HRS DOCUMENTATION RECORD COVER SHEET

Name of Site: Papelera Puertorriquena, Inc.

EPA ID No.: PRD090290685

Date Prepared: April 2009

Contact Persons

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Pathways, Components, or Threats Not Scored

Ground Water Migration Pathway

The ground water pathway was not scored. The surface water pathway score was sufficient to list the site.

Air Migration Pathway

The air migration pathway was not scored. The surface water pathway score was sufficient to list the site.

HRS DOCUMENTATION RECORD

Name of the Site:	Papelera Puertorriquena, Inc.
EPA Region:	2
*Street Address of Site:	RD 111 KM 1.8, Vivi Abajo Ward
City, County, State:	Utuado, Puerto Rico, 00641
General Location in State:	Centrally located in Puerto Rico, in the central/western mountainous region of the island known as La Cordillera Central
Topographic Map:	Utuado, Puerto Rico (Ref. 53)

*Latitude: 18º 15' 54.70" North *Longitude: 66º 41' 41.67" West

Reference for latitude and longitude: Measured from the southeastern corner of the facility, as shown in Reference 4, Figure 1; Reference 52; and Reference 53.

Scores	
Air Pathway	Not Scored
Ground Water Pathway	Not Scored
Soil Exposure Pathway	69.24
Surface Water Pathway	4.59
HRS SITE SCORE	34.69

* - The street address, coordinates, and contaminant locations presented in this Hazard Ranking System (HRS) documentation record identify the general area in which the site is located. They represent one or more locations EPA considers to be part of the site based on the screening information EPA used to evaluate the site for NPL listing. EPA lists national priorities among the known "releases or threatened releases" of hazardous substances; thus, the focus is on the release, not precisely delineated boundaries. A site is defined as where a hazardous substance has been "deposited, stored, placed, or otherwise come to be located." Generally, HRS scoring and the subsequent listing of a release merely represent the initial determination that a certain area may need to be addressed under the Comprehensive Environmental Response, Compensation, and Liability Act. Accordingly, EPA contemplates that the preliminary description of facility boundaries at the time of scoring will be refined as more information is developed as to where the contamination has come to be located.

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from Table 3-1, line 13)	NS	NS
2a.	Surface Water Overland/Flood Migration Component (from Table 4-1, line 30)	4.59	21.0681
2b.	Ground Water to Surface Water Migration Component (from Table 4-25, line 28)	NS	NS
2c.	Surface Water Migration Pathway Score (S_{sw}) Enter the larger of lines 2a and 2b as the pathway score.	4.59	21.0681
3.	Soil Exposure Pathway Score (S_s) (from Table 5-1, line 22)	69.24	4794.1776
4.	Air Migration Pathway Score (S_a) (from Table 6-1, line 12)	NS	NS
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		4815.2457
6.	**HRS Site Score** Divide the value on line 5 by 4 and take the square root	34.69	

Notes:
NS Not scored

TABLE 4-1: SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

Factor categories and factors	Maximum Value	Value Assigned	
Watershed Evaluated:			
Drinking Water Threat			
Likelihood of Release:			
1. Observed Release	550	550	
2. Potential to Release by Overland Flow:			
2a. Containment	10	NS	
2b. Runoff	25	NS	
2c. Distance to Surface Water	25	NS	
2d. Potential to Release by Overland Flow [lines 2a(2b + 2c)]	500	NS	
3.Potential to Release by Flood:			
3a. Containment (Flood)	10	NS	
3b. Flood Frequency	50	NS	
3c. Potential to Release by Flood (lines 3a x 3b)	500	NS	
4. Potential to Release (lines 2d + 3c, subject to a maximum of 500)	500	NS	
5. Likelihood of Release (higher of lines 1 and 4)	550		550
Waste Characteristics:			
6. Toxicity/Persistence	(a)	4×10^3	
7. Hazardous Waste Quantity	(a)	10	
8. Waste Characteristics	100		10
Targets:			
9. Nearest Intake	50	0	
10. Population:			
10a. Level I Concentrations	(b)	0	
10b. Level II Concentrations	(b)	0	
10c. Potential Contamination	(b)	0	
10d. Population (lines 10a + 10b + 10c)	(b)	0	
11. Resources	5	5	
12. Targets (lines 9 + 10d + 11)	(b)		5
Drinking Water Threat Score:			
13. Drinking Water Threat Score [(lines 5x8x12)/82,500, subject to a max of 100]	100		0.33
Human Food Chain Threat			
Likelihood of Release:			
14. Likelihood of Release (same value as line 5)	550		550
Waste Characteristics:			
15. Toxicity/Persistence/Bioaccumulation	(a)	2×10^5	
16. Hazardous Waste Quantity	(a)	10	
17. Waste Characteristics	1000		32
Targets:			
18. Food Chain Individual	50		20
19. Population			
19a. Level I Concentration	(b)		
19b. Level II Concentration	(b)		
19c. Potential Human Food Chain Contamination	(b)		
19d. Population (lines 19a + 19b + 19c)	(b)		
20. Targets (lines 18 + 19d)	(b)		20
Human Food Chain Threat Score:			
21. Human Food Chain Threat Score [(lines 14x17x20)/82500, subject to max of 100]	100		4.26

Environmental Threat			
Likelihood of Release:			
22. Likelihood of Release (same value as line 5)	550		550
Waste Characteristics:			
23. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	5×10^5	
24. Hazardous Waste Quantity	(a)	10	
25. Waste Characteristics	1000		32
Targets:			
26. Sensitive Environments			
26a. Level I Concentrations	(b)		NS
26b. Level II Concentrations	(b)		
26c. Potential Contamination	(b)		
26d. Sensitive Environments (lines 26a + 26b + 26c)	(b)		
27. Targets (value from line 26d)	(b)		
Environmental Threat Score:			
28. Environmental Threat Score [(lines 22x25x27)/82,500 subject to a max of 60]	60		NS
Surface Water Overland/Flood Migration Component Score for a Watershed			
29. Watershed Score[c] (lines 13+21+28, subject to a max of 100}	100		4.59
Surface Water Overland/Flood Migration Component Score			
30. Component Score (S_{sw})[c] (highest score from line 29 for all watersheds evaluated)	100		4.59

[a] Maximum value applies to waste characteristics category
[b] Maximum value not applicable
[c] Do not round to nearest integer
NS = Not Scored

TABLE 5-1: SOIL EXPOSURE PATHWAY SCORESHEET

Factor categories and factors	Maximum Value	Value Assigned	
Likelihood of Exposure:			
1. Likelihood of Exposure	550		550
Waste Characteristics:			
2. Toxicity	(a)	10000	
3. Hazardous Waste Quantity	(a)	10	
4. Waste Characteristics	100		18
Targets:			
5. Resident Individual	50	45	
6. Resident Population:			
6a. Level I Concentrations	(b)		
6b. Level II Concentrations	(b)	527	
6c. Population (lines 6a + 6b)	(b)	527	
7. Workers	15	5	
8. Resources	5		
9. Terrestrial Sensitive Environments	(c)		
10. Targets (lines 5 + 6c + 7 + 8 + 9)	(b)		577
Resident Population Threat Score			
11. Resident Population Threat Score (lines 1 x 4 x 10)	(b)		5712300
Nearby Population Threat			
Likelihood of Exposure:			
12. Attractiveness/Accessibility	100		
13. Area of Contamination	100		
14. Likelihood of Exposure	500		
Waste Characteristics:			
15. Toxicity	(a)		
16. Hazardous Waste Quantity	(a)		
17. Waste Characteristics	100		
Targets:			
18. Nearby Individual	1		
19. Population Within 1 Mile	(b)		
20. Targets (lines 18 + 19)	(b)		
Nearby Population Threat Score			
21. Nearby Population Threat (lines 14 x 17 x 20)	(b)		
Soil Exposure Pathway Score:			
22. Pathway Score[d] (S_s), [lines (11+21)/82,500, subject to max of 100]	100		69.24

[a] Maximum value applies to waste characteristics category
[b] Maximum value not applicable
[c] No specific maximum value applies to factor. However, pathway score based solely on terrestrial sensitive environments is limited to a maximum of 60
[d] Do not round to nearest integer

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Site Summary – Papelera Puertorriquena

Papelera Puertorriquena (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 (Ref. 4, p. 1 and Figures 1 and 2; Ref. 6). Many businesses surround the facility, including the funeral home "Funeraria Trrizarry" 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. At least eight public schools are within 0.5 mile of the facility, and one of them, the Judith A. Vivas Public School, is to the northwest of and within 0.25 mile of the facility (it is adjacent to the funeral home cited above). The university "Colegio del Este" Utuado Campus, where approximately 527 students attend, is on site (Ref. 3, p. 5; Ref. 4, p. 1; Ref. 63, p. 26).

Encompassing approximately 1.60 acres, PPI is located on a property with very steep inclination towards the Vivi River (State Road 111 is above a plateau, while PPI is at the side of the plateau, which slopes abruptly towards the river). The layout of the facility is shown in Reference 4, Figure 2. The facility can be accessed through two gates located on the northeastern side of the property. PPI facilities consist of five four-story, concrete buildings interconnected into one large, E-forming building). This large E-forming building has northwestern (NW), central, southeastern (SE), and southwestern wings. The third and fourth floors of the NW, the center, and the SE Wings are occupied by the university "Colegio del Este," the Puerto Rico Department of Labor, and the "Adminstracion para el Sustento de Menores" (ASUME), respectively (Ref. 3, pp. 4, 5; Ref. 4, Figure 2). All the PPI administrative offices are located in the Central Wing, while manufacturing occurs in the other wings of the PPI building (Ref. 4, p. 1, Figure 2).

PPI has been at this location for approximately 42 years and has been engaged in the manufacture of paper bags (for example, coffee bags, bags for bakery products, rice bags, supermarket bags), cardboard boxes (for example, pizza 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 to manufacture paper bags in 1960 under the name of Puerto Rico Paper, Inc., and then in 1981 started manufacturing also plastic bags under the name of All Plastic Products, Inc. Currently, PPI is part of the "Empresas Rios" corporation under which occur operations of Puerto Rico Paper, Inc. (paper bags manufacturer), Metropolitan Paper (importer of paper-based products such as gift wraps), and All Plastic Products, Inc. (plastic bag manufacturer) (Ref. 3, p. 5; Ref. 4, p. 2).

Water- and oil-based inks, high-density polyethylene (HDPE) pellets (resin pellets), ethyl acetate, and isopropanol, are among the materials and substances currently used in the manufacturing processes (Ref. 3, p. 5; Ref. 4, p. 2). These 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 (Ref. 4, p. 2). In order to manufacture the paper bags, the paper is cut into specific forms and dimensions, glued to form the bag, and then labeled on site. The plastic bags are made inside a machine that melts the resin pellets and produces a thin sheet of plastic. The plastic sheet is then cut into a specific form and dimension, sealed (by applying heat to the side of the bag to be sealed), and then labeled. All the above steps are performed one after the other and inside different machines (Ref. 3, pp. 5, 6; Ref. 4, p. 2).

In March 1998, the PPI facility discharged wastewater containing benzene, toluene, tetrachloroethylene (PCE), ethyl benzene, and trichloroethylene (TCE) to the Vivi River. The release caused a fish kill (Ref. 25, p. 2; Ref. 28, p. 1). Emissions from the facility have impacted the surrounding population. In 2001, students and personnel at a nearby school complained of gas emission by the facility (Ref. 22; Ref. 49).

In November 2005, Puerto Rico Environmental Quality Board (PREQB) Superfund Preliminary Assessment (PA) and Site Inspection (SI) Division conducted a site reconnaissance at PPI. The reconnaissance identified numerous holes in the facility though which hazardous substances and inks used in the manufacturing process could migrate (Ref. 3, pp. 7, 10, 11, 12, 13, 14, 21, 22). The holes in the ground are described as part of the PPI runoff system (Ref. 3, p. 7). Other holes were described as drainage holes in the wall of the facility (Ref. 3, pp, 10, 11, 14). Holes were observed in the floor (Ref. 3, p. 12). Holes were observed in the outdoor storage area where drums containing isopropanol were stored. The holes were drilled for drainage of rainwater and are connected to polyvinyl chloride (PVC) tubes that discharge into the Vivi River (Ref. 3, p. 13). Many of the holes discharge to the Vivi River through drainage ditches (Ref. 3, pp. 13, 65). Inks and stains were observed on the facility floor (Ref. 3, pp. 8, 9, 11, 17). Ink was observed dripping on the facility floor (Ref. 3, pp. 10, 11, 14). Containers, including drums, were observed in poor condition and leaking onto the facility floor (Ref. 3, pp. 9, 11, 17, 18).

These observations led to a screening site inspection (SSI) in January and February 2006 (Ref. 4). Soil samples were collected from stained soil areas, and sediment and surface water samples were collected from the Vivi River. The sampling documented an observed release by chemical analysis to the Vivi River of volatile organic compounds (VOC) and two areas of observed soil contamination. 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. Dos Bocas Dam supplies water to a public supply raw water intake pool for the Superaqueduct system located 6.2 miles (10 kilometers) downstream of Dos Bocas Dam (Ref. 6; Ref. 70). The system supplies drinking water to a population estimated between 1,300,000 and 2,230,000 (Ref. 50; Ref. 36). The university "Colegio del Este" Utuado Campus, where approximately 527 students attend, is within 200 feet of the two areas of observed soil contamination (Ref. 3, p. 5; Ref. 4, p. 1; Ref. 63, p. 26).

In 2008, a site reconnaissance was conducted at PPI to determine the current conditions of the facility. The drums previously observed by PREQB had been removed (Ref. 63, pp. 3, 5). No secondary containment was observed in ink, hazardous materials, and hazardous waste storage areas or in areas where ink was used and observed to leak onto the facility floor (Ref. 3, pp. 9, 10, 11, 14, 15, 16, 18, 60, 63). Numerous discharges were observed from the facility to the exterior ground surface and to drainage ditches that discharged to the Vivi River (Ref. 3, pp. 16, 19, 20, 21, 22, 62, 63, 65, 67 and Figure 2). PREQB observed green-colored discharges from PPI to the Vivi River (Ref. 3, p. 19). The ground surface at the discharge locations was observed to be stained black, green, and dark blue in some places (Ref. 3, pp. 20, 61, 62, 63).

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of source: Backyard
Number of source: 1
Source type: Contaminated Soil

Source 1, located in the backyard of the PPI facility, is an area of PCE soil contamination. Source 1 was initially identified on June 19, 2000, when an environmental consultant to PREQB Arecibo Regional Office collected soil samples from the backyard of the facility below the development room, on the southwest exterior side of the building (Ref. 4, p. 3, Figure 4). The soil samples were collected because PREQB observed holes on the floor in the development room and there was potential for PCE stored in the room to release to the backyard of the building. Additionally, the sink in the development room was observed to drain to one of the holes in the floor (Ref. 4, p. 3). The soil samples revealed 1,2-dichloroethane (DCA) ranging from 0.14 to 0.98 milligrams per liter (mg/L), PCE ranging from 20.7 to 33.9 mg/L, and TCE ranging from 13.8 to 15.9 mg/L (Ref. 33, pp. 1, 2, 4, 6, 7; Ref. 35, pp, 1, 2, 3; Ref. 46, pp. 1, 8, 15, 16, 22, 25, 29, 33; Ref. 62).

The backyard of the PPI facility is defined as a section of the land between the exterior of the SE Wing of the facility building and the Vivi River (Ref. 4, p. 5 and Figure 4). This area is shown on Figure 4 of Reference 4. As shown on Figure 4 of Reference 4, many discharge pipes lead from the southeast side of the building to the backyard. The discharge pipes are labeled on Figure 4 of Reference 4 as Discharges 1, 2, 3, 7, 8, and 9. The developing room is located in the southern corner of the southwestern wing, near the location of Discharge 6 shown in Figure 4 of Reference 4 (Ref. 62). The PCE used in the developing room may have reached Discharge 6, contaminating the soil.

In January 2006, the PREQB Superfund PA/SI Division conducted a SSI at the PPI facility and collected a soil sample (SS-12) from an area of stained soil in the backyard of the facility, between Discharges 1 and 2 (Ref. 4, p. 36, Figure 4; Ref. 62). The location of SS-12 is shown in Figure 4 of Reference 4. The soil samples contained PCE (Table 2 of this documentation record).

Location of source, with reference to a map of the facility: Source 1 (SS-12) is located in the backyard of the SE Wing of the facility (Ref. 4, p. 36, Figure 4; Ref. 33, p. 1; Ref. 62).

Containment:

Release to ground water: The ground water migration pathway was not scored.

Release via overland migration and/or flood: No maintained engineered cover or functioning and maintained run-on control system and runoff management system are documented at Source 1. As shown in Reference 63 (p. 9, 22, 40), surface water runoff from Source 1 flows directly to the Vivi River. A map of the drainage from PPI identifies sewers that discharge directly into the Vivi River (Ref. 72, pp. 25, 98). Observations of the surface soil sampling location SS-12 indicated no surface water containment (Ref. 63, p. 40). Therefore, a containment factor value for the surface water migration pathway is assigned a value of 10 (Ref. 1, Table 4-2).

Gas release to air: The gas release to air migration pathway was not scored.

Particulate release to air: The particulate release to air migration pathway was not scored.

2.4 WASTE CHARACTERISTICS

2.4.1 HAZARDOUS SUBSTANCES

On June 19, 2000, an environmental consultant to PREQB Arecibo Regional Office collected soil samples from the ground in the backyard below the development room. The soil samples were determined to contain 1,2-DCA at 0.98 mg/L, PCE ranging from 20.7 to 29.8 mg/L, TCE ranging from 13.8 to 105.9 mg/L, and methyl ethyl ketone ranging from 2.5 to 2.91 mg/L. The samples were submitted to a laboratory for EPA's Toxicity Characteristics Leaching Procedure (TCLP) analysis (Ref. 33, pp. 1, 2, 4, 7; Ref. 46, pp. 1, 8, 15, 16, 22, 25, 29, 33). The facility is known to use PCE (Ref. 4, p. 3). TCE is a common degradation product of PCE (Ref. 60). Biodegradation of PCE produces TCE (Ref. 67, p. 23; Ref. 69, p. 191). TCE is often found as a contaminant along with PCE (Ref. 69, pp. 100, 209).

In January 2006, the PREQB Superfund PA/SI Division conducted a SSI at the PPI facility (Ref. 4, p. 14). PREQB followed the QAPP for screening site inspections (Ref. 75). As part of the investigation, a soil sample (SS-12) was collected from an area of stained soil located in the backyard of the facility between Discharges 1 and 2 (Ref. 4, Figure 4; Ref. 62). The trip report summarizing the investigation is provided as Reference 9. Photographs of the sampling are provided in Reference 10. The soil sample was analyzed under EPA's Contract Laboratory Program (CLP) for target compound list (TCL) VOCs using EPA Statement of Work SOM 01.1 (Ref. 37, pp. 2, 7, 11, 15). The data validation report for the background soil sample SS-01 (B1MJ7) is presented in Reference 37, pages 1 through 6, pages 19 through 42, and pages 109 through 111. The data validation report for soil sample SS-12 (B1MK8) is presented in Reference 37, pages 493 through 502, 516 through 628, and 632 through 634. Table 1 describes the background and release soil samples. Table 2 summarizes the concentrations of hazardous substances detected in the soil sample. The background and contaminated surface soil samples are similar because the samples were collected using the same methods and during the same time frame (Ref. 8, pp. 20, 21; Ref. 7, p. 43); were analyzed using the same methods (Ref. 37); and were collected from a similar soil type (Ref. 56; Ref. 4, Figure 4; Ref. 63, p. 37; Ref. 64, pp. 1, 3; Ref. 65; Ref. 71). A description of the soil surrounding PPI and in the area of contaminated surface soil sample SS-12 was obtained during a 2008 site reconnaissance (Ref. 63, p. 37). The soil description matches the description for the Vivi soil series (Ref. 63, p. 37; Ref. 64; Ref. 71). The background sample was collected from the Pellejas series (Ref. 64). The Vivi series is similar to the Pellejas series. Both series are loams that contain organic material (roots) and are strongly acidic (Ref. 65; Ref. 71).

TABLE 1
SOURCE 1 – 2006 SOIL SAMPLE LOCATIONS

Sample Identification	Sample Depth	Sample Description	Location	Reference
SS-01 (Background)	0 – 12 inches below ground surface	Loose light brown to brown	Background soil sample. Grab sample collected off site from a location to the north, within a 0.25-mile radius from the PPI facility and presumed out of the influence of site activities and contamination.	4, p. 35, Figure 3; 8, pp. 20, 21
SS-12 (Source 1)	0 – 12 inches below ground surface	Loose brown soil	Grab sample collected on site from an area of the ground to the northwest of Discharge 2, where stained soil had been observed on November 10 and 22, 2005, halfway between Discharges 1 and 2. This sample was collected to determine the type and concentration of contaminants.	4, p. 36, Figure 4; 7, p. 43

TABLE 2
SOURCE 1 – 2006 SOIL SAMPLE ANALYTICAL RESULTS

Sample Identification	CLP Sample Number	Sample Date	Hazardous Substance	Con-centration (µg/kg)	SQL (µg/kg)	References
SS-01 (Background)	B1MJ7	1/31/2006	Tetra-chloroethylene	ND	5.9	4, p. 43; 8, pp. 20, 21; 10, pp. 2, 15, 16; 37, p. 121; 68; 77, pp. 29, 30
SS-12 (Source 1)	B1MK8	2/06/06	Tetra-chloroethylene	11	4.8	4, p. 43; 7, p. 43; 10, pp. 8, 50, 51; 37, pp. 677; 68 77, pp. 21, 22, 23

Notes:
µg/kg Micrograms per kilogram
CLP Contract Laboratory Program
ND Not detected at or above the adjusted SQL
SQL Sample quantitation limit
SS Surface soil

Tetrachloroethylene is also referred to as tetrachloroethene and PCE.

The data validation report for the background soil sample SS-01 (B1MJ7) is presented in Reference 37, pages 1 to 6, pages 19 to 42, and pages 109 to 111. The data validation report for soil sample SS-12 (B1MK8) is presented in Reference 37, pages 493 to 502, 516 to 628, and 632 to 634.

2.4.2.1 SOURCE HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support evaluation of the hazardous constituent quantity for Source 1.

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is not sufficient to adequately support evaluation of the hazardous waste stream quantity for Source 1.

2.4.2.1.3 Volume

The information available is not sufficient to adequately support evaluation of the volume for Source 1.

2.4.2.1.4 Area

As documented in Table 2, the soil sample collected from Source 1 revealed the presence of PCE in surface soil. The area of soil contamination associated with Source 1 is undetermined but greater than zero, and is assigned a hazardous waste quantity (HWQ) value of > 0 (Ref. 1, Table 2-5).

Area Assigned Value: >0

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source area HWQ value for Source 1 is assigned a value of >0 (Ref. 1, Table 2-5).

Source HWQ Value: >0

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of source: Contaminated soil, east side of the SE Wing of the facility
Number of source: 2
Source type: Contaminated Soil

Source 2 is an area of soil contaminated with PCE and butylbenzylphthalate, as documented in Table 4 of this documentation record. In January 2006, the PREQB Superfund PA/SI Division conducted a SSI at the PPI facility. The goals of the investigation were to collect sufficient information regarding PPI to assess the current conditions at the facility and to determine the need for additional investigation (Ref. 4, p. 14). As part of the investigation, soil samples were collected from areas of stressed vegetation located on the southeast side of the SE Wing of the facility, topographically downgradient of Discharges 4, 5, 10, 11, and 12, and on the east side of a concrete ditch that receives Discharge 5 (Ref. 4, Figure 4; Ref. 62). The soil samples include SS-6, SS-7, and SS-14. As shown in Figure 4 of Reference 4, the soil sampling locations are affected by discharges from the facility on the southeast side of the SE Wing of the facility. Soil sampling location SS-6 receives discharge from discharges 5, 10, 11, and 12. Soil sampling locations SS-7 and SS-14 receive discharges from discharges 4, 5, 10, 11, and 12. As documented in Table 4, the soil samples contain a similar contaminant, PCE. Butylbenzylphthalate was detected in SS-06 at 270 micrograms per kilogram (μg/kg). PCE was detected in the soil samples at up to 2,400 μg/kg. PCE and butylbenzylphthalate were not detected in the background sample (see Table 4).

Source 2 soil samples were collected from a small corridor between the SE Wing of PPI building and the adjacent property. Observations of the corridor included: six corroded 55-gallon metal drums on the ground; stained soil (blue and black stains); three areas of stressed vegetation; partially buried concrete septic tank; and five plastic PVC tubes from beneath the PPI building and from the septic tank that discharge liquids directly into both the ground and the concrete ditch (Ref. 4, p. 5 and Figure 4; Ref. 62).

Contamination at Source 2 location resulted from the use of PCE in the manufacturing process at the facility, discharges from the facility, and storage of drums in the area of Source 2 (Ref. 4, pp. 2, 3, 4, and 5).

Location of source, with reference to a map of the facility: Source 2 is located on the southeast side of the SE Wing of the facility at sampling locations SS-6, SS-7, and SS-14─shown in Figure 4 of Reference 4 and Reference 62.

Containment:

Release to ground water: The ground water migration pathway was not scored.

Release via overland migration and/or flood: As documented in Table 4, surface soil samples collected from Source 2 on the southeast side of the SE Wing of the facility and on the east side of a concrete ditch contained PCE and butylbenzylphthalate. The sampling locations include SS-6, SS-7, and SS-14. Observations during a 2008 site reconnaissance indicated that the area of contaminated soil had no maintained engineered cover or functioning and maintained run-on control system and runoff management system (Ref. 63, pp. 23, 24, 39, 40). Therefore, a containment factor value for the surface water migration pathway is assigned a value of 10 (Ref. 1, Table 4-2).

Gas release to air: The gas release to air migration pathway was not scored.

Particulate release to air: The particulate release to air migration pathway was not scored.

2.4 WASTE CHARACTERISTICS

2.4.1 HAZARDOUS SUBSTANCES

In January 2006, the PREQB Superfund PA/SI Division conducted a SSI at the PPI facility (Ref. 4, p. 14). PREQB followed the QAPP for SSIs (Ref. 75). As part of the investigation, soil samples were collected from the southeast side of the facility, topographically downgradient of Discharges 4, 5, 10, 11, and 12, and on the east side of a concrete ditch that receives Discharge 5 (Ref. 4, Figure 4). The Trip Report summarizing the investigation is provided in Reference 9. Photographs of the sampling are provided in Reference 10. The soil samples were analyzed under EPA's CLP program for TCL organics using EPA Statement of Work SOM 01.1 (Ref. 37, pp. 1, 7, 11, 15). The data validation report for the soil samples is presented in Reference 37, pages 1 through 10, pages 19 through 42, and pages 109 through 114. Table 3 provides a description of the background and release (source) soil samples. Table 4 summarizes the concentrations of hazardous substances detected in the soil sample. The background and contaminated surface soil samples are similar because the samples were collected using the same methods and during the same time frame (Ref. 8, pp. 20, 25, 31, 33); were analyzed using the same methods (Ref. 37); and were collected from a similar soil type (Ref. 56; Ref. 4, Figure 4; Ref. 63, pp. 8, 37; Ref. 64, pp. 1, 3; Ref. 65; Ref. 71). A description of the soil surrounding PPI and in the area of contaminated surface soil samples (SS-06, SS-07, and SS-14) was obtained during a 2008 site reconnaissance (Ref. 63, pp. 8, 37). The soil description matches the description for the Vivi soil series (Ref. 63, pp. 8, 37; Ref. 64; Ref. 71). The background sample was collected from the Pellejas series (Ref. 64). The Vivi series is similar to the Pellejas series. Both series are loams that contain organic material (roots) and are strongly acidic (Ref. 65; Ref. 71).

TABLE 3
SOURCE 2 – 2006 SOIL SAMPLE LOCATIONS

Sample Identification	Sample Depth (inches bgs)	Sample Description	Location	Reference
SS-01 (Background)	0 – 12	Loose light brown to brown	Background soil sample. Grab sample collected off site from a location to the north, within a 0.25-mile radius from the PPI facility and presumed to be out of the influence of site activities and contamination.	4, p. 35, Figure 3; 8, pp. 20, 21
SS-06 (Source 2)	0 – 12	Loose dry and black with debris pieces	Grab sample collected on site from an area with stressed vegetation adjacent and to the southeast of Discharge #5. This sample was collected to determine the type and concentration of contaminants.	4, p. 35, Figure 4; 8, pp. 31, 32
SS-07 (Source 2)	0 – 12	Loose soil light brown to brown	Grab sample collected on site from an area with stressed vegetation to the southwest of and within 5 feet from where sample SS-06 was collected. The area with stressed vegetation from where this sample was collected is between Discharge 4 and the southern corner of the PPI building. This sample was collected to determine the type and concentration of contaminants.	4, p. 35, Figure 4; 8, pp. 23, 24

Sample Identification	Sample Depth (inches bgs)	Sample Description	Location	Reference
SS-14 (Source 2)	0 – 12	Brown soil based on photograph	Grab sample collected on site from the ground within 200 feet and to the south of the PPI building southern corner, from an area where liquids released from Discharges 4 and 5 flow just before they fall into the Vivi River. This sample was collected to determine the type and concentration of contaminants.	4, p. 36, Figure 4; 8, pp. 33, 34; 10, pp. 3, 4, 23, 24

Notes:
bgs Below ground surface

TABLE 4
SOURCE 2 – 2006 SOIL SAMPLE ANALYTICAL RESULTS

Sample Identification	CLP Sample Number	Sample Date	Hazardous Substance	Con-centration (µg/kg)	SQL or CRQL (µg/kg)	References
SS-01 (Background)	B1MJ7	1/31/06	Tetrachloroethylene	ND	5.9	4, p. 43; 8, pp. 20, 21; 10, pp. 2, 15, 16; 37, p. 121; 68; 77, pp. 29, 30
SS-01 (Background)	B1MJ7	1/31/06	Trichloroethene	ND	5.9	4, p. 43; 8, pp. 20, 21; 10, pp. 2, 15, 16; 37, p. 121; 68; 77, pp. 29, 30
SS-01 (Background)	B1MJ7	1/31/06	Butylbenzylphathalate	ND	200	4, p. 43; 8, pp. 20, 21; 10, pp. 2, 15, 16; 37, p. 166; 68; 77, pp. 29, 30
SS-06 (Source 2)	B1MK2	1/31/06	Tetrachloroethylene	35	7.2	4, p. 43; 8, pp. 31, 32; 10, pp. 3, 22; 37, p. 136; 68; 77, pp. 29, 30
SS-06 (Source 2)	B1MK2	1/31/06	Butylbenzylphthalate	270	230	4, p. 43; 8, pp. 31, 32; 10, pp. 3, 22; 37 p. 181; 68; 77, pp. 29, 30
SS-07 (Source 2)	B1MK3	1/31/06	Tetrachloroethylene	2,400 D	5 (CRQL)	4, p. 43; 8, pp. 23, 25; 10, pp. 2, 17, 18; 37, p. 139; 68; 77, pp. 29, 30
SS-07 (Source 2)	B1MK3	1/31/06	Trichloroethene	7.5	5.5	4, p. 43; 8, pp. 23, 25; 10, pp. 2, 17, 18; 37, p. 109, 139; 68; 77, p. 29, 30
SS-14 (Source 2)	B1MP1	1/31/06	Tetrachloroethylene	22	7.3	4, p. 43; 8, pp. 33, 34; 10, pp. 3, 4, 23, 24; 37, p. 163; 68; 77, pp. 29, 30

Notes:
µg/kg Micrograms per kilogram
SQL Sample Quantitation Limit
CLP Contract Laboratory Program
ND Not detected at or above the adjusted CRQL
SQL Sample quantitation limit
SS Surface soil
D Sample diluted
Reference 37 refers to tetrachloroethylene as tetrachloroethene.
The data validation report for the background soil sample SS-01 (B1MJ7) is presented in Reference 37, pages 1 to 10, pages 19 to 67, and pages 109 to 115.

2.4.2.1 SOURCE HAZARDOUS WASTE QUANTITY

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support evaluation of the hazardous constituent quantity for Source 2.

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is not sufficient to adequately support evaluation of the hazardous waste stream quantity for Source 2.

2.4.2.1.3 Volume

The information available is not sufficient to adequately support evaluation of the volume for Source 2.

2.4.2.1.4 Area

As documented in Table 4 of this documentation record, soil samples collected from Source 2 revealed the presence of PCE and butylbenzylphthalate in surface soil. The area of contamination cannot be determined because the soil samples were collected in a straight line. Therefore, the area of observed contamination associated with Source 2 is undetermined but greater than zero, and is assigned a HWQ value of > 0 (Ref. 1, Table 2-5).

Area Assigned Value: >0

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source area HWQ value for Source 2 is assigned a value of >0 (Ref. 1, Table 2-5).

Source HWQ Value: >0

2.2 SOURCE CHARACTERIZATION

2.2.1 SOURCE IDENTIFICATION

Name of source: Discharge from the facility
Number of source: 3
Source type: Other

On March 14, 1998, personnel from the Emergency Response Division of the PREQB Arecibo Regional Office responded to a discharge of solvents into the Vivi River from PPI (Ref. 4, p. 10; Ref. 25, pp. 1, 2, 3; Ref. 26, pp. 1, 2; Ref. 27, pp. 1, 2). Photographs of the discharge show the discharge originating from under the PPI facility, flowing into a concrete drainage ditch, and finally to the Vivi River (Ref. 25, p. 5; Ref. 26, p. 3). The discharge appeared to contain dye (Ref. 25, p. 3). The constituents of the discharge included toluene (up to 14,597 micrograms per liter [µg/L]), PCE (up to 421.5 µg/L), ethylbenzene (up to 477 µg/L), and TCE (up to 157.5 µg/L) (see Table 9; Ref. 28, pp. 1, 2, 3, 7; Ref. 30, p. 3; Ref. 31).

Location of source, with reference to a map of the facility: The photographs of the discharge indicate the discharge location on the northern bank of the Vivi River. The ditch containing the discharge extends from the facility (north) to the Vivi River (South) (Ref. 4, Figure 4; Ref. 25, pp. 2, 3, 4).

Containment:

Release to ground water: The ground water migration pathway was not scored.

Release via overland migration and/or flood: The discharge flowed directly to a ditch and finally the Vivi River (Ref. 25, p. 4). Therefore, a containment factor value for the surface water migration pathway is assigned a value of 10 (Ref. 1, Table 4-2).

Gas release to air: The gas release to air migration pathway was not scored.

Particulate release to air: The particulate release to air migration pathway was not scored.

2.4 WASTE CHARACTERISTICS

2.4.1 HAZARDOUS SUBSTANCES

On March 14, 1998, personnel from the Emergency Response Division of the PREQB Arecibo Regional Office responded to a discharge of solvents into the Vivi River from PPI (Ref. 4, p. 10; Ref. 25, pp. 1, 2, 3; Ref. 26, pp. 1, 2; Ref. 27, pp. 1, 2). The constituents of the discharge included toluene (up to 14,597 µg/L), PCE (up to 421.5 µg/L), ethylbenzene (up to 477 µg/L), and TCE (up to 157.2 µg/L) (Ref. 28, pp. 1, 2, 3, 7; Ref. 30, p. 3; Ref. 31). The discharge appeared to contain dye (Ref. 25, p. 3; Ref. 26, p. 3). The samples were analyzed using EPA Method 624 (Ref. 28, p. 1; Ref. 51). A summary of the concentrations of hazardous substances detected in the sample of the discharge is provided in Table 5.

TABLE 5
HAZARDOUS SUBSTANCES DETECTED
IN RELEASE TO THE VIVI RIVER

Sample Identification	Hazardous Substance	Conc. Adjusted For Dilution Factor (µg/L)	Method Detection Limit (Ref. 51) (µg/L)	References
Canal Descarga E1 (concrete ditch over which the liquids were discharged)	toluene	14,597	6	4, p. 10; 28, p. 1. 3; 51, p. 2
Canal Descarga E1 (concrete ditch over which the liquids were discharged)	tetrachloro-ethylene	185	4.1	4, p. 10; 28, p. 1, 3; 51, p. 2
Canal Descarga E1 (concrete ditch over which the liquids were discharged)	ethylbenzene	477	7.2	4, p. 10; 28, p. 1, 3; 51, p. 2
Cuerpo Receptor E2 (point of entry to Vivi River)	toluene	1,464	6	4, p. 10; 28, p. 1, 7; 51, p. 2
Cuerpo Receptor E2 (point of entry to Vivi River)	tetrachloro-ethylene	421.5	4.1	4, p. 10; 28, p. 1, 7; 51, p. 2
Cuerpo Receptor E2 (point of entry to Vivi River)	ethylbenzene	144	7.2	4, p. 10; 28, p. 1, 7; 51, p. 2
Cuerpo Receptor E2 (point of entry to Vivi River)	trichloro-ethylene	157.50	1.9	4, p. 10; 28, p. 2, 7; 51, p. 2

Notes:
µg/L Micrograms per liter
Conc. Concentration

2.4.2 HAZARDOUS SUBSTANCES

2.4.2.1 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support evaluation of the hazardous constituent quantity for Source 3.

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is not sufficient to adequately support evaluation of the hazardous waste stream quantity for Source 3.

2.4.2.1.3 Volume

The information available is not sufficient to adequately support the volume for Source 3; however, a discharge containing hazardous substances flowed to the Vivi River (Ref. 4, p. 10; Ref. 25, pp. 1, 2, 3; Ref. 26, pp. 1, 2; Ref. 27, pp. 1, 2; Table 5 of the HRS documentation record). Therefore, the volume of the discharge associated with Source 3 is undetermined but greater than zero, and is assigned a HWQ value of > 0 (Ref. 1, Table 2-5).

Volume Assigned Value: >0

2.4.2.1.4 Area

Not applicable.

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source volume HWQ value for Source 3 is assigned a value of >0 (Ref. 1, Table 2-5).

Source HWQ Value: >0

Table 6 is a summary of source descriptions.

Table 6
Summary of Source Descriptions

Source No.	Source Hazardous Waste Quantity Value	Source Hazardous Constituent Quantity Complete? (Y/N)	Containment Factor Value by Pathway				
			Ground Water (GW) (Table 3-2)	Surface Water (SW)		Air	
				Overland/ flood (Table 4-2)	GW to SW (Table 3-2)	Gas (Table 6-3)	Particulate (Table 6-9)
1	> 0	No	Not Scored	10	Not Scored	Not Scored	Not Scored
2	> 0	No	Not Scored	10	Not Scored	Not Scored	Not Scored
3	> 0	No	Not Scored	10	Not Scored	Not Scored	Not Scored

OTHER POSSIBLE SOURCES

Two underground injection control (UCI) systems on site consist of two septic tanks. During the November 2005 PREQB site reconnaissance, liquids were observed coming out of three plastic tubes connected to the septic tank inside the southwestern wing. The liquids were observed to fall directly onto both the ground and a concrete ditch next to the septic tank (Discharges 10, 11, 12 in Figure 2 of Reference 3). The ground where the discharge was falling had blue to black stains, and the water reaching the ditch flowed downhill to the Vivi River (Ref. 3, p. 63; Ref. 4, pp. 8, 10, 11, 13). A sample of the sludge from the septic tank was determined to contain benzene (156.2 parts per million [ppm]), chromium (9.8 ppm), copper (10.89 ppm), and nickel (17.22 ppm) (Ref. 4, p. 12). PREQB personnel observed the contents of one of the septic tanks ("underground tank used for the collection of stormwater") discharging into the Vivi River on June 13, 2005 (Ref. 59, p. 2). Releases from the septic systems are possible sources of surface water contamination in the Vivi River.

Two areas on the facility are covered with vegetation (Ref. 4, Figure 2). One of them is a small corridor on the east side of the PPI building. The other is in the backyard located between the southwestern wing and the Vivi River. During the visual inspections of November 10 and 22, 2005, the following were observed in the corridor on the east side of the facility: six corroded, 55-gallon metal drums placed directly over the ground; stained soil (blue to black stains); and three areas with stressed vegetation (Ref. 3, p. 63, 64, Figure 2; Ref. 4, Figure 2).

The vegetated area located in the backyard of PPI's property begins at the PPI building southwestern wing and reaches the ground along the river border (Ref. 4, Figure 2). During the two visual inspections of November 10 and 22, 2005, two areas with stressed vegetation and four areas with stained soil (green, blue, and black stains) were observed in the backyard (Ref. 3, pp. 21, 31, 61, 62; Ref. 4, Figure 2). In addition, unidentified liquids coming out of many holes in the floors and walls were observed, along with 15 plastic PVC tubes projecting out from beneath the PPI building and from the 2nd and 3rd floors of the southwestern and SE wings (Ref. 3, pp. 19, 20, 21, 22, 65, 66, 67; Ref. 4, Figure 2, Discharges 1 through 12). These liquids were falling directly onto the ground in the two vegetated areas described above (Ref. 4, Figure 2). Based on the topography of the facility, these liquids reached the Vivi River at six different points of probable entry (PPE) (Ref. 4 Figure 2, PPEs 1 through 6) (Ref. 4, p. 6; Ref. 3, pp. 31, 32, 61 through 72). These plastic tubes are part of the PPI runoff system, which consists of the following: one sewer between the Central and the SE Wing (within less than 32 meters from and adjacent to the washing room); one 20-inch-diameter plastic tube at the entrance to the southwestern wing (between the Central and NW Wing); and many interconnected plastic PVC tubes that receive liquids from the many holes drilled all around the different floors of the building. All of the water collected by this runoff system falls into the ground of the backyard and flows towards the Vivi River (Ref. 3, pp. 15, 18, 20, 21, 22, 66 and Figure 2; Ref. 4, p. 6).

An enclosed outdoor storage area, shed, is located on the second floor of the southwestern wing; it is adjacent and to the southeast of the plastic bags manufacturing area. This outdoor storage area is approximately 8 ft high, 8 ft wide, and 24 ft long. This room is poorly maintained (unpainted wood walls, ink dripping stains on all the walls, and a metal roof with many holes in it), is divided into three interior rooms, and has 2-ft-high concrete containment walls. The 2-ft-high containment walls have a hole at the entrance of the room, and liquids were observed coming out from the hole and into the outdoor concrete platform during the visual inspections of November 10 and 22, 2005 (Ref. 3, pp. 12, 13, and Figure 2). During the same inspections, PREQB observed inside this room eight metal and two plastic 55-gallon metal drums containing isopropanol (97% isopropanol, 3% ethyl acetate), 10 55-gallon metal drums with ethyl acetate,

and 80 unlocked, unlabeled, 5-gallon metal containers holding ink. More than 100 5-gallon ink containers (with dripping stains) and 10 metal 55-gallon drums with known contents (e.g., ethyl acetate and isopropanol) or unknown contents (unlabelled drums) were also observed scattered all over the concrete platform of this outdoor storage area. In the concrete platform of this outdoor storage area are at least 10 holes in the floor (part of the runoff system discharging into the backyard). Six holes were also observed at the bottom of the walls bordering the platform. No secondary containment system is in this outdoors storage area to prevent liquid spilled from or leaking from the drums, containers, or the storage room from flowing into the holes (both in the floor and in the bottom of the walls) and reaching the Vivi River (Ref. 3, pp. 13, 14, 18, 60; Ref. 4, p. 7).

An indoor storage area is located inside the first floor of the southwestern wing. Approximately 160 55-gallon drums labeled as containing isopropanol or ethyl acetate, and approximately 700 5-gallon ink containers (plastic or metal) were observed by PREQB in November 2005. Some of the drums or containers were placed over wood palettes, while others were directly over the floor. Most of the drums and ink containers were open, piled on top of each other, corroded, bulging, covered with a plastic sheet, and labeled as flammable. Many of the 5-gallon ink containers were dripping onto the floor. Many blue, green, red, and pink ink stains were observed on the floor. The storage area had no containment system (Ref. 3, p. 60).

During the PREQB site reconnaissance of November 10 and 25, 2005, PREQB observed 12 discharge locations from the PPI to the Vivi River. The locations of the discharges are shown on Figure 2 of Reference 3 and are summarized as follows:

- Discharge 1 includes three elevated, 12-inch-diameter PVC tubes that exit the facility on the west side. Green liquid flows out the tubes and into a concrete ditch and the ground adjacent to the tubes. The ditch extends west to the ground adjacent to the Vivi River. The concrete ditch and the ground next to the ditch are stained green and blue (Ref. 3, pp. 19, 61, 62, 69, 76).

- Discharge 2 is a 1- to 2-inch-diameter elevated PVC tube that exits the facility on the southeast side. The pipe discharges directly to the ground, and flow follows along a depression on the ground to the Vivi River. The ground adjacent to the tube is stained black and green (Ref. 3, pp. 20, 62, 70, 77).

- Discharge 3 is a 12-inch-diameter PVC tube located on the second floor of the southwest wing of the facility. The tube discharges to ground (Ref. 3 p. 21).

- Discharges 4 and 5 are 2- to 3-inch-diameter PVC tubes located on the southeastern wall of the southeast wing of the facility. The tubes discharge directly to the ground, and flow follows to a concrete ditch or to the ground that slopes towards the Vivi River; flow then continues to the Vivi River (Ref. 3, pp. 20, 72, 87). Stressed vegetation was observed on the ground adjacent to the concrete ditch and between Discharges 4 and 5 (Ref. 3, pp. 21, 62, 64, 70, 71, 78, 80, 82, 83). Reference 3, Figure 2 identifies two different outfall pipes as Discharge 5. One is located on the southeast wall and one on the southwest wall of the facility. Reference 4, Figure 4, identifies Discharge 5 on the southeast wall of the facility. Discharge 5 is considered to be on the southeast wall of the facility.

- Discharges 6, 7, and 8 are located on the southwestern wall of the facility, and discharge to the ground surface (Ref. 3, pp. 21, 65, 66, 71, 72, 84, 85, 86, 87).

- Discharge 9 is an 18- to 20-inch-diameter plastic tube from the northwestern wall of the facility that discharges directly onto the concrete-covered ground surface; the discharge reaches the Vivi River through a crack in the concrete. The discharge also reaches a concrete ditch containing blue to black sludge (Ref. 3, pp. 22, 66, 67, 71, 72, 86, 89).

- Discharges 10, 11, and 12 were observed on the northeast corner of the facility (Ref. 3, Figure 2). These are three 2- to 3-inch-diameter PVC tubes discharging dark blue to black slimy substance directly to the ground (Ref. 3, pp. 63, 70, 78, 79, 80, 81).

Further evidences that the discharges contain hazardous substances are stained soils and stressed vegetation at the discharge locations (Ref. 3, pp. 19, 20, 21, 61, 62, 63, 64, 70, 71, 76, 77, 78, 79, 80, 81, 83).

The constituents of the discharges from the facility have not been fully characterized. However, potential for the discharges to contain hazardous substances exists because hazardous substance storage areas in the facility are not contained; these hazardous substances could be released from the facility through the abovementioned discharges. Holes in the facility have been documented to lead to the discharges (Ref. 3, pp. 7, 10, 11, 12, 13, 14, 19, 21, 22).

Hazardous wastes at the PPI facility are not properly stored or contained, allowing for the possibility of migration off site. On February 11, 1998, personnel from the PREQB Arecibo Regional Office conducted a visual inspection of PPI. Violations of Rule 533 of the PREQB Regulation for the Management of non-hazardous solid wastes (i.e., inadequate storage and disposition of inks and chemicals) were found. Among the hazardous substances observed stored during this inspection were ammonia, butanol, ethyl acetate, sodium cyanide, sulfuric acid, and PCE (Ref. 4, p. 23). The drums (storage containers) were observed dripping, leaking, and corroded, and were not labeled. The room in which the drums were stored lacked ventilation and a secondary containment system (Ref. 4, p. 10; Ref. 13, p. 1; Ref. 24, pp. 1, 2, and 4). These substances have the potential to enter the discharge from the facility.

Wastewaters containing inks, solvents, and oil have entered the discharges (Ref. 4, pp. 9, 10; Ref. 11; 12; 15; 16; 17; 18; 23; 26, pp. 1, 2, 3). Discharges from the facility have resulted in fish kills, indicating that the discharges contain hazardous substances (Ref. 4, p. 10; Ref. 26, pp. 1, 2, 3, 4).

4.0 SURFACE WATER MIGRATION PATHWAY

4.1 OVERLAND/FLOOD MIGRATION COMPONENT

4.1.1 GENERAL CONSIDERATIONS

During the site inspection of May 7, 2001, PREQB personnel inspected the area under the development (plate) room. PREQB observed spills marks on the column of the building and holes in the development (plate) room floor. According to the PPI president, Mr. Rios, the holes in the floor of the plate room had been placed to drain water entering the plate room from the Vivi River during major rain events. The locations where the excavated TCE- and PCE-contaminated soils were present also floods during the rain events (Ref. 66, p. 3). The facility is located within a 100-year flood plain (Ref. 5). Sources on the facility can be flooded. The overland migration pathway, 15-mile target distance limit (TDL), and observed releases to surface water are described in the sections below.

4.1.1.1 DEFINITION OF HAZARDOUS SUBSTANCE MIGRATION PATH FOR OVERLAND/FLOOD COMPONENT

Two PPEs are evident for hazardous substances to migrate from Sources 1, 2, and 3 into the Vivi River. Surface water runoff from SS-06 (Source 2) follows the contours of the land (overland path) towards Source 2 soil sampling locations SS-07 and SS-14 approximately 65 feet south to the Vivi River at PPE-1 (Ref. 63, pp. 39, 40, and 42). The discharge which is evaluated as Source 3 flowed into a concrete ditch and then followed the contour of the land to also discharge to PPE-1 (Ref. 4, Figure 4; Ref. 25, p. 5; Ref. 26, p. 3). Surface water runoff from Source 1, soil sampling location SS-12, follows the contours of the land and flows approximately 30 feet to the south to the Vivi River at PPE-2 (Ref. 63; pp. 40, 42). Table 7 documents locations of the PPEs. The PPEs are locations where runoff and discharge from sources enter the Vivi River. The 15-mile downstream TDL includes the distance between PPE-1 and PPE-2, and 15 miles downstream from PPE-2; it is shown in Reference 6.

TABLE 7
PROBABLE POINTS OF ENTRY

Probable Point of Entry	Location	Description	Reference
PPE-1	PPE-1 is the most upstream PPE	Surface water runoff from Source 2 soil sampling locations SS-06, SS-07, and SS-14 and Source 3 flows approximately 65 feet to PPE-1. *	4, Figures 2 and 4; 6; 63, pp. 39, 40, and Figure 1
PPE-2	PPE-2 is the most downstream PPE	Surface water runoff from Source 1 soil sampling location SS-12 flows approximately 30 feet to PPE-2. **	4, Figures 2 and 4; 6; 63, p. 40 and Figure 1

Note:
PPE Probable point of entry
* PPE 1 in this HRS documentation record and Reference 6 is PPE 6 in Reference 4, Figure 4.
** PPE 2 in this HRS documentation record and Reference 6 is PPE 4 in Reference 4, Figure 4.

4.1.1.2 Target Distance Limit

The TDL includes surface water located between the most upstream PPE (PPE-1) and 15 miles downstream of the most downstream PPE (PPE-2) (Ref. 1, Section 4.1.1.2). The 15-mile downstream TDL is illustrated in Reference 6; it consists of the Vivi River flowing for 0.9 mile northwest into the Rio Grande de Arecibo from PPE-1. The Rio Grande de Arecibo flows into the Dos Bocas Lake at approximately 8 miles downstream from the confluence of the Vivi River and the Rio Grande de Arecibo (Ref. 4, pp. 17, 54). Dos Bocas Lake has a dam at the southern end, 9 miles downstream from PPE-1. The dam discharges to the downstream segment of Rio Grande de Arecibo, which completes the 15-mile TDL. Table 8 summarizes the surface water bodies within the 15-mile TDL.

TABLE 8
SURFACE WATER BODIES WITHIN 15-MILE TDL

Surface Water Body	In Water Segment Downstream from PPE-1 (miles)	Reference
Vivi River	0.9	4, p. 17; 6
Rio Grande de Arecibo	0.9 to 7	4, p. 17; 6
Dos Bocas Lake	7 to 9	4, p. 17; 6
Rio Grande de Arecibo	9 to 15	4, p. 17; 6

Note:
PPE Probable point of entry

4.1.2.1 LIKELIHOOD OF RELEASE

An observed release to Vivi River is documented in the sections below.

4.1.2.1.1 Observed Release

An observed release by both direct observation and chemical analysis is documented in the sections below for the Vivi River.

Direct Observation

On March 14, 1998, personnel from the Emergency Response Division of the PREQB Arecibo Regional Office, responded to a discharge of solvents into the Vivi River from PPI (Ref. 4, p. 10; Ref. 25, pp. 1, 2, 3; Ref. 26, pp. 1, 2; Ref. 27, pp. 1, 2). The responders of the incident reported a brownish liquid flowing into the Vivi River, where dead fish were also observed (Ref. 25, pp. 1, 2, 2; Ref. 27, pp. 1, 2; Ref. 28, p. 1; Ref. 31, p. 1). The constituents of the spill included toluene (up to 14,597 µg/L), PCE (up to 421.5 µg/L), ethylbenzene (up to 477 µg/L), and TCE (up to 157.5 µg/L) (see Table 9; Ref. 28, pp. 1, 2, 3, 7; Ref. 31, p. 2). The spill samples were analyzed using EPA Methods 624 (Ref. 28, p. 1; Ref. 51). Because the spill was observed to enter the Vivi River, an observed release by direct observation to the river is documented (Ref. 1, Section 4.1.2.1.1). The spill contained hazardous substances, and was observed to flow through a ditch to the Vivi River, and to enter surface water through migration (Ref. 25, pp. 2, 4; Ref. 26, pp. 2, 3; Ref. 28, p. 1). Photographs of the spill show the spill entering the Vivi River (Ref. 25, p. 4; Ref. 26, p. 3). The hazardous substances detected in the spill are documented in Table 9.

TABLE 9

HAZARDOUS SUBSTANCES DETECTED
IN RELEASE TO THE VIVI RIVER – 1998

Sample Identification	Hazardous Substance	Conc. (µg/L)	Method Detection Limit (Ref. 51) (µg/L)	References
Canal Descarga E1 (concrete ditch over which the liquids were discharged)	Toluene	14,597	6	28, p. 3; 51, p. 2
Canal Descarga E1 (concrete ditch over which the liquids were discharged)	Tetrachloroethylene	185	4.1	28, p. 3; 51, p. 2
Canal Descarga E1 (concrete ditch over which the liquids were discharged)	Ethylbenzene	477	7.2	28, p. 3; 51, p. 2
Cuerpo Receptor E2 (point of entry to Vivi River)	Toluene	1,464	6	28, p. 7; 51, p. 2
Cuerpo Receptor E2 (point of entry to Vivi River)	Tetrachloroethylene	421.5	4.1	28, p. 7; 51, p. 2

Sample Identification	Hazardous Substance	Conc. (µg/L)	Method Detection Limit (Ref. 51) (µg/L)	References
Cuerpo Receptor E2 (point of entry to Vivi River)	Ethylbenzene	144	7.2	28, p. 7; 51, p. 2
Cuerpo Receptor E2 (point of entry to Vivi River)	Trichloroethylene	157.50	1.9	28, p. 7; 51, p. 2

Notes:
µg/L Micrograms per liter
Conc. Concentration

As a result of this release, 11 persons were evacuated and police complaint 98-11-173-011-02 was filed against PPI. The responders of the incident reported a brownish-red liquid flowing into the Vivi River, where dead fish were also observed (Ref. 25, pp. 1 2, 3; Ref. 27, pp. 1, 2; Ref. 28, p. 1).

During a follow-up inspection on March 16, 1998, by personnel from the Emergency Response Division of PREQB and the Puerto Rico Fire Department, continuous flow of wastewaters from PPI was observed to discharge into the Vivi River. Dead fish were observed in the river (Ref. 4, p. 10; Ref. 25, p. 2). Neighbors indicated that the odors coming from the facility affected their health and that occasionally they had seen discharges from the facility turning the water different colors. A dye test was performed during the facility inspection of March 16, 1998. Dye was added to the septic tank, and the dye reached the Vivi River (Ref. 26, pp. 1, 2, 3).

Chemical Analysis:

The surface water and sediment samples collected in January and February 2006 by PREQB are used to document an observed release to surface water. PREQB followed its QAPP for screening site inspections (Ref. 75). The background and release samples are considered similar because the samples were collected using the same procedures, collected within the same time frame, were analyzed using the same methods, were collected from the same depths and were collected from same surface water body—as documented in Tables 10 and 12. During the 2008 site reconnaissance conducted at the PPI site, the release and background sediment sampling locations were observed, and descriptions of the sediment were obtained. The release and background sediment sampling locations were determined to contain sediment composed of sand, pebbles, gravel, and clay. The clay was below the sand, pebble, and gravel. Small amounts of organic matter were observed at the sampling locations (Ref. 63, pp. 27 to 31, Figure 2 [p. 43]).

The surface water background samples (SW-03 and SW-04) were collected from the Vivi River approximately 0.4 mile upstream from the PPI facility (Ref. 4, pp. 37 and Figure 3; Ref. 76). The release surface water samples were collected along the southern boundary of the facility from the Vivi River (Ref. 4, Figure 4). Based on the aerial photograph of the facility, locations of background surface water samples (SW-03 and SW-04), and size of the river, flow rate of the Vivi River at the background surface water sampling locations and release surface water sampling locations is similar (Ref. 76).

Background Sampling Locations:

In February 2006, the PREQB Superfund PA/SI Division conducted a SSI at the PPI facility. The goals of the investigation were to collect sufficient information regarding PPI to assess the current conditions at the facility and to determine need for additional investigation (Ref. 4, p. 14). As part of the investigation, two background sediment and surface water samples were collected from the Vivi River (Ref. 4, Figure 3 and Table 1, pp. 37, 39). Descriptions of the background sediment and surface water sampling locations are provided in Table 10.

TABLE 10
2006 BACKGROUND SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS

Sample ID	Date	Depth (inches bgs)	Location	References
Sediment Samples				
SD-02	02/02/06	0 - 12	Grab background sample collected upstream at the Vivi River, which is adjacent and to the southwest of the PPI facility. This sample location is approximately 100 feet upstream from PPE-6 in Figure 4 of Reference 4 and out of the influence of the site activities and contamination. (During a site reconnaissance, observations of the Vivi River between PPI and SD-02 were made to identify discharges and sources of potential contamination to the Vivi River between PPI and SD-2. None was identified.)	4, p. 37 and Figure 3; 7, pp. 23, 24; 10, pp. 6, 42;
SD-03	02/02/06	0 - 12	Grab background sample collected upstream at the Vivi River, which is adjacent and to the southwest of the facility. This sample location is approximately 200 feet upstream from PPE 6 in Figure 4 of Reference 4 and out of the influence of the site activities and contamination.	4, p. 37 and Figure 3; 7, pp. 24 to 27; 10, pp. 6, 43, 44: 63, Figure 2
Surface Water Samples				
SW-03	02/02/06	Surface	Grab background sample collected upstream at the Vivi River, which is adjacent and to the southwest of the PPI facility. This sample location is approximately 100 feet upstream from PPE-6 in Figure 4 of Reference 4 and out of the influence of the site activities and contamination.	4, p. 38 and Figure 3; 7, pp. 23, 24; 10, pp. 6, 41
SW-04	02/02/06	Surface	Grab background sample collected upstream at the Vivi River, which is adjacent and to the southwest of the facility. This sample location is approximately 200 feet upstream from PPE 6 in Figure 4 of Reference 4 and out of the influence of the site activities and contamination.	4, p. 38 and Figure 3; 7, pp. 24 to 27; 10, pp. 6, 42, 43, 44

Notes:
bgs Below ground surface
ID Identification
SD Sediment
SW Surface water

During the 2008 site reconnaissance conducted at the PPI site, the release and background sediment sampling locations were observed, and descriptions of the sediment were obtained. The release and background sediment sampling locations were determined to contain sediment composed of sand, pebbles, gravel, and clay. The clay was below the sand, pebble, and gravel. Small amounts of organic matter were observed at the sampling locations (Ref. 63, Figure 2 [p. 43]).

Background Concentrations:

The concentrations of hazardous substances detected in the background samples are summarized in Table 11. The VOC data validation report for the sediment samples is presented in Reference 37, pages 760 through 794, 823 through 847, and 895 through 896. The SVOC data validation report for the sediment samples is presented in Reference 37, pages 749 through 753, 775 through 798, and 892 through 894. The VOC data validation report for the surface water samples is presented in Reference 37 pages 493 through 497, 516 through 539, and 629 through 631. The samples were analyzed through the EPA CLP program and were analyzed for VOCs using EPA SOM 01.1 (Ref. 37, p. 2), and for SVOCs using EPA SOM 01.1 (Ref. 37, p. 7). The samples were validated through the CLP program for VOCs using October 2005, EPA Region II Data Validation Standard Operating Procedure (SOP) (Ref. 37, p. 2), and for SVOCs using December 2005, EPA Region II Data Validation SOP (Ref. 37, p. 7). The analytical method is provided in Reference 61.

TABLE 11
2006 BACKGROUND SURFACE WATER AND SEDIMENT CONCENTRATIONS

Sample ID	CLP Sample Number	Hazardous Substance	Conc.	CRQL or SQL	References
Sediment Background Concentrations					
SD-02	B1ML1	Diethyl-phathalate	ND	170 µg/kg (CRQL)	4, p. 45; 7, pp. 23, 24; 10, pp. 6, 42; 37, p. 947; 68; 77, pp. 34, 35
SD-02	B1ML1	*cis*-1,2-dichloroethylene	ND	5 µg/kg (CRQL)	4, p. 45; 7, pp. 23, 24; 10, pp. 6, 42; 77, pp. 34, 35
SD-02	B1ML1	4-Methylphenol	ND	170 µg/kg (CRQL)	4, p. 45; 7, pp. 23, 24; 10, pp. 6, 42; 37, p. 946; 68; 77, pp. 34, 35
SD-03	B1ML2	Diethyl-phathalate	ND	220 µg/kg (SQL)	4, p. 45; 7, pp. 24 to 27; 10, pp. 6, 43, 44; 37, p. 950; 68; 77, pp. 34, 35
SD-03	B1ML2	*cis*-1,2-dichloro-ethylene	ND	5 µg/kg (CRQL)	4, p. 45; 7, pp. 24, 25, 26; 10, pp. 6, 43, 44; 77, pp. 34, 35
SD-03	B1ML2	4-Methylphenol	ND	220 µg/kg (SQL)	4, p. 45; 7, pp. 24, to 27; 10, pp. 6, 43, 44; 37, p. 949; 68; 77, pp. 34, 35

Sample ID	CLP Sample Number	Hazardous Substance	Conc.	CRQL or SQL	References
Surface Water Background Concentrations					
SW-03	B1MM1	*cis*-1,2-dichloroethylene	ND	0.50 µg/L (CRQL)	4, p. 48; 7, pp. 23, 24; 10, pp. 6, 41; 37, p. 643; 77, pp. 4, 5
SW-03	B1MM1	Trichloro-ethylene	ND	0.50 µg/L (CRQL)	4, p. 48; 7, pp. 23, 24; 10, pp. 6, 41; 37, p. 644; 77, pp. 4, 5
SW-03	B1MM1	Tetra-chloroethylene	ND	0.50 µg/L (CRQL)	4, p. 48; 7, pp. 23, 24; 10, pp. 6, 41; 37, p. 644; 77, pp. 4, 5
SW-04	B1MM2	*cis*-1,2-dichloroethylene	ND	0.50 µg/L (CRQL)	4, p. 48; 7, pp. 24, 25, 26; 10, pp. 6, 35, 43; 37, p. 646; 77, pp. 11, 12
SW-04	B1MM2	Trichloro-ethylene	ND	0.50 µg/L (CRQL)	4, p. 48; 7, pp. 124, 25, 26; 10, pp. 6, 35, 43; 37, p. 647; 77, pp. 11, 12
SW-04	B1MM2	Tetra-chloroethylene	ND	0.50 µg/L (CRQL)	4, p. 48; 7, 24, 25, 26; 10, pp. 6, 35, 43; 37, p. 647; 77, pp. 11, 12

Notes:

µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
CLP	Contract Laboratory Program
CRQL	Contract Required Quantitation Limit
ID	Identification
ND	Not detected at or above the adjusted SQL or CRQL
SD	Sediment
SQL	Sample quantitation limits (CRQL adjusted for percent moisture and dilution. Applies to sediment samples only because none of the surface water samples were diluted.)
SW	Surface Water

Trichloroethylene, tetrachloroethylene, and *cis*-1,2-dichloroethylene are referred to as trichloroethene, tetrachloroethene, and *cis*-1,2-dichloroethene, respectively, in the references.

Release Sampling Locations:

In February 2006, the PREQB Superfund PA/SI Division conducted a SSI at the PPI facility. The goals of the investigation were to collect sufficient information regarding PPI to assess the current conditions at the facility and to determine need for additional investigation (Ref. 4, p. 14). As part of the investigation, 13 surface water samples were collected from the six PPEs and a location downstream from the PPEs (Ref. 4, p. 16). The release sampling locations are summarized in Table 12.

TABLE 12
2006 RELEASE SAMPLING LOCATIONS

Sample ID	Date	Depth	Location	References
Sediment Sampling Locations				
SD-05	2/01/06	0 - 12 inches bgs	Grab sample collected downstream of all the PPEs of discharges in Figure 4 of Reference 4 coming from the facility into the Vivi River.	4, p. 37 and Figure 4; 8, pp. 40 to 44; 10, pp. 4, 25, 26
SD-08	2/01/06	0 – 12 inches bgs	Grab sample collected at the PPE-5 in Figure 4 of Reference 4 in the Vivi River that is adjacent to the southwest of the facility.	4, p. 37 and Figure 4; 7, pp. 3 to 6; 10, pp. 5, 31
Surface Water Sampling Locations				
SW-01	1/30/06	Surface	Grab sample collected downstream of all the PPEs of discharges in Figure 4 of Reference 4 coming from the facility into the Vivi River.	4, p. 38 and Figure 3; 8, pp. 8 to 11; 10, pp. 1, 10, 11
SW-02D	1/30/06	Surface	Duplicate of SW-01.	4, p. 38 and Figure 3; 8, pp. 8, 9, 10; 10, pp. 1, 11, 12
SW-07	1/30/06	Surface	Grab sample collected at the PPE-1 in Figure 4 of Reference 4 in the Vivi River that is adjacent to the southwest of the facility.	4, p. 39 and Figure 4; 8, pp. 12, 13, 14; 10, pp. 2, 14
SW-05	2/01/06	Surface	Grab sample collected at the PPE-2 in Figure 4 of Reference 4 in the Vivi River that is adjacent to the southwest of the facility.	4, p. 39 and Figure 4; 8, pp. 41 to 43; 10, pp. 4, 24, 25
SW-06	2/01/06	Surface	Grab sample collected at the PPE-3 in Figure 4 of Reference 4 in the Vivi River that is adjacent to the southwest of the facility.	4, p. 39 and Figure 4; 8, pp. 44 to 45; 10, pp. 4, 26, 27, 28
SW-08	2/01/06	Surface	Grab sample collected at the PPE-4 in Figure 4 of Reference 4 in the Vivi River that is adjacent to the southwest of the facility.	4, p. 39 and Figure 4; 8, pp. 46 to 48; 10, pp. 4, 28, 29
SW-09	2/01/06	Surface	Grab sample collected at the PPE-5 in Figure 4 of Reference 4 in the Vivi River that is adjacent to the southwest of the facility.	4, p. 39 and Figure 4; 7, pp. 3 to 6; 10, pp. 5, 30

Notes:

bgs	Below ground surface
ID	Identification
SD	Sediment
SW	Surface water

During the 2008 site reconnaissance conducted at the PPI site, the release and background sediment sampling locations were observed, and descriptions of the sediment were obtained. The release and background sediment sampling locations were determined to contain sediment composed of sand, pebbles, gravel, and clay. The clay was below the sand, pebble, and gravel. Small amounts of organic matter were observed at the sampling locations (Ref. 63, Figure 2 [p. 43]).

Release Concentrations:

Concentrations of hazardous substances detected in the release sediment sample area are listed in Table 13. As documented in Table 11, none of the hazardous substances detected in the release samples was detected in the background sediment samples. The VOC data validation report for the sediment samples is presented in Reference 37, pages 2 though 6, 19 through 42, and 109 through 111. The SVOC data validation report for the sediment samples is presented in Reference 37, pages 7 through 10, 43 through 67, and 112 through 114. The VOC data validation report for the surface water samples is presented Reference 37, pages 244 through 249, 289 through 312, and 377 through 379. The samples were analyzed through EPA's CLP program for organics using EPA Statement of Work SOM01.1 (Ref. 37, pp. 2 and 7). The samples were validated through the CLP using October 2005 and December 2005, EPA Region II Data Validation SOPs (Ref. 37, pp. 2, 7 and 261). The analytical method is provided in Reference 61.

TABLE 13
2006 SEDIMENT AND SURFACE WATER
RELEASE CONCENTRATION

Sample ID	CLP Sample Number	Hazardous Substance	Conc.	CRQL or SQL	References
Sediment Sample Release Concentrations					
SD-05	B1ML4	Diethylphthalate	980 µg/kg	240 µg/kg (SQL)	4, p. 45; 37, p. 193; 68; 77, pp. 47, 48
SD-08	B1ML7	*cis*-1,2-dichloroethylene	10 µg/kg	6.4 µg/kg (SQL)	4, p. 45; 37, p. 156; 68; 77, pp. 47, 48
SD-08	B1ML7	4-Methylphenol	420 µg/kg	240 µg/kg (SQL)	4, p. 45; 37, p. 201; 68; 77, pp. 47, 48
Surface Water Sample Release Concentrations					
SW-01	B1ML9	Tetrachloroethylene	5.8 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 391
SW-02	B1MM0	Tetrachloroethylene	5.9 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 394
SW-07	B1MM5	*cis*-1,2-dichloroethylene	0.91 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 396
SW-07	B1MM5	Trichloroethylene	0.81 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 397
SW-07	B1MM5	Tetrachloroethylene	11 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 397
SW-05	B1MM3	*cis*-1,2-dichloroethylene	1.4 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 902; 77, pp. 43, 44
SW-05	B1MM3	Trichloroethylene	1.1 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 903; 77, pp. 43, 44
SW-05	B1MM3	Tetrachloroethylene	15 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 903; 77, pp. 43, 44
SW-06	B1MM4	*cis*-1,2-dichloroethylene	3.5 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 905; 77, pp. 43, 44
SW-06	B1MM4	Trichloroethylene	2.5 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 906; 77, pp. 43, 44

Sample ID	CLP Sample Number	Hazardous Substance	Conc.	CRQL	References
Surface Water Sample Release Concentrations					
SW-06	B1MM4	Tetrachloroethylene	26 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 906; 77, pp. 43, 44
SW-08	B1MM6	*cis*-1,2-dichloroethylene	8.9 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 908; 77, pp. 45, 46
SW-08	B1MM6	Trichloroethylene	6.7 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 909; 77, pp. 45, 46
SW-08	B1MM6	Tetrachloroethylene	32 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 909
SW-09	B1MM7	*cis*-1,2-dichloroethylene	4.3 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 911; 77, pp. 45, 46
SW-09	B1MM7	Trichloroethylene	2.4 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 912; 77, pp. 45, 46
SW-09	B1MM7	Tetrachloroethylene	19 µg/L	0.50 µg/L (CRQL)	4, p. 48; 37, p. 912; 77, pp. 45, 46

Notes:

µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
CLP	Contract Laboratory Program
CRQL	Contract Required Quantitation Limit
ID	Identification
SD	Sediment
SQL	Sample quantitation limits (CRQL adjusted for percent moisture and dilution. Applies to sediment samples only because none of the surface water samples was diluted.)
SW	Surface Water

Trichloroethylene, tetrachloroethylene, and *cis*-1,2-dichloroethylene are referred to as trichloroethene, tetrachloroethene, and *cis*-1,2-dichloroethene, respectively, in the references.

Attribution:

Historical data and available evidence indicate that the PPI facility has released waste containing hazardous substances to the Vivi River. The evidence that the PPI facility has released hazardous substances to the Vivi River is presented in the sections below.

Background surface water and sediment samples collected upstream of PPI did not contain any of the hazardous substances detected in the surface water and sediment samples collected from the Vivi River at or downstream of the PPI facility's PPEs to the river (see Tables 11 and 13). Therefore, no sources of these hazardous substances are upstream of the PPI facility. The hazardous substances associated with the observed release to surface water are VOCs, which volatilize into the air and are not persistent (Ref. 61, p. 2). The presence of these hazardous substances near the PPI facility indicates that the PPI facility is an ongoing source of VOC contamination to the Vivi River and that the VOCs are not from an upstream source.

The surface water observed release samples were collected along the southern bank of the Vivi River on the south side of PPI, as documented in Table 12. Sources of contamination to the Vivi River between the observed release surface water and sediment samples would be identified in the background samples. As documented in Tables 11 and 13, none of the hazardous substances detected in the release samples was detected in the background samples. The observed release surface water sampling locations receive surface water runoff only from PPI (Ref. 63, pp. 22, 23, 24, 25). The 2006 SI prepared by PREQB did not identify any facilities in the vicinity of PPI that would be possible sources of contamination to the Vivi River (Ref. 4, p. 1). During a 2008 site reconnaissance at PPI, a transmission repair automobile shop was observed across the street and north of PPI. The shop property was flat. Drainage from the shop property appeared to flow north to an unnamed tributary (Ref. 63, pp. 25, 26, 29, 30). The tributary flowed to the west past the PPI facility. If the tributary merged with the Vivi River, this would have been downstream of the PPI facility (Ref. 63, p. 30). No other potential sources of contamination to the Vivi River upstream or adjacent to PPI have been identified (Ref. 63, p. 26).

Hazardous Substances Generated or Used on the Facility Were Detected in Observed Release Samples

Presence of the hazardous substances detected in the source samples (including 1,2-DCA, PCE, TCE, toluene, and ethyl benzene), the observed release by direct observation and/or observed release samples, and the improper containment of the sources provide evidence that hazardous substances in the sources have been released to surface water, the Vivi River (documented in Tables 2, 4, 5, 9, and 13). Therefore, the presence of these hazardous substances in release samples on the Vivi River is associated with sources at the PPI facility.

Hazardous substances detected in the observed release samples and summarized in Tables 9 and 13 are or were generated from PPI. The type of hazardous wastes generated by PPI through its manufacturing processes include butanol (D00l), copper cyanide (D003, P029), cyanide (F008), isopropanol (D001), lead (D008), monobutyl ether-D-ethylene glycol, mercury (D009), sodium cyanide (D003), sulfuric acid (D002), 1,2-DCA (D028), perchloroethylene (D039) (also known as tetrachloroethene [PCE]), and trichloroethylene (D040) (also known as trichloroethene [TCE]) (Ref. 4, pp. 3, 4). PCE is known to be used at PPI (Ref. 72, pp. 9, 12, 51). 1,2-DCA, PCE, and TCE were detected in the observed release samples (Tables 9 and 13), and were detected in samples of the spill that released to the Vivi River (in the observed release by direct observation). Observations of the waste and product storage area at PPI indicated that the storage areas are not contained, and pathways such as direct discharges from the facility and holes in the facility lead

to the Vivi River (Ref. 3, pp. 7, 10, 11, 12, 13, 14, 19, 21, 22). The PPI drainage system discharges directly to Vivi River (Ref. 72, pp. 25, 98). Therefore, the release of these hazardous substances to the surface water migration pathway is attributable to sources (wastes, product, and discharges) on PPI. The amount of waste, product, and discharges on PPI could not be quantified or characterized with available data and information. Therefore, these sources were not scored as source areas.

Numerous Discharges Were Observed From the PPI Facility to the Vivi River

Numerous discharges and releases from the PPI facility to the Vivi River have been observed. In 1998, Junta De Calidad Ambiental responded to a spill of solvents from a PPE to the Vivi River (Ref. 25, pp. 1, 2, 3; Ref. 26, pp. 1, 2; Ref. 27, pp. 1, 2). The constituents of the discharge included toluene (up to 14,597 µg/L), PCE (up to 421.5 µg/L), ethylbenzene (up to 477 µg/L), and TCE (up to 157.2 µg/L) (Ref. 28, pp. 1, 2, 3, 7; Ref. 30, p. 3; Ref. 31). The discharge appeared to contain dye (Ref. 25, p. 3; Ref. 26, p. 3).

Many complaints have been filed against PPI, including unauthorized air emissions and discharges of wastewaters (i.e., containing inks, solvents, or oil residues) into the Vivi River. These complaints have been reported by nearby residents, other Utuado citizens (including the Mayor), PPI employees (by confidential reports to the PREQB personnel from the Arecibo Regional Office), and personnel from the PREQB who have visually inspected the facility since 1984 (Refs. 12; 13; 14; 15; 16; 17; 18; 19, p. 1). In addition, two administrative orders—OAL-98-RA-88 (Cease and Desist Order to Do and Show Cause) and OAL-00-RA-39 (Cease and Desist Order)—were filed by the PREQB against PPI on May 22, 1998, and April 12, 2000, respectively (Ref. 30, pp. 1, 2, 3, 6; Ref. 34, pp. 1, 2, 3, 6).

Since 1984, unauthorized air emissions and discharges of wastewater have led to various emergency response actions, criminal and environmental investigations, and visual inspections at PPI by state and local agencies. On March 28, 1984, a visual inspection at PPI by the PREQB Water Quality Area followed an accidental spill from PPI that had resulted in discharge of liquids containing inks and oil residues into the Vivi River. During this incident, oil residues and waters containing residues of inks from the sinks inside the washing room and the development room accessed the pluvial system, reached the underground injection system UIC-97-72-0012-RA on site, and flowed into the Vivi River (Ref. 23; Ref. 4, p. 9).

During a follow-up visual inspection at PPI by personnel from the Emergency Response Division of the PREQB Arecibo Regional Office and the Puerto Rico Fire Department (as part of the investigation of the incident that had occurred on March 14, 1998, Ref, 25; 27; 28), a continuous flow of wastewaters from the site and into the Vivi River was observed. Dead fish were observed. Neighbors indicated that the odors coming from the site had affected their health, and that occasionally, they had seen discharges from the facility turn the water different colors (Ref. 4, p. 10; Ref. 26, pp. 1, 2, 3).

On March 17, 1998, a visual site inspection of PPI by PREQB Water Quality Area followed an accidental spill from PPI that had resulted in discharge of liquids containing inks and oil residues into the Vivi River. During this incident, oil residues and waters containing residues of inks from sinks inside the washing room and the development room accessed the pluvial system, reached the underground injection system UIC-97-72-0012-RA on site, and discharged into the Vivi River (Ref. 4, p. 9; Ref. 26, pp. 1, 2, 3, 4).

Photographs taken in March 1998 and February 2001 by Junta de Calidad Ambiental show wastes being discharged directly into the Vivi River (Ref. 48, pp. 1, 3, 4, 27 to 37).

On February 11, 1998, personnel from the PREQB Arecibo Regional Office conducted a visual inspection of PPI. Violations of Article 3.1.2 of the PREQB Water Quality Standards (i.e., inks flowing into the Vivi River) were found (Ref. 24, pp. 1, 2, 4; Ref. 4, p. 10).

During the November 2005 site reconnaissance conducted by PREQB, holes were observed in the facility building that discharge to the Vivi River (Ref. 3, pp. 7, 10, 11, 12, 13, 14, 19, 21, 22). Stained floors were observed in the facility, and no containment system prevented the liquids dripping from the machines or containers from flowing outside the property and reaching the river (Ref. 3, pp. 11, 14). Holes outside on the property surrounding the facility that had been drilled for drainage of rainwater are connected to PVC tubes that discharge into the Vivi River (Ref. 3, p. 13). Sewers at the facility discharge to the Vivi River (Ref. 3, pp. 15, 18).

Also during a site reconnaissance, PREQB observed 12 discharge locations from the PPI to the Vivi River. The locations of the discharges are shown on Figure 2 of Reference 3 and are summarized as follows:

- Discharge 1 includes three elevated 12-inch-diameter PVC tubes that exit the facility on the west side. Green liquid flows out the tubes and into a concrete ditch and the ground adjacent to the tubes. The ditch extends west to the ground adjacent to the Vivi River. The concrete ditch and the ground next to the ditch are stained green and blue (Ref. 3, pp. 19, 61, 62, 69, 76).

- Discharge 2 is a 1- to 2-inch-diameter elevated PVC tube that exits the facility on the southeast side. The pipe discharges directly on the ground, and flow follows along a depression on the ground to the Vivi River. The ground adjacent to the tube is stained black and green (Ref. 3, pp. 20, 62, 70, 77).

- Discharge 3 is a 12-inch-diameter PVC tube located on the second floor of the southwest wing of the facility. The tube discharges to the ground (Ref. 3 pp. 21, 31).

- Discharges 4 and 5 are 2- to 3-inch-diameter PVC tubes located on the southeastern wall of the southeast wing of the facility. The tubes discharge directly to the ground, and flow follows to a concrete ditch or to the ground that slopes towards the Vivi River; flow thus continues to the Vivi River (Ref. 3, p. 20). Stressed vegetation was observed on the ground adjacent to the concrete ditch and between discharges 4 and 5 (Ref. 3, pp. 21, 62, 64, 70, 71, 78, 83).

- Discharges 5, 6, 7, and 8 are located on the southwestern wall of the facility and discharge to the ground surface (Ref. 3, pp. 21, 65, 66, 71, 72, 82 to 87).

- Discharge 9 is an 18- to 20-inch-diameter plastic tube from the northwestern wall of the facility that discharges directly to the ground; the discharge reaches the Vivi River through a fracture in the ground. The discharges also reach a concrete ditch containing blue to black sludge (Ref. 3, pp. 22, 66, 67, 71, 72, 86, 89).

- Discharges 10, 11, and 12 were observed on the northeast corner of the facility (Ref. 3, Figure 2). These are three 2- to 3-inch-diameter PVC tubes discharging dark blue to black slimy substance directly to the ground (Ref. 3, pp. 63, 64, 70, 78, 79, 80, 81).

During the visual inspections of November 10 and 22, 2005, PVC tubes (from beneath the PPI building) were observed discharging liquids directly to both the ground and into a concrete ditch (3 ft deep, 2 ft wide, and 100 feet long) adjacent to the PPI building SE Wing; the flow continued into the Vivi River (Ref. 4, Figure 2; Ref. 3, p. 63).

Photographs taken during the visual inspection of the PPI facility revealed releases from the facility to the ground, to ditches, overland, and finally to the Vivi River (Ref. 48). The photographs document that the PPI facility periodically released liquids to the Vivi River.

Hazardous Substances Improperly Stored on the PPI Facility

Wastes at the PPI facility are not properly stored. In February 11, 1998, personnel from the PREQB Arecibo Regional Office conducted a visual inspection of PPI. Violations of Rule 533 of the PREQB Regulation for the Management of non-hazardous solid wastes (i.e., inadequate storage and disposition of inks and chemicals) were found. Among the hazardous substances observed stored during this inspection were ammonia, butanol, ethyl acetate, sodium cyanide, sulfuric acid, and PCE. The drums (storage containers) were observed dripping, leaking, and corroded, and were not labeled. The room in which the drums were stored lacked ventilation and a secondary containment system (Ref. 4, p. 10; Ref. 24, pp. 1 to 4).

Preparation of the flexography plates is performed inside a developing room located on the south corner of the southwestern wing on the first floor. The flexography plates used for labeling the manufactured bags are prepared on site through a development process that involves use of PCE, butanol, and different developer and fixer solutions (Ref. 4, pp. 2, 3; Ref. 20, pp. 1, 3, 5, 28, 34). PREQB conducted various inspections of the PPI facility between 1993 and 2003. PREQB personnel observed drums containing PCE (as well as other substances), holes in the floor of the facility, and a sink that drained into one of the holes inside the development room (Ref. 3, pp. 7, 10 through 15; Ref. 4, p. 3). According to PPI employees, and as observed by personnel from PREQB, hazardous substances (e.g., PCE) were regularly discharged through these holes (Ref. 3, pp. 7, 10 through 15; Ref. 4, p. 3; Ref. 24, pp. 1, 2, 3; Ref. 25, pp. 1, 2, 3; Ref. 32, pp. 1, 8, 15, 17; Ref. 38, pp. 1, 2; Ref. 39). During various dye tests performed by personnel from the PREQB Arecibo Regional Office from April 4 to 6, 2000, dyes poured into the sink and the floor holes reached the backyard of PPI and the Vivi River (Ref. 4, p. 3; References [Refs.] 38 through 43). In addition, when the soil below the development room was sampled by Altol Chemical Environmental Laboratory (Alchem Laboratories, Inc.) on June 19, 2000, the contaminants 1,2-DCA (0.98 ppm), PCE (20.7-29.8 ppm), and TCE (13.8-15.9 ppm) were detected at concentrations above their respective detection limits (Ref. 33, pp. 2, 4; Ref. 35, p. 1).

Wastewaters are generated following the manufacturing process by cleaning the press rolls and the flexography plates removed from the machines that manufacture paper and plastic bags. The ink residues (oil- or water-based inks) present in these rolls and on the plates are cleaned on site inside a washing room located at the entrance to the first floor of the southwestern wing between the Central and SE Wings (Ref. 3, pp. 6, 14; Ref. 4, Figure 2). Prior to moving the press rolls to the washing room, they are removed from the machines and placed in metal racks. During the visual inspections of November 10 and 22, 2005**,** the press rolls on the metal racks (inside the plastic bags manufacture area) were dripping ink onto the floor, and no containment system was

in place to prevent the ink from exiting the PPI building southwestern wing (Ref. 3, pp. 7, 8, 14; Ref. 4, p. 4).

In the cleaning process, the press rolls are submerged in water, scrubbed with a broom, and finally, rinsed with a water hose inside the metal sink of the washing room (1st floor of the southwestern wing). In the past and until 2003, PCE or thinner (usually consisting of acetone, methyl isobutyl ketone, and toluene) was used by PPI in the washing room to remove the oil-based inks from the rolls and the flexography plates. According to the owner, PPI currently uses a neutral mild detergent for its washing process because most of the inks used are water-based. No secondary containment system is inside the wash room to collect and prevent any liquids from flowing outside the room and towards a ditch that drains to the Vivi River (Ref. 3, pp. 6, 16, 17, 59, Figure 2; Ref. 4, p. 4, 5; Ref. 72, pp. 25, 98)

Hazardous Substance in the Release:
Butylbenzylphathalate
cis-1,2-Dichloroethylene
Diethylphthalate
Ethylbenzene
4-Methylphenol
PCE
TCE
Toluene

Likelihood of Release Value: 550

4.1.2.2 WASTE CHARACTERISTICS

4.1.2.2.1 Toxicity/Persistence

Table 14 summarizes the toxicity and persistence factor values for the hazardous substances associated with sources at the facility and in the observed release to surface water. The values are assigned in accordance with Section 4.1.2.21 of Reference 1. The toxicity and persistence values were obtained from Reference 2.

TABLE 14
TOXICITY/PERSISTENCE FACTOR VALUES

Hazardous Substance	Source/ Observed Release	Toxicity Factor Value	Persistence Factor Value*	Toxicity/ Persistence Factor Value	Reference
Butylbenzylphthalate	2	10	1	10	2, p. BI-2
cis-1,2-Dichloroethylene	OR	100	0.4	40	2, p. BI-5
Diethylphthalate	OR	1	1	1	2, p. BI-5
Ethylbenzene	3, OR	10	0.0007	0.007	2, p. BI-6
4-Methylphenol	3, OR	100	0.0007	0.07	2, p. BI-9
Trichloroethylene	2, 3, OR	10,000	0.4	4,000	2, p. 16
Tetrachloroethylene	1, 2, 3. OR	100	0.4	40	2, p. BI-10
Toluene	3, OR	10	0.07	0.7	2, p. BI-11

Notes:
* Persistence value is for a river; the predominant water body between the PPE and the target is a river (Ref. 6).

OR = Observed release

Toxicity/Persistence Factor Value: 4,000 (Ref. 1, Table 4-12)

4.1.2.2.2 Hazardous Waste Quantity

The hazardous waste quantity values for Sources 1, 2, and 3 are summarized in Table 15.

TABLE 15
HAZARDOUS WASTE QUANTITY FACTOR VALUES

Source No.	Source Type	Source Hazardous Waste Quantity
1	Contaminated soil	> 0
2	Contaminated soil	> 0
3	Other	>0

Sum of Values: > 0

The hazardous waste quantity factor value of 10 is assigned to the surface water migration pathway because the value from Table 2-6 is less than 10 and a removal action has not been completed at the facility (Ref. 1, Section 2.4.2.2).

HWQ Factor Value: 10

4.1.2.2.3 Waste Characteristics Factor Category Value

The toxicity/persistence and hazardous waste quantity factor values are multiplied to obtain the drinking water threat-waste characteristics factor category for the watershed from Table 2-7 of Reference 1.

4,000 (toxicity/persistence factor value) × 10 (hazardous waste quantity factor value) = 40,000

Using the product of the toxicity/persistence and hazardous waste quantity factor values, the waste characteristics factor category value is obtained from Table 2-7 of Reference 1, a value of 10.

Waste Characteristics Factor Category Value: 10

4.1.2.3 DRINKING WATER TARGETS

The Vivi River is located 30 to 40 feet from the PPI facility. The Vivi River flows into the Rio Grande de Arecibo at approximately 0.9 mile downstream from the most downstream PPE (PPE-1) to the Vivi River. The Rio Grande de Arecibo flows into the Dos Bocas Lake at approximately 8 miles downstream from the point at which the Vivi River connects with the Rio Grande de Arecibo. Dos Bocas Lake (reservoir) is used for hydroelectric power generation and as a flow-control structure to regulate releases for the North Coast Superaqueduct intake pool. The Puerto Rico Electric Power Authority (PREPA) owns and operates the Dos Bocas Reservoir. Dos Bocas Reservoir is an essential part of the Puerto Rico Aqueduct and Sewer Authority (PRASA) North Coast Superaqueduct System and is supplied by controlled releases for hydroelectric power generation to replenish the public supply raw water intake pool located about 6.2 miles (10 kilometers) downstream from Dos Bocas Dam. As of 2005, the Superaqueduct supplied about 4.03 cubic meters per second (348,192 cubic meters per day) of potable water to communities extending along the north coast from Arecibo to the San Juan metropolitan area (Ref. 70, p. 1). The Superaqueduct System (water system ID PR0002000) supplies water to a population of between 1,300,000 and 2,235,000 persons (Ref. 4, p. 17; Ref. 36; Ref. 50).

4.1.2.3.3 Resources

Dos Bocas Lake is within the 15-mile target distance category and is considered a designated water recreation area. The lake has a public boat dock and is used for recreational fishing (Ref. 63, pp. 33, 34, 35). A resource value of 5 is assigned (Ref. 1, Section 4.1.2.3.3).

Resources: 5

4.1.3.2 WASTE CHARACTERISTICS

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Table 16 summarizes the toxicity/persistence and bioaccumulation factor values for the hazardous substances associated with sources at the PPI facility and in the observed release to surface water. The values are assigned in accordance with Section 4.1.3.2.1 of Reference 1. The toxicity/persistence and bioaccumulation values were obtained from Reference 2.

TABLE 16
TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES

Hazardous Substance	Source	Toxicity/ Persistence* Factor Value	Bioaccumulation Factor Value	Toxicity/ Persistence/ Bioaccumulation Factor Value	References
Butylbenzylphthalate	2	10	500	5,000	2, p. BI-2
cis-1,2-Dichloroethylene	OR	40	5	200	2, p. BI-5
Diethylphthalate	OR	1	500	500	2, p. BI-5
Ethylbenzene	3, OR	0.007	50	0.35	2, p. BI-6
4-Methylphenol	3, OR	0.07	5	3.2	2, p. BI-9
Trichloroethylene	2, 3, OR	4,000	50	200,000	2, p. 16
Tetrachloroethylene	1, 2, 3, OR	40	5	200	2, p. BI-10
Toluene	3, OR	0.7	50	35	2, p. BI-11

Notes:
* Persistence value based on river; river is the predominant surface water body between the PPE and the target.

OR Observed release

Toxicity/Persistence/Bioaccumulation Factor Value: 200,000 (Ref. 1, Table 4-16)

4.1.3.2.2 Hazardous Waste Quantity

The hazardous waste quantity values for Sources 1, 2, and 3 are summarized in the Table 17.

TABLE 17
HAZARDOUS WASTE QUANTITY FACTOR VALUES

Source No.	Source Type	Source Hazardous Waste Quantity
1	Contaminated soil	> 0
2	Contaminated soil	> 0
3	Other	> 0

Sum of Values: > 0

The hazardous waste quantity factor value of 10 is assigned to the surface water migration pathway because the value from Table 2-6 is less than 10 and a removal action has not been completed at the facility (Ref. 1, Section 2.4.2.2).

HWQ Factor Value: 10

4.1.3.2.3 Waste Characteristics Factor Category Value

The toxicity/persistence factor value and bioaccumulation potential factor value are used to determine the waste characteristics factor category value. The toxicity/persistence factor value (4,000) is multiplied by the hazardous waste quantity value (10). The product of these two values (40,000) is multiplied by the bioaccumulation potential factor value (50). The product of these two values (2×10^6) is used to obtain the waste characteristics factor category value (32) from Table 2-7 of Reference 1.

4,000 (toxicity/persistence factor value) × 10 (hazardous waste quantity factor value) = 40,000

40,000 × 50 (bioaccumulation factor value) = 2×10^6

Using 2×10^6, the waste characteristics factor category value is obtained from Table 2-7 of Reference 1, a value of 32.

Waste Characteristics Factor Category Value: 32

4.1.3.3 HUMAN FOOD CHAIN THREAT – TARGETS

Actual Human Food Chain Contamination

Actual contamination of a human food chain cannot be documented with available data.

4.1.3.3.1 Food Chain Individual

As noted in Section 4.1.3.3.1 of this HRS documentation record, an observed release of hazardous substances having a bioaccumulation factor value of 500 or greater is documented in the Vivi River. Dos Bocas Lake is used for recreational fishing and is within the 15-mile target TDL (Ref. 6; Ref. 63, pp. 34, 35). The food chain individual factor is assigned a value of 20 (Ref. 1, Section 4.1.3.3.1).

Food Chain Individual Factor Value: 20 (Ref. 1, Section 4.1.3.3.1)

4.1.3.3.2 Population

Consumption of fish in the Vivi River has not been documented (Ref. 1, Table 4-18).

Human Food Chain Population Value: 0

4.1.3.3.2.3 Potential Human Food Chain Contamination

The potential human food chain contamination value is very low and therefore, not scored.

Potential Human Food Chain Contamination Value: Evaluated but not scored.

4.1.4 ENVIRONMENTAL THREAT

4.1.4.2 Waste Characteristics

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Table 18 presents the ecosystem toxicity/persistence/bioaccumulation factor values for hazardous substances detected in sources with containment values greater than zero. Table 19 presents ecosystem toxicity/persistence/bioaccumulation factor values.

TABLE 18
ECOSYSTEM TOXICITY/PERSISTENCE FACTOR VALUES

Hazardous Substance	Source	Ecosystem Toxicity Value*	Persistence Value**	Ecosystem Toxicity/ Persistence Factor Value	Reference
Butylbenzylphthalate	2	1,000	1	1,000	2, p. BI-2
cis-1,2-Dichloroethylene	OR	40	5	200	2, p. BI-5
Diethylphthalate	OR	10	1	10	2, p. BI-5
Ethylbenzene	3, OR	100	50	5,000	2, p. BI-6
4-Methylphenol	3, OR	100	0.0007	0.07	2, p. BI-9
Trichloroethylene	2, 3, OR	100	0.4	40	2, p. 16
Tetrachloroethylene	1, 2, 3, OR	0	0.4	0	2, p. BI-10
Toluene	3, OR	100	0.07	7	2, BI-11

Notes:

* Fresh-water ecotoxicity values.

** Persistence values are for a river; river is the predominant surface water body between the PPE and the target.

OR Observed release

TABLE 19
ECOSYSTEM TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES

Hazardous Substance	Source	Ecosystem Toxicity/ Persistence Factor Value	Ecosystem Bioaccumulation Value *	Ecosystem Toxicity/ Persistence/ Bioaccumulation Value	Reference
Butylbenzylphthalate	2	1,000	500	500,000	2, p. BI-2
cis-1,2-Dichloroethylene	OR	200	0	0	2, p. BI-5
Diethylphthalate	OR	10	500	5,000	2, p. BI-5
Ethylbenzene	3, OR	5,000	50	250,000	2, p. BI-6
4-Methylphenol	3, OR	0.07	5	0.35	2, p. BI-9
Trichloroethylene	2, 3, OR	40	50	2,000	2, p. 16
Tetrachloroethylene	1, 2, 3 OR	0	50	0	2, p. BI-10
Toluene	3, OR	7	5,000	35,000	2, BI-11

Notes:
* Fresh-water environmental bioaccumulation value.

OR Observed release

Ecosystem Toxicity/Persistence/Bioaccumulation Potential Factor Value: 5×10^5

4.1.4.2.2 Hazardous Waste Quantity

The hazardous waste quantity factor value of 10 is assigned to the surface water migration pathway because the value from Table 2-6 is less than 10 and a removal action has not been completed at the facility (Ref. 1, Section 2.4.2.2).

HWQ Factor Value: 10

4.1.4.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor category value is determined by taking the product of the ecosystem toxicity/persistence factor value (1,000) and the HWQ value (10) and multiplying the product by the ecosystem bioaccumulation factor value for that substance (500) (Ref. 1, Section 4.1.4.2.3).

$1{,}000 \times 10 = 1 \times 10^4$

Ecosystem toxicity/persistence factor value × Hazardous waste quantity factor value: 10^4

(Ecosystem toxicity/persistence × hazardous waste quantity) × ecosystem bioaccumulation potential factor value (500): 5×10^6

Waste Characteristics Factor Category Value: 32 (Ref. 1, Table 2-7)

4.1.4.3 ENVIRONMENTAL THREAT – TARGETS

The environmental threat value was evaluated but was not scored.

4.1.4.3.1 Sensitive Environments

Evaluated but not scored.

4.1.4.3.1.1 Level I Concentrations

Evaluated but not scored.

Level I Concentrations Factor Value: 0

4.1.4.3.1.2 Level II Concentrations

No Level II concentrations have been documented with available data.

Level II Concentrations Factor Value: 0

4.1.4.3.1.3 Potential Contamination

Evaluated but not scored.

5.0 SOIL EXPOSURE

5.0.1 General Considerations

Observed contamination has been documented on the PPI property (see the following sections for documentation). The area of observed soil contamination on the PPI property is documented in accordance with Section 5.0.1 of the HRS (Ref. 1, Section 5.0.1). The area of observed soil contamination is delineated by the locations of soil samples documenting concentrations of hazardous substances three times above background concentration or above sample detection limit if the background is non-detect, and the area lying between those locations, minus the areas covered by impenetrable surfaces (such as houses, roads, and sidewalks) (Ref. 1, Section 5.0.1).

Letter by which this area is to be identified: A

Name of area: Contaminated soil surrounding PPI

The area of observed soil contamination associated with Area A includes sampling locations SS-06, SS-07, SS-12 and SS-14 (Area A). The sampling locations are shown in Figure 4 of Reference 4. As Figure 4 shows, the areas of soil contamination cannot be determined because Area A includes four samples in a linear arrangement. Therefore, to calculate the most conservative estimate, the area of observed soil contamination is assigned a value of greater than 0 (Ref. 1, Section 5.0.1).

Location and description of area (with reference to a map of the site):

As shown in Figure 4, Area A (sampling locations SS-06, SS-07, SS-12 and SS-14) is located in the backyard of the facility on the north bank of Vivi River and along the SE side of the SE wall of the PPI facility. The backyard of the PPI facility is defined as a section of the land between the exterior of the SE Wing of the PPI building and the Vivi River (Ref. 4, p. 5). As shown in Figure 4 of Reference 4, the soil sampling locations are affected by discharges from the facility on the southeast side of the SE Wing of the PPI facility. Soil sampling location SS-06 receives discharge from discharges 5, 10, 11, and 12. Soil sampling locations SS-07 and SS-14 receive discharges from discharges 4, 5, 10, 11, and 12. Soil sampling location SS-12 receive discharges from discharges 1 and 2 (Ref. 63, pp. 22-24). Drums also were stored in the SE Wing near the discharges 1, 2, and 3 (Ref. 4, Figure 4). The soil may have been contaminated from drums stored in the PPI facility. The drums may have released through holes in the PPI building that drained to the backyard (Ref. 4, p. 3).

Soil sampling locations SS-06, SS-07, and SS-14 were collected in an area described as a small corridor between the PPI building SE Wing and the adjacent property. During the PREQB SI, the corridor was observed to include: six corroded 55-gallon metal drums on the ground; stained soil (blue and black stains); three areas of stressed vegetation; partially buried concrete septic tank; and five plastic PVC tubes from beneath the PPI building and from the septic tank discharging liquids directly into both the ground and the concrete ditch (Ref. 4, p. 5). Soil sample SS-12 was collected from an area of stained soil in the backyard of the facility, between Discharges 1 and 2 (Ref. 4, p. 36, Figure 4; Ref. 62). The location of SS-12 is shown in Figure 4 of Reference 4. The contamination in Area A is attributed to the use of PCE in the manufacturing process at the facility, discharges from the facility, storage of drums in the area, and runoff from the facility roof where drums were formerly stored (Ref. 4, pp. 2-7; Ref. 63, p. 24).

As documented in Table 23, soil samples SS-06, SS-07, SS-12 and SS-014 contained the contaminant PCE. Butylbenzylphthalate was detected in SS-06 at 270 micrograms per kilogram (µg/kg). PCE was detected in the soil samples up to 2,400 µg/kg. PCE and butylbenzylphthalate were not detected in the background sample (see Table 21).

Observed Contamination Evidence – Area A

The sections below document the background and contaminated surface soil sampling locations, collection dates, and concentrations of VOCs and SVOCs reported in these soil samples.

Background Samples for Area: A

The sections below describe background sampling location and VOCs and SVOCs concentrations reported in the background sample.

Background Sampling Locations for Area: A

In January and February 2006, the PREQB Superfund PA/SI Division conducted a SI at the PPI facility (Ref. 4, pp. 14, 15, 33, 34). PREQB followed its QAPP for SSIs (Ref. 75). As part of the investigation, a background soil sample (SS-01) was collected northeast of the PPI facility (Ref. 4, p. 35 and Figure 3; Ref. 9, p. 7; Ref. 63, pp. 29, 30). The trip report summarizing the investigation is provided as Reference 9. A photograph of SS-01 is shown in Reference 10, page 15 (Ref. 10, pp. 2, 15). The soil appears to be an organic dark brown loam (Ref. 10, p. 15; 63, pp. 29, 30). The background and contaminated soil samples were analyzed under EPA CLP program for TCL including VOCs and SVOCs using EPA Statement of Work SOM 01.1 (Ref. 37, p.109). The data validation report for the background soil sample SS-01 (B1MJ7) is presented in Reference 37, pages 1 through 10, 19 through 67, and 109 through 114. Table 20 describes the background soil sample. The background and contaminated surface soil samples are similar because the samples were collected using the same methods and during the same time frame (Ref. 8, pp. 20, 21, 23-25, 31-34; Ref. 7, p. 43); were analyzed using the same methods (Ref. 37, pp. 109, 112, 632, 635); and were collected from the similar soil type (Ref. 56; Ref. 4, Figure 4; Ref. 63, p. 37; Ref. 64, pp. 1, 3; Ref. 65; Ref. 71). The background sample was collected from the Pellejas clay (Ref. 64). The contaminated surface soil samples (SS-06, SS-07, SS-12, and SS-14) were collected from the soil series Vivi (Ref. 63, p. 37; Ref. 64; Ref. 71). The Vivi series is similar to the Pellejas series. Both series are loams that contain organic material (roots) and are strongly acidic (Ref. 65; Ref. 71).

TABLE 20
BACKGROUND SOIL SAMPLE LOCATION AND DESCRIPTION

Sample ID	Sample Depth (inches bgs)	Sample Description	Location	Reference
SS-01	0 – 12	Loose light brown to brown; Pellejas clay loam	Background soil sample. Grab sample collected off site from a location to the northeast, within a 0.25-mile radius from the PPI facility and presumed out of the influence of site activities and contamination.	4, p. 35, Figure 3; 8, pp. 20, 21; 63, pp. 29, 30; 64, pp. 1 and 3; 65, p. 1

Notes:
bgs Below ground surface
ID Identification
SS Surface soil

Pellejas clay: The National Cooperative Soil Survey describes Pellejas clay as: **0 to 5 inches bgs**; dark grayish brown clay loam; moderate fine granular structure; firm, slightly sticky, slightly plastic; many fine roots; many fine quartz grains; strongly acid; clear smooth boundary. **5 to 11 inches bgs**; brown clay loam; weak medium subangular blocky structure; firm, slightly sticky, plastic; many fine roots; common fine and few medium quartz grains; strongly acid; clear wavy boundary. **11 to 15 inches bgs**; pale brown sandy loam; weak fine and medium subangular blocky structure; friable, nonsticky, slightly plastic, common fine roots; many fine quartz grains; many fine black and white specks; common medium distinct dark yellowish brown streaks and splotches; strongly acid; clear wavy boundary (Ref. 65, p. 1).

Background Sample Concentrations for Area: A

Table 21 summarizes the concentrations of VOCs and SVOCs detected in the background sample.

TABLE 21
AREA A BACKGROUND SOIL SAMPLE - ANALYTICAL RESULTS

Sample ID	CLP Sample Number	Sample Date	Hazardous Substance	Conc. (µg/kg)	SQL (µg/kg)	References
SS-01	B1MJ7	1/31/06	Tetrachloro-ethylene	ND	5.88	4, p. 43; 8, pp. 20, 21; 10, pp. 2, 15, 16; 37, p. 121; 68; 77, pp. 29, 30
SS-01	B1MJ7	1/31/06	Trichloroethene	ND	5.88	4, p. 43; 8, pp. 20, 21; 10, pp. 2, 15, 16; 37, p. 121; 68; 77, pp. 29, 30
SS-01	B1MJ7	1/31/06	Butylbenzyl-phathalate	ND	200	4, p. 43; 8, pp. 20, 21; 10, pp. 2, 15, 16; 37, p. 166; 68; 77, pp. 29, 30

Notes:
µg/kg Micrograms per kilogram
CLP Contract Laboratory Program
ID Identification
ND Not detected at or above the adjusted CRQL
SS Surface soil
SQL Sample quantitation limit

Contaminated Samples for Area: A

The sections below describe contaminated sampling locations and concentrations detected in the contaminated samples.

Contaminated Sampling Locations for Area: A

The locations of the contaminated surface soil samples are shown in Reference 4, Figure 4, and Reference 62 as sampling locations SS-06, SS-07, SS-12, and SS-14. Table 22 summarizes the sampling locations.

TABLE 22
AREA A – SOIL SAMPLING LOCATIONS

Sample ID	Sample Depth (inches bgs)	Sample Description	Location	Reference
SS-06	0 - 12	Loose dry and black with debris pieces; Vivi loam	Grab sample collected on site from an area with stressed vegetation adjacent and to the southeast of Discharge #5 in Figure 4 of Reference 4. The location receives drainage only from the PPI including the roof where drums were stored. This sample was collected to determine the type and concentration of contaminants.	4, p. 35, Figure 4; 8, pp. 31, 32; 63, pp. 23, 24, 26, 37
SS-07	0 - 12	Loose soil light brown to brown; Vivi loam	Grab sample collected on site from an area with stressed vegetation to the southwest of and within 5 feet from where sample SS-06 was collected. The area with stressed vegetation from where this sample was collected is between Discharge 4 in Figure 4 of Reference 4 and the southern corner of the PPI building. The location receives drainage only from the PPI including the roof where drums were stored. This sample was collected to determine the type and concentration of contaminants.	4, p. 35, Figure 4; 8, pp. 23, 24; 63, pp. 23, 24, 26, 37

Sample ID	Sample Depth (inches bgs)	Sample Description	Location	Reference
SS-12	0 - 12	Loose brown soil; Vivi loam	Grab sample collected on site from an area of the ground to the northwest of Discharge 2 in Figure 4 of Reference 4, where stained soil had been observed on November 10 and 22, 2005, halfway between Discharges 1 and 2 in Figure 4 of Reference 4. The sample was collected from the north bank of the Vivi River. The bank of the river at the location is steep. The sampling location receives surface water runoff only from the PPI facility. This sample was collected to determine the type and concentration of contaminants.	4, p. 36, Figure 4; 7, p. 43; 63, pp. 22, 37
SS-14	0 - 12	Brown soil based on photograph; Vivi loam	Grab sample collected on site from the ground within 200 feet and to the south of the PPI building southern corner, from an area where liquids released from Discharges 4 and 5 in Figure 4 of Reference 4 flows just before they fall into the Vivi River. The location receives drainage only from the PPI including the roof where drums were stored. This sample was collected to determine the type and concentration of contaminants.	4, p. 36, Figure 4; 8, pp. 33, 34; 10, pp. 3, 4, 23, 24; 63, pp. 23, 24, 37

Notes:
bgs below ground surface
ID Identification
SS Surface soil

Vivi loam: The National Cooperative Soil Survey describes Vivi loam as: **0 to 7 inches bgs**; very dark grayish brown loam; weak fine granular structure; very friable, nonsticky, nonplastic; many fine roots; many fine quartz grains; strongly acid; clear smooth boundary. **7 to 14 inches bgs**; dark grayish brown loam; weak coarse subangular blocky structure; friable, nonsticky, nonplastic; common fine roots; many fine quartz grains; medium acid; clear smooth boundary. (Ref. 71)

Contaminated Sample Concentration for Area: A

In January and February 2006, the PREQB Superfund PA/SI Division conducted a SI at the PPI facility (Ref. 4, pp. 14, 15, 33, 34). PREQB followed its QAPP for SSIs (Ref. 75). Soil samples SS-06, SS-07, SS-12, and SS-14 were collected during the SI (Ref 4, p. 43). The soil samples were analyzed using EPA CLP program for TCL using EPA Statement of Work SOM 01.1 (Ref. 37, p.109). The data validation report for soil samples SS-06 (B1MK2), SS-07 (B1MK3), and SS-14 (B1MP1) is provided in Reference 37, pages 1 through 10, 19 through 67, and 109 through 114. The data validation report for soil sample SS-12 (B1MK8) is presented in Reference 37, pages 493 to 502, 516 to 628, and 632 to 634. The background and contaminated surface soil

samples are similar because the samples were collected using the same methods and during the same time frame (Ref. 8, pp. 20, 21, 23-25, 31-34; Ref. 7, p. 43); were analyzed using the same methods (Ref. 37); and were collected from a similar soil type (Ref. 56; Ref. 4, Figure 4; Ref. 63, p. 37; Ref. 64, pp. 1, 3; Ref. 65; Ref. 71). The contaminated surface soil samples (SS-06, SS-07, SS-12, and SS-14) were collected from the soil series Vivi (Ref. 63, p. 37). The background sample was collected from the Pellejas series (Ref. 64, pp. 1 and 3). The Vivi series is similar to the Pellejas series. Both series are loams that contain organic material (roots) and are strongly acidic (Ref. 65; Ref. 71).

Table 23 summarizes the concentration of hazardous substances detected in the Area A contaminated surface soil samples.

TABLE 23
AREA A CONTAMINATED SURFACE SOIL SAMPLES
ANALYTICAL RESULTS

Sample ID	CLP Sample Number	Sample Date	Hazardous Substance	Conc. (µg/kg)	SQL (µg/kg)	References
SS-06	B1MK2	1/31/06	Tetrachloroethylene	35	6.76	4, p. 43; 8, pp. 31, 32; 10, pp. 3, 22; 37, p. 136; 68; 77, pp. 29, 30
SS-06	B1MK2	1/31/06	Butylbenzylphthalate	270	230	4, p. 43; 8, pp. 31, 32; 10, pp. 3, 22; 37 p. 181; 68; 77, pp. 29, 30
SS-07	B1MK3	1/31/06	Tetrachloroethylene	2,400	6.02	4, p. 43; 8, pp. 23 to 25; 10, pp. 2, 17, 18; 37, p. 139; 68; 77, pp. 29, 30
SS-07	B1MK3	1/31/06	Trichloroethene	7.5	6.02	4, p. 43; 8, pp. 23 to 25; 10, pp. 2, 17, 18; 37, p. 139; 68; 77, pp. 29, 30
SS-12	B1MK8	2/6/06	Tetrachloroethylene	11	5.44	4, p. 43; 7, p. 43; 10, pp. 8, 50, 51; 37, p. 677; 68; 77, pp. 20, 21
SS-14	B1MP1	1/31/06	Tetrachloroethylene	22	6.25	4, p. 43; 8, pp. 33, 34; 10, pp. 3, 4, 23, 24; 37, p. 163; 68; 77, pp. 29, 30

Notes:
µg/kg Micrograms per kilogram
Conc. Concentration
CLP Contract Laboratory Program
ID Identification
SQL Sample quantitation limit
SS Surface soil

Attribution

The contaminated surface soil sampling locations SS-06, SS-07, SS-12, and SS-14 were collected from soil adjacent to the PPI facility. The sampling locations do not receive surface water runoff from areas outside of PPI (Ref. 63, pp. 22, 23, 24). No other potential sources of contamination to the soil sampling locations have been identified (Ref. 63, pp. 22, 23, 24).

Wastes at the PPI facility are not properly stored. In February 11, 1998, personnel from the PREQB Arecibo Regional Office conducted a visual inspection of PPI. Violations of Rule 533 of the PREQB Regulation for the Management of non-hazardous solid wastes (i.e., inadequate storage and disposition of inks and chemicals) were found. Among the hazardous substances observed during this inspection stored were ammonia, butanol, ethyl acetate, sodium cyanide, sulfuric acid, and PCE. The drums (storage containers) were observed dripping, leaking, and corroded, and were not labeled. The room in which the drums were stored lacked ventilation and a secondary containment system (Ref. 24, pp. 1 to 4; Ref. 4, p. 10).

Preparation of plates is performed inside a developing room located on the south corner of the southwestern wing first floor. The plates are used for labeling the manufactured bags prepared on site through a development process that involved use of PCE, butanol, and different developer and fixer solutions (Ref. 20, pp. 1, 3, 5, 28, 34; Ref. 4, pp. 2, 3). PREQB conducted various inspections of the PPI facility between 1993 and 2005. PREQB personnel observed drums containing PCE (as well as other substances), holes in the floor, and a sink that drained into one of the holes inside the development room (Ref. 3, pp. 7, 10 through 15; Ref. 4, p. 3). According to PPI employees, and as observed by personnel from PREQB, hazardous substances (e.g., PCE) were regularly discharged through these holes (Ref. 3, pp. 7, 10 through 15; Ref. 4, p. 3; Ref. 24, pp. 1-3; Ref. 25, pp. 1-3; Ref. 32, pp. 1, 8, 15, 17; Ref. 38, pp. 1, 2; Ref. 39). During various dye tests performed by personnel from the PREQB Arecibo Regional Office from April 4 to 6, 2000, dyes poured into the sink and the floor holes reached the backyard of PPI (Ref. 4, p. 3; Refs. 38 through 43). In addition, when the soil below the development (plate) room was sampled by Altol Chemical Environmental Laboratory (Alchem Laboratories, Inc.) on June 19, 2000, the contaminants 1,2-DCA (0.98 ppm), PCE (20.7-29.8 ppm), and TCE (13.8-15.9 ppm) were detected at concentrations above their respective detection limits (Ref. 33, pp. 2, 4; Ref. 35, p. 1).

In the cleaning process, the press rolls are submerged in water, scrubbed with a broom, and finally, rinsed with a water hose inside the metal sink of the washing room (1st floor of the southwestern wing). In the past and until 2003, PCE or thinner (usually consisting of acetone, methyl isobutyl ketone, and toluene) was used by PPI in the washing room to remove the oil-based inks from the rolls and the flexography plates. According to the owner, PPI currently uses a neutral mild detergent for its washing process because most of the inks used are water-based. No secondary containment system is inside the wash room to collect and prevent any liquids from flowing outside the room and towards a ditch that drains to the Vivi River (Ref. 3, pp. 6, 15, 16, 17, 59, Figure 2; Ref. 4, p. 4, 5; Ref. 72, pp. 25, 98)

Perchloroethylene (also known as tetrachloroethene (PCE), and tetrachloroethylene) was detected in the soil samples and is known to have been used at PPI and generated as a waste (Ref. 4, pp. 3, 4; Ref. 20, pp. 1, 3; Ref. 21, p. 5; Ref. 24, p. 4; 34, p. 3; 72, pp. 9, 12, 51). PCE was used in cleaning flexography plates (Ref. 4, p. 2; Ref. 66, pp. 2, 3). Drums containing PCE were observed in the facility. The areas where the drums were stored were observed to have holes in the walls and drains in floor (Ref 4, p. 3; Ref. 24, p. 4; Ref. 26, p. 2; Ref. 38, pp. 1, 2; Ref. 32, p. 15). TCE is a common degradation product of PCE (Ref. 60). The natural biodegradation of PCE produces TCE (Ref. 67, p. 23; Ref. 69, p. 191). TCE often is found as a contaminant along

with PCE (Ref. 69, pp. 100, 209).

PCE and TCE were detected in a discharge from PPI to the Vivi River (Ref. 28, pp. 1, 2; Ref. 29, p. 2).

During a site inspection on May 7, 2001 by PREQB, PREQB determined that PCE (perchloroethylene also known as tetrachloroethene) was used to clean printing plates in the "photopilomeric" plate room. Holes were observed in the floor where PCE was used. A drum of PCE was observed in the plate room and holes (which led to underlying soil) were observed in the plate room floor where the drum was stored. An out of service machine containing PCE was observed in the plate room (Ref. 66, pp. 2, 3).

The report of the site inspection of May 7, 2001, discusses the contaminated soil in the ground in the backyard below the development (plate) room (Ref. 66, pp. 2, 3). On June 19, 2000, an environmental consultant to PREQB Arecibo Regional Office had collected soil samples from the ground in the backyard below the development room. The soil samples were determined to contain 1,2-DCA ranging from 0.14 to 0.98 mg/L, PCE ranging from 20.7 to 33.9 mg/L, TCE ranging from 13.8 to 19.5 mg/L, and methyl ethyl ketone at 2.91 mg/L. The samples were submitted to a laboratory for EPA's TCLP analysis (Ref. 33, pp. 1, 2, 4, 7; Ref. 46, pp. 1, 8, 15, 16, 22, 25, 29, 33; Ref. 66, pp. 2, 3). The report of the site inspection of May 7, 2001, indicates this PCE- and TCE-contaminated soil had been excavated and stored in six 2-cubic-yard boxes in the plate room (Ref 66, pp. 2, 3, 4).

During the site inspection of May 7, 2001, PREQB personnel inspected the area under the development (plate) room. PREQB observed spills marks on the column of the building and holes in the development (plate) room floor. According to the PPI president, Mr. Rios, the holes in the floor of the plate room had been put there to drain water entering the plate room from the Vivi River during major rain events. The location where the TCE- and PCE-contaminated soil had been excavated also floods during the rain events (Ref. 66, p. 3).

On March 14, 1998, personnel from the Emergency Response Division of the PREQB Arecibo Regional Office and Junta De Calidad Ambiental responded to a discharge of solvents into the Vivi River from PPI (Ref. 4, p. 10; Ref. 25, pp. 1, 2, 3; Ref. 26, pp. 1, 2; Ref. 27, pp. 1, 2). The constituents of the discharge included toluene (up to 14,597 µg/L), PCE (up to 421.5 µg/L), ethylbenzene (up to 477 µg/L), and TCE (up to 157.5 µg/L) (see Table 9; Ref. 28, pp. 1, 2, 3, 7; Ref. 31; Ref. 30, p. 3; Ref. 4, p. 10).

The Area A soil samples were collected in a small corridor between the PPI building SE Wing and the adjacent property. Evidence of releases of hazardous substances to Area A included: six corroded,
55-gallon metal drums on the ground; stained soil (blue and black stains); three areas of stressed vegetation; partially buried concrete septic tank; and five plastic PVC tubes from beneath the PPI building and from the septic tank discharging liquids directly to the ground in Area A (Ref. 4, p. 5).

Area A soil contamination is attributed to the use of PCE in the manufacturing process at the facility, discharges from the facility, and storage of drums (Ref. 4, pp. 2, 3, 4, and 5).

Hazardous Substances:
Butylbenzylphthalate
PCE
TCE

5.1 RESIDENT POPULATION THREAT

The resident population threat includes school and worker populations within an area of observed contamination defined by the property boundary of a school or workplace, or within 200 feet of the school or workplace. Area A is located on school and workplace property and within 200 feet of the building which houses the Universidad Del Este, Centro Universitario de Utuado, with 527 full time students, and workers (Ref. 63, pp. *i*, 4, 9, 26). The university is located in the NW Wing of PPI (Ref. 63, p. 26; Ref. 4, p. 1; Ref. 4, Figure 4). Table 22 documents the sampling locations that meet the criteria for observed contamination (Ref. 1, Section 5.0.1).

5.1.1 Likelihood of Exposure

As documented in Tables 21 and 23 the soil samples collected from the property which has school and worker locations meet the criteria for observed contamination (Ref. 1, Section 5.0.1). The contamination is on property where a school and worker locations are within 200 feet of the contamination (Ref. 63, p. 9, 24, 42); therefore, the likelihood of exposure factor for the resident population threat is assigned a value of 550 (Ref. 1, Section 5.1).

Resident Population Threat Likelihood of Exposure Category Value: 550

5.1.2 Waste Characteristics

5.1.2.1 Toxicity

The toxicity value of butylbenzyl phthalate is 10; of TCE is 10,000; and of PCE is 100 (Ref. 2, pp. BI-2, BI-10, 16). The toxicity factor value of 10,000 is assigned in accordance with Reference 1, Section 5.1.2.1.

Highest Toxicity Factor Value: 10,000

5.1.2.2 Hazardous Waste Quantity

The hazard waste quantity (HWQ) value for the area of observed contamination (Area A) on the PPI property is greater than zero (Ref. 1, Section 2.4.2.2). The area of observed contamination cannot be determined because the soil samples cannot be connected in a way that defines an area. Therefore, the area of soil contamination is assigned a value of greater than 0. As described in Reference 1, Sections 2.4.2.2 and 5.1.2.2, a soil exposure pathway HWQ value of 10 is assigned because the area could not be adequately evaluated.

HWQ Factor Value: 10

5.1.2.3 Calculation of Waste Characteristics Factor Category Value

The waste characteristics factor value for the soil exposure pathway is calculated below, as specified in the HRS (Ref. 1, Section 5.1.2.3)

Toxicity: 10,000
HWQ Factor Value: 10
Toxicity (10,000) x HWQ Factor Value (10): 1×10^5

Waste Characteristics Factor Category Value: 18 (Ref. 1, Table 2-7)

5.1.3 Targets

The targets associated with the soil exposure pathway include resident individual, workers, resources, and terrestrial sensitive environments (Ref. 1, Section 5.1.3).

5.1.3.1 Resident Individual

Surface soil samples collected from the PPI property were collected on Universidad Del Este, Centro Universitario de Utuado property and within 200 feet of a school. The university has 527 full time students (Ref. 6; 63, pp. *i*, 4, 9, 26). Therefore, a value of 45 was assigned for the resident individual factor value (Refs. 1, Section 5.1.3.1; 42, p. 2).

Area Letter: A
Level of Contamination (Level I/Level II): II
Reference: 63, pp. *i,* 4, 26, Figure 2 [p. 42]; 4, p. 1, Figure 4

Resident Individual Factor Value: 45

5.1.3.2 Resident Population

5.1.3.2.1 Level I Concentrations

No HRS benchmarks were exceeded; therefore, only Level II concentrations were evaluated (Ref. 1, Table 5-3 and Section 5.1.3.2).

Sum of Level I Resident Population x 10 (Ref. 1, Section 5.1.3.2.1): None
Level I Resident Population Factor Value: 0

5.1.3.2.2 Level II Concentrations

There are 527 full time students associated with Universidad Del Este, Centro Universitario de Utuado (Ref. 63, pp. *i*, 4, 26). Table 24 summarizes the Level II sample identifications (see Table 23 for documentation).

TABLE 24
LEVEL II SAMPLES

Sample ID	Hazardous Substance
SS-06	Tetrachloroethylene
SS-06	Butylbenzylphthalate
SS-07	Tetrachloroethylene
SS-07	Trichloroethene
SS-12	Tetrachloroethylene
SS-14	Tetrachloroethylene

Sum of individuals subject to Level II concentrations: 527

Level II Resident Population Factor Value: 527 (Ref. 1, Section 5.1.3.2.2)

5.1.3.3 Workers

The PPI building which houses 65 workers is within 200 feet of contaminated soil sampling locations
SS-06, SS-07, SS-12, and SS-14 (Ref. 4, p. 2; 6; Ref. 63, 9). A worker factor value is assigned using Table 5-4 of Reference 1.

TABLE 25
NUMBER OF WORKERS

Area Letter	Number of Workers	References
A	65	4, p. 2

Total workers: 65

Workers Factor Value: 5
(Ref. 1, Table 5-4)

5.1.3.4 Resources

No resources have been identified in the area of observed contamination.

Resource Factor Value: 0

5.1.3.5 Terrestrial Sensitive Environments

No terrestrial sensitive environments have been identified in the area of observed contamination.

Terrestrial Sensitive Environment Factor Value: 0