to a report of discharges from the facility. Ethylbenzene, PCE, TCE, and toluene were detected in these samples (Table 1). Because these data were collected during an episodic sampling event in direct response to observed releases from the facility, ATSDR considers these events as representing potentially acute exposures and does not consider them sufficient to characterize chronic exposures at the site. As a result, ATSDR has compared them to acute environmental media evaluation guides (EMEGs) (see Appendix B). Toluene was the only analyte that exceeded a screening value. Its concentration of 14,597 ppb detected in Canal Descarga E1 exceeded its child EMEG of 8000 ppb.

In January and February 2006 thirteen additional samples were collected by the PREQB Superfund PA/SI Division from six potential points of entries into the Vivi River and two locations downstream from the facility. PCE, TCE, and cis-1,2-dichloroethene were detected in seven samples. None of the detected measurements exceeded acute EMEGs. Samples were also collected from background locations; no analytes were detected in the background samples.

Table 1: Summary of Analyte Detections in Surface Water (ppb), Papelera Puertorriqueña Inc.

March 1998 Sampling Event

	ethylbenzene	trichloroethene	tetrachloroethene	toluene
Acute EMEG	*700 (MCL)*	*2000 (child)/ 7000 (adult)*	*500 (child)/ 2000 (adult)*	*8000 (child)/ 30000 (adult)*
Canal Descarga E1	477		185	**14,597**
Cuerpo Receptor E2	144	157.50	421.5	1,464

Table 2: Summary of Analyte Detections in Surface Water (ppb), Papelera Puertorriqueña Inc.

January - February 2006 Sampling Event

	cis-1,2-dichloroethene	trichloroethene	tetrachloroethene
Acute EMEG	*10000 (child) / 40000 (adult)*	*2000 (child)/ 7000 (adult)*	*500 (child)/ 2000 (adult)*
SW-03, background	ND	ND	ND
SW-04, background	ND	ND	ND
SW-01, downstream	O.46J	0.38 J	5.8
SW-02D, downstream	O.44J	O.39J	5.9
SW-07, point of entry #1	0.91	0.81	11
SW-05, point of entry #2	1.4	1.1	15
SW-06, point of entry #3	3.5	2.5	26
SW-08, point of entry #4	8.9	6.7	32
SW-09, point of entry #5	4.3	2.4	19
SW-10, point of entry #6	ND	ND	ND
SW-11, background (Arecibo River)	ND	ND	ND
SW-12, background (Arecibo River)	ND	ND	ND
SW-13, background (Arecibo River)	ND	ND	ND

ND = Analyte not detected above detection limits

J = Reported concentration is an estimated value

Soil and Sediment:

ATSDR determined that sediment and soil comprise a completed exposure pathway at the PPI site. Contaminants can reach the soil from any of the discharge pipes identified by PREQB and contaminants can reach the sediment by any of the potential points of entry identified by PREQB. The exposure point for soil is the area located on the southeast to the southwest perimeter of the facility and adjacent to the Vivi River while the exposure point for sediment is along the banks of and in the streambed of the Vivi River. It has been confirmed through interviews with Utuado residents that people engage in recreational activities in the Vivi River near the plant. Also, there is no barrier preventing someone from crossing the river and accessing the PPI property where known releases have occurred. That said, the likely routes of exposure for soil and sediment are skin contact (dermal), incidental ingestion, and inhalation.

ATSDR evaluated soil and sediment samples collected by PREQB during their PA/SI sampling event in January and February 2006. Sixteen grab soil samples, including two background samples, were collected at soil depths ranging from zero to twelve inches along the southeast to the southwest perimeter of the PPI facility. Thirteen sediment samples were collected during the February sampling event. The sediment samples were collected at the six potential points of entry, upstream from the facility, along the concrete ditch on the southeastern side of the facility, and downstream at the Rio Grande de Arecibo. ATSDR evaluated exposure to sediment and soil using the methods and comparison values described in Appendix B. Because the soil and sediment samples were collected during an episodic event, ATSDR considers the concentrations to reflect acute exposures and has compared them to acute EMEGs. Cadmium does not have an acute EMEG, so ATSDR initially chose a conservative comparison value, the intermediate EMEG. A variety of chemicals were detected in the soil and sediment samples but only one of the samples contained an analyte that exceeded a comparison value. Soil sample SS-03 was a grab sample taken from the southeast wing of the facility where an area of soil was stained. SS-03 contained a cadmium concentration of 2,370 ppm which exceeds its intermediate EMEG (see Table 3).

The dominant fate of most solvents released to surface soils is volatilization. However, they also percolate to groundwater because they do not bind strongly to soil. PCE and TCE are particular solvents of concern that have been used in PPI's past operations. PCE and its degradation compound TCE are dense nonaqueous phase liquids (DNAPL) which are well documented to contaminate groundwater. DNAPLs are heavier than water, and they are only slightly soluble in water. These two physical characteristics mean that when released into the environment in sufficient quantity, they can move through soils and groundwater until they encounter a sufficiently resistant layer that will impede further mass vertical movement and allow the liquid to pool (www.clu-in.org).

Ambient Air:

ATSDR recognizes that volatile organic compounds are likely to volatilize from surface water or soil into ambient air. Further, it is possible that the facility releases fugitive emissions to the air and there have been complaints about odor near the facility. No ambient air data were collected during historical sampling events so ATSDR was unable to further evaluate this pathway.

Indoor Air:

ATSDR recognizes that contaminants can migrate by vapor intrusion from soil and groundwater into buildings. Thus, indoor air may be a potential source of exposure. However, no indoor air or groundwater data were collected during historical sampling events so ATSDR was unable to further evaluate this pathway. Aside from potential vapor intrusion, ATSDR did not identify any potential points of contact with groundwater at the site.

Table 3: Summary of Detection in Sediment and Soil Samples (ppm), Papelera Puertorriqueña Inc.

January - February 2006 Sediment Sampling Event

	diethylphthalate	*cis*-1,2-dichloroethylene	4-methylphenol
Acute EMEG	*10,000*	*2,000*	*100*
SD-05	0.98	ND	ND
SD-08	ND	0.01	0.42

January - February 2006 Soil Sampling Event

	tetrachloroethylene	trichloroethylene	arsenic	cadmium
Acute EMEG	*100*	*400*	*20*	
Intermediate EMEG				*30 (child)/ 400 (adult)*
SS-03	ND	ND	0.61J	**2370**
SS-06	0.035	ND	8.6	ND
SS-07	2.4	0.0075	1.8	ND
SS-12	0.011	ND	ND	ND
SS-14	0.022	ND	ND	ND

ND = Analyte not detected above detection limits
J = Reported concentration is an estimated value

Data Needs

ATSDR's ability to assess public health hazards at the PPI site is limited by the absence of data that can be used to assess long term exposures. Nearly all the currently available data for the site were collected in direct response to observed releases. While useful in the assessment of acute exposures, these data may be insufficient for appropriate evaluation of chronic exposures, including cancer risk. Overall, a more extensive monitoring effort in all media is required to fully characterize the PPI site. EPA's planned RI/FS sampling events will likely fill the data gaps that ATSDR needs to conduct a future evaluations.

In order to determine the public health risk present at the site resulting from exposure to air, surface water and sediment in the Vivi River, groundwater, and soil around the facility, data describing representative contaminant concentrations in air, water, sediment, groundwater, and soil should be collected. Additional representative environmental data are needed to accurately assess the level and extent of contamination in order to evaluate potential exposures.

Public Health Implications

Following the review of the limited sampling data, site-specific literature, and the information collected during a site visit, ATSDR does not deem the PPI site to pose a public health hazard requiring immediate action. It has been documented that PPI caused releases of contaminants, exhibited inadequate chemical storage, and practiced poor disposal techniques. However, PREQB reported to ATSDR that the chemical storage practices observed at the facility during the September 16, 2009 site visit were greatly improved from previous site inspections.

One surface water sample was found to contain levels of toluene above the acute EMEG for exposure to drinking water in children. Exposure to the surface water would result from incidental ingestion while playing, wading, fishing, or washing clothes in the Vivi River. Incidental ingestion of surface water is typically considered to be of a much lower volume than the volume of drinking water consumed daily. Also, the exposure would be expected to be less frequent (not daily). Thus, comparison to acute drinking water screening values should be considered conservative. While contaminants were detected well below acute drinking water EMEGs, their chronic non-cancer and carcinogenic potential will be evaluated when adequate data have been generated to characterize the site.

The soil on the southwest side of the facility and the sediment in the Vivi River represent a completed exposure pathway. Contaminant concentration and detection frequency does not suggest a public health hazard requiring immediate action. The limited sampling that was conducted by PREQB detected cadmium above its intermediate EMEG in only one of the soil samples. Given the accounts of poor disposal practices, documented poor storage procedures and releases reported by PREQB, concern remains for exposure to contaminated soil or sediment. A more complete environmental characterization of the site is necessary to adequately identify the public health implications of PPI's environmental contamination.

Exhibit 1: Exposure Dose Equation for Ingestion

$$D = \frac{C \times IR \times EF \times CF}{BW}$$

where,

D	=	exposure dose in milligrams per kilogram per day (mg/kg/day)
C	=	chemical concentration in milligrams per kilogram or liter (mg/kg) or (mg/L)
IR	=	intake rate in milligrams or milliliters per day (mg/day) or (mL/day)
EF	=	exposure factor (unitless)
CF	=	conversion factor
BW	=	body weight in kilograms (kg)

In the absence of complete exposure-specific information, ATSDR applied several conservative exposure assumptions to estimate exposure doses for contaminants exceeding environmental screening levels as accurately as possible. ATSDR evaluated exposure of elementary school aged children, teenagers, and adults while wading or swimming in the river or engaging in recreational or domestic activities near the PPI facility. Specifically, ATSDR estimated exposure doses using the following assumptions and default intake rates for exposure through incidental ingestion:

- The maximum levels of the contaminants were used when calculating the exposure doses for acute (short-term) exposures. In addition, an exposure factor of 1 was used for the surface water

and sediment, and soil which is the most conservative value and used during acute dose calculations.

- The soil and sediment intake rate for elementary school children was assumed to be 200 mg/day, and for teenagers and adults was assumed to be 100 mg/day.
- The surface water intake rate for all age groups was assumed to be 50 mL/day.
- The body weights of elementary school children, teenagers, and adults were assumed to be 33.8, 65.0, and 80.8 kg, respectively. Of note, all weights used in ATSDR's calculations in this health consultation were taken from the findings of the National Health and Nutrition Examination Survey (NHANES) (CDC 2004).
- The bioavailability of all contaminants was assumed to be 100%—that is, all of the contaminant in media that a person ingested was assumed to enter the bloodstream.

ATSDR, on the basis of these conservative assumptions, derived estimated exposure doses. This exposure dose evaluation supports that an acute health issue does not exist in the surface water or sediment. The estimated doses were compared to the appropriate comparison values and found to be below the comparison value in all samples except for one soil sample of cadmium (see Table 4). The SS-03soil sample was taken from the southeast side of the facility. Of note, SS-08 was the only other soil sample that detected cadmium and its concentration was 0.65 ppm. For cadmium exposures in soil, an acute comparison value for oral exposures was not located. As a worst case scenario, ATSDR performed an initial screening using an ATSDR intermediate EMEG which was developed from rodent studies of drinking water exposures (ATSDR 2008). For further evaluation, ATSDR compared the maximum cadmium concentration to a chronic comparison value developed by EPA (RfD) for soil exposure to cadmium, 0.001 mg/kg/day, based on a no observed adverse effect level (NOAEL) for an exposure of 0.01 mg/kg/day (EPA). While the chronic comparison value was exceeded, ATSDR considers the likelihood of adverse health effects occurring for this worst-case exposure scenario minimal due to the following:

- The comparison value (Rfd) was developed for exposures occurring for more than one year. The exposure scenario evaluated at PPI is an acute, one-time exposure. Chronic exposures will be evaluated when environmental characterization is complete.
- The NOAEL dose was equivalent to the maximum exposure dose (0.01 mg/kg/day).
- Cadmium detections in soil were rare with one other detection of much lower magnitude.
- The area surrounding the PPI typically contains dense vegetation and ground cover which reduces the risk of exposure to contaminated soil.
- The available scientific information for acute oral exposure to cadmium reports gastrointestinal effects at high concentrations of cadmium. These observed concentrations resulted in higher doses than calculated at PPI (Klaassen 2001, ATSDR 2008).

Table 4. Calculated Doses for Contaminants Exceeding Environmental Screening Levels

Contaminant	Media	Concentration (ppm)	Comparison Value	Calculated Dose (mg/kg/day)		
				Elementary School Age	Teenager	Adult
toluene	surface water	14.497	0.8 mg/kg/day (acute MRL)	2.16 E-02	1.12 E-02	9.03 E-03
cadmium	soil	2370	0.001 mg/kg/day (RfD)	1.40 E-02	3.65 E-03	2.93 E-03

Child Health Considerations

ATSDR recognizes the unique vulnerabilities of infants and children. This must be taken into account when considering potential exposures and health effects in children who live near the PPI site or play in the Vivi River near the facility. Children are not just 'little adults' - they are often undergoing rapid development of various body systems, and their behavioral patterns often result in increased contact with environmental media. Additionally, children have a higher ingestion rate related to body weight when compared to adults and their breathing zone is closer to the ground than an average sized adult. Inadvertent soil ingestion among children may occur more often than adults through the mouthing of objects or hands. While deliberate soil ingestion, defined as pica, is considered to be relatively uncommon (EPA 1997), mouthing behavior is considered to be a normal phase of childhood development.

Ingestion of soil and water and dermal exposure to contaminated water and soil are potential sources of human exposure to the chemicals used by PPI. The potential for exposure to contaminants via these sources is greater for children because they are more likely to ingest more soil and water than adults as a result of behavioral patterns present during childhood. They are also more likely to engage in play activities in the Vivi River which could cause increased opportunity for dermal exposure. Until conditions are characterized, residents should be aware of potential exposures and heed local health guidance when conducting activities in the river near the facility.

Findings

- Completed exposure pathways exist in the surface water, sediment, and soil; potential exposure pathways may include ambient and indoor air.
- PREQB documented PPI's past chemical storage and disposal practices to be ineffective and in violation of environmental regulations; this creates a concern for exposure to contaminants released by PPI.
- One surface water sample contained a level of toluene that exceeded its acute EMEG and one soil sample contained a level of cadmium that exceeded its chronic Rfd.
- Pipes extend into the river from businesses and residences across the river from PPI. It has not been determined what these pipes discharge or have discharged into the river. The potential exists for these discharges to impact the water quality of the river.
- The interviewees had diverse perceptions of environmental health issues, and most had vague awareness that the river had been contaminated by PPI.

Conclusions

- ATSDR concludes that no site-specific public health hazard requiring immediate action is apparent, based on the available data provided.

Recommendations

- The EPA should continue efforts to characterize the extent of contamination and control site-related emissions and migration of contamination from the site.
- Non-site related exposures should be investigated to determine if effluent discharges which may be occurring across the river are of public health concern.
- Until conditions are characterized, residents should be aware of potential exposures and heed local health guidance when conducting activities in the river near the facility.

ATSDR will remain in communication with EPA as well as local health and environmental agencies regarding activity at the site and evaluate appropriate data as it becomes available.

Authors, Technical Advisors

Rob Robinson, BSEH

Environmental Health Scientist
Consultation Team
Exposure Investigation and Site Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Rachel Worley, MA

Environmental Health Scientist
Consultation Team
Exposure Investigation and Site Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

David Fowler, PhD

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

Maria Teran-Maciver, BS BSN
Senior Program Management Officer
Health Promotion and Community Involvement Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Reviewers

Susan Moore, MS

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

Peter Kowalski, MPH, CIH

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

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Figures

Figure 2: Site Map and Demographic Characteristics

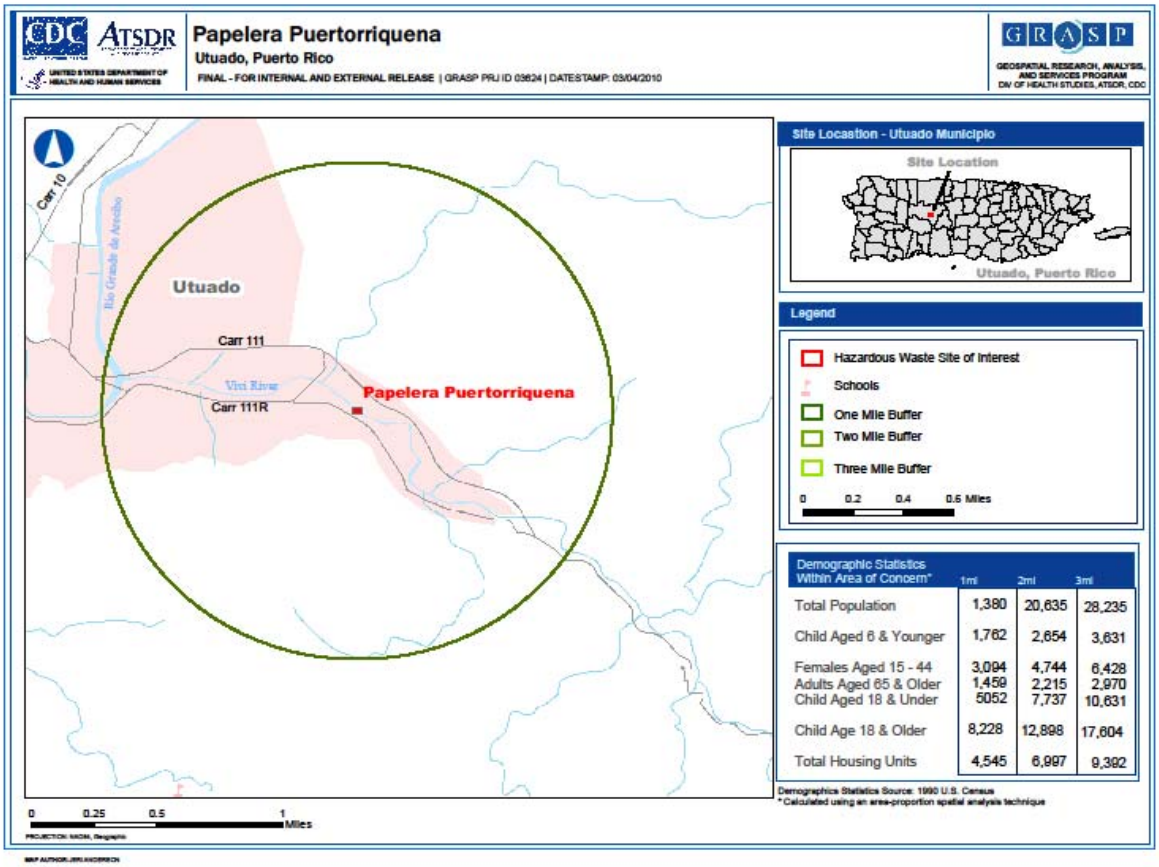

Figure 3:

Businesses and residences located directly across the Vivi River from PPI

Figure 4:

Looking South from the facility's balcony on the Southwest side of the building

Figure 5:

Southwest wall of the PPI building which faces the Vivi River

Appendix A

Results of Analysis of Individual Interview Data
Papelera Puertorriqueña Site, Utuado, Puerto Rico
Interviews conducted Nov. 16-20, 2009
Authored by Maria Teran-Maciver of ATSDR's Health Promotion & Community Involvement Branch

Key Players

Interviewees were people who lived or worked near the river, were elected officials of the community, or were employed by the plant that was causing the contamination. Two respondents lived near the river and close the plant; two respondents worked for a school near the plant; one respondent worked for a university near the plant; one respondent worked at the plant in question; one respondent worked at a private school near the site; two respondents were local government officials.

Awareness

Interviewees had diverse perceptions of environmental health issues. Most had vague awareness that the river had been contaminated by the Papelera plant. Some that lived or worked near the river were aware that dyes had been spilled into the river.

"Water is being exposed by chemicals used to make paper," said one respondent.

Other interviewees that worked near the river said "We live in a healthy environment—lots of fresh air, except when there are fires." The reference to fires was about the practice by farmers to burn their fields in preparation for the next planting season.

Other interviewees referred to Utuado as a valley in which inversion of air emissions get "trapped". "Utuado is at the bottom of a valley; air above the city holds dust and gas emissions from vehicles in the air."

One interviewee regarded herself as an environmental activist and said, "Many people are unaware of environmental hazards; they are not aware that contamination in one place affects other places and people. We need to increase the awareness of environmental health issues for the community." Another interviewee said, 'There is a lack of awareness; it's not that they do not care, but that they don't know what is happening."

Two respondents when referring to environmental health concerns related the city's efforts to control mosquito-borne illnesses, H1N1, removal of dead animals from the streets, preventing rabies, and removing packs of dogs that roam the streets. They seemed to be unaware of what they can do to prevent contamination from the river and downstream to the reservoir.

Concerns

Most interviewees stated that the community was aware of the river being contaminated, but did not know how serious the contamination could be.

The local government officials had concerns about biological sources of environmental illness, such as Dengue fever and H1N1. They also mentioned that no one had complained about contamination of the river to the municipality.

Three respondents mentioned that they or their family experienced lots of respiratory problems due to the perceived air inversions in the community. The employee of the private school also mentioned that many children had asthma, particularly when the burning of the fields occurs.

In response to the question "On a scale of 1-5, (5 being very high and 1 being very low) how concerned do you think the community is about the potential environmental hazard for Papelera Puertorriqueña?" the average number reported was 2.4.

One of the respondents was the mother of two young children and lived next to the river. She was concerned about seeing children wading or swimming in the river next to the plant. An employee of the school also expressed concern about people he had observed swimming or wading or fishing in the river near the plant. He was also concerned about the effects of the contamination on the reservoir downstream from the river.

The plant employee stated that he was unaware of any health concerns regarding the contamination of the river, since the plant was doing everything to contain any further contamination.

One respondent mentioned that people bathing in rivers were exposed to herbicides and pesticides and that their health might be impacted.

In summary, the health concerns were contamination from swimming or wading or fishing in the river, exposure to pesticides and herbicides in the rivers, the prevalence of asthma and respiratory problems from burning fields and air inversion in the valley and the lack of awareness of the effects of contamination for those exposed.

Trust and Satisfaction with Past Actions

Industry and local government officials were more likely to report trust in government's ability to take action to protect the community's health.

Most respondents, however, expressed the state/local/federal government's lack of responsiveness as a reason not to trust government.

There was a difference between expressed trust between local government and federal government.

- Some of the respondents felt that the reason local government was not responsive was due to lack of resources. There was also a concern that "I fear the government has not been responsive; we have laws, but they are not enforced." Another respondent stated, "The level of trust in government is not very high; they do not have a pro-active approach. They come into the situation too late."
- Two of the respondents expressed trust in the federal government. They indicated that EPA and ATSDR were trusted sources for remediating the contamination and preventing health effects. The rest of the respondents were not clear on what EPA and ATSDR's roles were in protecting health.
- But most generally agreed "When federal agencies are involved, more gets done."

Perceived personal risk

There was a consensus that "People who swim, wade and fish in the river –including children, might have their health affected by contamination."

There was also a perceived risk in that "The river empties into a lake where people fish. The names of the fish caught there are "tocumare, livina and baluu. People eat these fish."

One respondent mentioned the risk of some people who swim in the rivers being exposed to herbicides and pesticides.

Perception of Fault/Responsibility

The plant employee allowed that it was the plant's fault for the contamination. Several respondents stated that the Papelera was the source of the contamination. One respondent added that there are not many

factories in the town, so that pollution can only be traced to Papelera, although they did report that there are odors from a coffee manufacturer nearby and by a mortuary also nearby.

One respondent mentioned that the local government did not enforce laws or take action to prevent contamination until it's too late.

Two other respondents explained that the community members throw trash in the river and that they share the fault for contamination.

Other respondents explained that burning the fields once a year causes air pollution that affects their health. Also related to air pollution, the respondents mentioned the air inversion that traps dust and emissions from cars into the air.

One respondent said, "The mayor of the town is responsible for addressing environmental concerns; he has contacts with agencies with resources for cleaning up the environment."

Another respondent said, "The community should also take responsibility for their environment."

Readiness to Act

Most of the respondents alluded to the fact that most of the community members are not aware of either the contamination or the possible effects to their health because of the contamination. In the Stages of Change model, this means that most of the community is at the Pre-contemplation stage.

That means that the agency should make an effort to explain what the contamination was and what it means. The community also needs to know what our agency can do to help them. For this stage, the agency could collaborate with the municipality's plans to hold several health fairs in the early part of 2010. The goal would be to raise awareness and to elicit community concerns once their awareness is raised.

One respondent said, "We need messages about how to preserve the environment clean. Many people throw used car oil in their yards; they need messages to stop that."

Another respondent said, "The community needs to know about contaminants in the air, water and soil. They need to know the effects of contamination. The most effective way to educate them is through messages via the television."

Most respondents referred to education of the community through the use of messages via the television. The second most preferred method was through personal contact such as meetings and health fairs. The least preferred method of education was through written materials. However, the school employees mentioned "take-home" materials for students to help educate their families.

Community Climate and Cohesiveness

The interview data provides a mixed review of the community's climate. While community members reported varying levels of risk, local government officials and industry were more confident that their health was being protected. The government officials perceived a low level of concern given that community members were not reporting health concerns to the municipality.

Most of the respondents stated that there was a general lack of awareness by the community regarding environmental health issues. Both school employees were interested in working with local government and ATSDR to develop a dialogue with the community regarding how to secure environmental health. Most of the respondents felt that the local government had little in financial resources to address the issues, but they felt that there were plenty of human resources to help educate the community.

Appendix B

ATSDR's Screening Analysis

ATSDR gathers information for the exposure evaluation and gains an understanding of the site and community health concerns, the nature and extent of contamination, and exposure pathways, and begins performing the other scientific component of the public health assessment process—the health effects evaluation. The health effects evaluation consists of two pieces: a screening analysis and, at some sites, based on the results of the screening analysis and community health concerns, a more in-depth analysis to determine possible public health implications of site-specific exposures.

During the public health assessment process, ATSDR typically needs to review large volumes of environmental data and evaluate these data in the context of the site-specific exposure assessment. The *screening analysis* enables ATSDR to sort through the data in a consistent manner to identify substances within completed and potential exposure pathways that may need to be evaluated more closely. This is achieved through the use of health-based "comparison values."

The screening analysis is generally conducted in a step-wise manner:

- Step #1: The *environmental guideline comparison* involves comparing detected substance concentrations to medium-specific comparison values derived from standard exposure default values.
- Step #2: The *health guideline comparison* involves looking more closely as site-specific exposure conditions, estimating exposure doses, and comparing them to dose-based comparison values. (Some health assessors may begin with this step recognizing substance- or site-specific concerns.)

After completing a screening analysis, ATSDR will have divided substances identified at the site into two categories:

- Those not exceeding comparison values and usually requiring no further analysis.
- Those exceeding comparison values and requiring further analysis to evaluate the likelihood of possible harmful effects.

Comparison values are doses (health guidelines) or substance concentrations (environmental guidelines) set well below levels that are known or anticipated to result in adverse health effects. ATSDR and other government agencies have developed these values to help health assessors make consistent decisions about what substance concentrations or dose levels associated with site exposures might require a closer look.

Health guidelines are derived based on data drawn from the epidemiologic and toxicological literature with many uncertainty or safety factors applied to ensure that they are amply protective of human health. ATSDR's minimal risk level (MRL) and EPA's reference doses, reference concentrations, and cancer slope factors are the health guidelines most commonly used in the public health assessment screening process.

Environmental guidelines are derived from the health guidelines and represent concentrations of a substance (e.g., in water, soil, and air) to which humans may be exposed via a particular exposure route during a specified period of time without experiencing adverse health effects. ATSDR's environmental guidelines include environmental media evaluation guides (EMEGs) and cancer risk evaluation guides (CREGs).