DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION
Interim Final 2/5/99
RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA725)
Current Human Exposures Under Control

Facility Name: **Caribbean Petroleum Refining LP**
Facility Address: **Carr. #28, Km. 2, Urb. Industrial Luchetti, Bayamón, Puerto Rico**
Facility EPA ID #: **PRD00632182**

1. Has **all** available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   __X__ If yes - check here and continue with #2 below.
   _____ If no - re-evaluate existing data, or
   _____ If data are not available skip to #6 and enter "IN" (more information needed) status code.

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

Facility Description:

The Caribbean Petroleum Refining LP (CPR) facility is located in the Luchetti Industrial Park in Bayamón, Puerto Rico. The CPR site encompasses approximately 179 acres, of which 115 is developed. The facility is divided into four general areas: tank farm area, process area, administration area, and wastewater treatment plant area. In addition, CPR owns and operates a loading dock facility on San Juan Bay in Guaynabo, approximately two and one-half miles northeast of the site.

Petroleum refinery operations commenced at the site in 1955 under the name of Caribbean Refining Corporation. The facility was purchased in 1962 by the Gulf Oil Corporation, at which time the name was changed to Caribbean Gulf Refining Corporation. Chevron Corporation acquired ownership of the facility when it purchased Gulf Oil Corporation in 1984. In 1987, the facility was sold to First Oil Corporation and now operates as an independent refinery. Until cessation of operations in 2000, CPR operated a 48,000 barrel per day petroleum refining facility at the site. CPR now operates the facility as a petroleum product storage and distribution facility, although refining operations may commence again sometime in the future.

The CPR site is bounded to the west and southwest by industrial and commercial facilities, and to the south and east by Fort Buchanan, a U.S. military reservation. Highway 28 separates the CPR facility from an industrial/commercial area to the southwest and from the Fort Buchanan property. An undeveloped land area owned by CPR is situated north of the operations area and extends about 1000 ft north to Highway 22, a major thoroughfare in the Bayamón area. Swampy undeveloped land, an industrial facility, and a small residential community occur north of Highway 22.

Hazardous wastes historically managed at the site include primary oil/water/solids separation sludge (F037), secondary oil/water/solids separation sludge (F038), slop oil emulsion solids (K049), heat exchanger bundle solids (K050), API separator sludge (K051), ignitable waste (D001), and toxicity characteristic (benzene) wastewater (D018).

CPR has two on-site water wells which are completed in the carbonate formations underlying the facility. However, only one of the wells (North Well) is currently being used. Water from the well is used for process purposes only. Drinking water at the site is provided by a municipal supply system.

The regional groundwater flow direction in the area varies between north and northeast (Ref. 1). The nearest off-site water production wells occur within a distance of 3000 to 4000 ft to the east, south, and west of the CPR facility. There are no known water supply wells downgradient (north to northeast) of the facility.

Surface water bodies that traverse through the CPR facility are Las Lajas and Diego Creeks. Las Lajas Creek is a low-flow, shallow stream that originates in the hills south of the facility, traverses through the north-central part of the facility, and eventually discharges into San Juan Bay. Las Lajas Creek is channeled underground as it enters the facility and returns to an open channel north of the refinery's wastewater treatment plant (WWTP) area. Treated effluent from the WWTP was previously discharged to Las Lajas Creek under a National Pollutant Discharge Elimination System (NPDES) permit through NPDES Outfall 001. As of November 2002, the effluent is discharged by pipeline to San Juan Bay via NPDES Outfall 001A. Diego Creek is a shallow low-flow creek that traverses through the northwest portion of the CPR site. The Bayamón River traverses in a general north-south direction about 1.4 miles west of the facility. San Juan Bay is located about 1.75 miles northeast of the facility; the Atlantic Ocean is about 3 miles north.

An Administrative Order on Consent was executed by EPA and CPR in October 1995 to investigate 32 Solid Management Units (SWMUs)/Areas of Concern (AOC), Las Lajas Creek sediment, the facility Process Sewer, and the groundwater beneath the facility. A RCRA Facility Investigation (RFI) is currently being performed at the facility. Included in the RFI is a Sitewide Groundwater Monitoring Program designed to evaluate the groundwater quality at the facility. A Process Sewer assessment and human health assessment of Las Lajas Creek sediment were also completed.

Interim measure activities consist of measurement and recovery of petroleum hydrocarbon light non-aqueous phase liquid (LNAPL) and groundwater monitoring. LNAPL measurements are performed at 129 monitoring wells situated throughout the facility. Weekly and monthly measurements are performed at selected wells; quarterly measurements are performed at all the wells. LNAPL is recovered by 22 automatic ejector pumps and by manual bailing on a weekly and/or monthly basis at 35 supplemental wells. On average, about 350 gal per month of LNAPL are recovered. Groundwater sampling (VOCs, arsenic, lead, and/or mercury) is performed at 10 selected wells on a semiannual basis and 6 additional wells on an annual basis. The wells are mostly situated downgradient of the LNAPL plumes and also at the northern facility border. Semiannual groundwater sampling (BTEX) is also performed at 6 wells at the former facility equalization basin.

RCRA closure of the equalization basin at the WWTP was completed in August 1999. Closure activities consisted of dewatering the basin, stabilizing the residual sludge, backfilling the basin, installing an impermeable clay and flexible membrane liner cap, installing a drainage layer, and installing a vegetative cover. Groundwater monitoring at the former equalization basin is being addressed as part of corrective action.

References:

1. United States Geological Survey, 2002, Geology and Hydrogeology of the Caribbean Islands Aquifer System of the Commonwealth of Puerto Rico and the U.S. Virgin Islands: USGS Professional Paper 1419.

2. Are groundwater, soil, surface water, sediments, or air media known or reasonably suspected to be "contaminated"1 above appropriately protective risk-based "levels" (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

Media	Yes	No	?	Rationale / Key Contaminants
Groundwater	X			VOCs, BNAs, metals, and LNAPL
Air (indoors) 2		X		See discussion below
Surface Soil (e.g., <2 ft)	X			Arsenic
Surface Water		X		See discussion below
Sediment	X			Arsenic
Subsurf. Soil (e.g., >2 ft)	X			Arsenic, vanadium, benzo(a)anthracene, benzo(a)pyrene
Air (outdoors)	X			Benzene

_____ If no (for all media) - skip to #6, and enter "YE," status code after providing or citing appropriate "levels," and referencing sufficient supporting documentation demonstrating that these "levels" are not exceeded.

__X__ If yes (for any media) - continue after identifying key contaminants in each "contaminated" medium, citing appropriate "levels" (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.

_____ If unknown (for any media) - skip to #6 and enter "IN" status code.

Rationale and Reference(s):

A RCRA Facility Investigation (RFI) is being performed at the facility according to an EPA-approved March 2001 RFI Work Plan (Ref. 1) and an April 2002 Sitewide Groundwater Monitoring Program (SGMP) Work Plan (Ref. 2). The majority of the RFI work has been completed and reported (Refs. 3-11). A Process Sewer Assessment (Ref. 8) and human health assessment of Las Lajas Creek sediment and bank soil (Ref. 9) were also completed. An initial document for the human health baseline risk assessment for the facility has also been completed (Ref 12).

Footnotes:

1 "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriately protective risk-based "levels" (for the media, that identify risks within the acceptable risk range).

2 Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggest that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

Groundwater:

The CPR facility is located in the north coast groundwater province of Puerto Rico. Two general water-bearing units are present beneath the facility: an upper overburden unit and an underlying carbonate sediment unit. Well yields in the overburden are generally less than in the carbonate sediment, as observed during well development and groundwater sampling activities. Groundwater in the overburden varies from unconfined to semi-confined. Groundwater in the carbonate sediment varies from semi-confined to confined. The regional groundwater flow direction varies between the north and northeast (Ref. 13). At the facility area groundwater flow in the overburden and carbonate generally varies from the north to east (Ref. 10), although localized variations occur due to geologic controls at the site, permeability contrasts, and local recharge. Groundwater is not used at the site for drinking water purposes.

Groundwater samples were collected and analyzed for VOCs, BNAs, and/or metals at 51 monitoring wells and at 11 direct-push locations as part of the RFI SGMP. Two SGMP groundwater sampling events were performed at the monitoring wells: May-July 2003 and October 2003. The direct-push groundwater sampling was performed during July 2003. Supplemental groundwater sampling was also performed at 6 newly installed monitoring wells in July and September 2004. The groundwater results are presented in (Refs. 10 and 11).

Groundwater results were compared to groundwater screening levels. Screening levels were EPA Maximum Contaminant Levels (MCLs) and, where MCLs are not available, EPA Region III tap water risk-based concentrations (RBCs) (EPA Region III, April 2004). For lead, the EPA action level of 15 ug/L was used as a groundwater screening level. For MTBE, the acceptable drinking water guideline (20 to 40 ug/L) established by EPA (Ref. 14) was used. The constituents of concern that exceeded groundwater screening levels, their maximum concentrations, and the location of the maximums are shown in the table below.

Groundwater Contaminant	Screening Levels (ug/L)	Maximum Concentration (ug/L)	Location of Maximum
Overburden Water-Bearing Zone			
Benzene	5	2910	Well MW-91A
1,2 Dichloroethane	5	6.9 J	DP location PS-15G
Methyl Tertiary-Butyl Ether	20-40**	652	Well B-2
Methylene Chloride	5	6.0	Direct-push location 11-13G
Bis(2-Ethylhexyl)Phthalate	6	20.8	Direct-push location PS-29G
2-Methylnaphthalene	120*	6100 J	Direct-push location PS-28G
Naphthalene	6.5*	358 J	Direct-push location PS-16G
Arsenic	10	55.4	Direct-push location PS-28G
Barium	2000	3590	Direct-push location PS-28G
Beryllium	4	10.4	Direct-push location PS-28G
Chromium	100	1130	Direct-push location PS-28G
Lead	15	170	Direct-push location PS-28G
Vanadium	260*	2850	Direct-push location PS-28G
Carbonate Sediment Water-Bearing Zone			
Cis-1,2-Dichlorethene	70	71.7	Well MW-75B
Trichloroethene	5	154 J	Well MW-83B1
Vinyl Chloride	2	5.8	Well MW-75B
Arsenic	10	121	Well MW-110B (see note)
Chromium	100	248	Well MW-110B (see note)
Mercury	2	3.4	Well MW-21B
Vanadium	260*	408	Well MW-110B (see note)

Notes: * - indicates an EPA Region 3 tap water RBC. ** - indicates EPA drinking water guideline. All other screening levels are EPA MCLs, except for lead, which is the EPA action level. The 'J' data qualifier indicates an estimated concentration. Total metal results at well MW-110B were above screening levels; dissolved metal results were below screening levels, however. High turbidity encountered during sampling at well MW-110B appears to have significantly biased high the total metals results. The dissolved metal results, which are below screening levels, are therefore believed to be more representative than the total metals results shown in the table.

Petroleum hydrocarbon LNAPL is detected in main five plumes contained within the facility. The plume locations are generally within the Tank Farm and WWTP areas of the facility. As discussed in Item 1, interim measures consisting of LNAPL measurement and recovery within the plumes are being performed on an ongoing basis. Wells downgradient of the LNAPL plumes have been monitored for the presence of LNAPL since about 1991. All of the five plumes have remained stable with negligible migration. Thus, the LNAPL plumes are stable.

Soil Vapor/Indoor Air:

For on-site groundwater, the only areas where volatile compounds occur in the groundwater within 100 ft of occupied on-site buildings are at the control rooms at the facility WWTP area and Process Sewer area (Ref. 10). Direct-push results from locations PS-28G and PS-29G are the closest upgradient locations to the control room at the WWTP that exhibits elevated VOC levels. Detected constituents were compared to the State of Connecticut Groundwater Standards for Protection of Indoor Air under the Industrial/Commercial Scenario (CT I/C VC) to determine whether migration of VOCs to indoor air may be of concern. Based on this comparison, no VOCs exceeded the CT I/C VC.

A trichloroethene (TCE) plume at the northeast refinery area migrates through the facility and offsite. The source and extent of the TCE plume, which may be from offsite, is under investigation. The residential community of Puente Blanco is located about 1200 ft north of well MW-75B at which chlorinated hydrocarbons (TCE, 1,2-dichloroethene, and vinyl chloride) were detected. The groundwater flow in the area of this well is to the northeast, which indicates that the residential community is not directly downgradient of the plume, hence no impact is likely. Additionally, State of Connecticut Groundwater Standards for Protection of Indoor Air standards apply only to groundwater within 15 ft below ground surface (bgs) as deeper sources are not likely to affect indoor air quality. The depth to the top of the carbonate sediment in the area of well MW-75B is about 44 ft bgs. Since the chlorinated hydrocarbon plume occurs only in the deeper carbonate sediment, no impact to indoor air quality in surface structures is likely. (Note: the State of Connecticut proposes to increase the depth criteria for indoor air to 30 ft bgs. Since the depth to the top of the carbonate sediment is deeper than this, no impact is indicated). Additionally, no buildings at CPR are located in this area of the facility. Hence, no exposure to workers is indicated.

Surface Soil (< 2 ft):

Surface soil samples were collected at 25 SWMUs/AOCs/areas as part of RFI activities (Refs. 3-8). The samples were analyzed for VOCs, BNAs, and/or metals. No constituents were detected in the surface soil above Region 3 industrial ingestion RBCs, with the exception of arsenic. Arsenic exceeded its Region 3 industrial RBC (1.9 mg/kg) at 25 SWMUs/AOCs with levels ranging up to 93.2 mg/kg. Arsenic also exceeded its background level of 23 mg/kg at 15 SWMUs/AOCs. Table 1 (attached) shows the maximum detected arsenic concentrations that exceed its surface soil screening level at the SWMUs/AOCs/areas.

Surface Water:

No surface water sampling has been performed in Las Lajas Creek. Groundwater discharge from the overburden water-bearing zone to the Creek was indicated as part of the Las Lajas Creek Assessment (Ref. 9). Thus, groundwater sampling results from shallow wells nearby and adjacent to the Creek (wells MP-1, MP-5A, MP-9, MP-10, MW-86A, MW-110A, and MW-111A) are used to demonstrate surface water environmental indicators. None of the results from these wells show any constituents of concern above groundwater screening levels (Refs. 10 and 11). Total arsenic and vanadium were detected above screening levels at well MW-110A during the July 2004 sampling event; the dissolved metals results were below screening levels, however. High turbidity occurred in the groundwater sample, which biased high the total metal results. Therefore, the dissolved arsenic and vanadium results are considered to be more representative than the total results for this sampling event. Resampling of well MW-110A in September 2004 showed that both total and dissolved metals were below screening levels, which confirms the dissolved metals results from July 2004. Therefore, no impact to surface water is indicated.

No LNAPL plumes occur adjacent to Las Lajas Creek, hence no impact to surface water is indicated. As discussed above, the LNAPL plumes are stable and not migrating.

Sediment:

Sediment samples were collected at nine locations in Las Lajas Creek upstream and within the facility boundary. Additionally, bank soil samples were collected at three locations north of the facility WWTP. The samples were analyzed for VOCs, BNAs, PCBs, and/or metals. Arsenic (maximum concentration of 71.2 mg/kg) was detected in sediment above its EPA Region 3 industrial ingestion RBC of 1.9 mg/kg and above the arsenic background level of 23 mg/kg. No other constituents were detected above RBCs in the sediment or bank soil. (Ref. 9).

No LNAPL plumes occur adjacent to Las Lajas Creek, hence no impact to sediment is indicated. As discussed above, the LNAPL plumes are stable and not migrating.

Subsurface Soil (> 2 ft):

Subsurface soil samples were collected at 30 SWMUs/AOCs/areas as part of RFI activities (Refs. 3-8). The samples were analyzed for VOCs, BNAs, and/or metals. No constituents were detected in the surface soil above Region 3 industrial ingestion RBCs, with the exception of arsenic, vanadium, benzo(a)anthracene, and benzo(a)pyrene. Arsenic exceeded its Region 3 industrial RBC (1.9 mg/kg) at 27 SWMUs/AOCs/areas with levels ranging up to 138 mg/kg. Arsenic also exceeded its background level of 23 mg/kg at 18 SWMUs/AOCs/areas. Vanadium (1350 mg/kg) exceeded its RBC (1000 mg/kg) only at SWMU 34; the background level of vanadium is 250 mg/kg. Benzo(a)anthracene (9900 ug/kg) exceeded its RBC (3900 ug/kg) only at SWMU 11. Benzo(a)pyrene (up to 8200 ug/kg) exceeded its RBC (390 ug/kg) only at SWMUs 3 and 11. Table 2 (attached) shows the maximum detected concentrations that exceed subsurface soil screening levels at the SWMUs/AOCs/areas.

Air (outdoors):

No constituents were detected in the soil above outdoor air (volatilization to air and fugitive dust) EPA risk-based screening levels (Ref. 15) with the exception of benzene at SWMU 1. Benzene exceeds its inhalation screening level (1000 ug/kg) at only 1 out of 10 sampling locations at SWMU 1. The concentrations in the surface soil (1.5-2 ft) and subsurface soil (4-4.5 ft) are 1700 and 2400 ug/kg, respectively.

No assessment of the impacts to outdoor air from groundwater has been conducted at the site. However, migration of VOCs from groundwater into outdoor air is not expected to be of concern due to natural dispersion of contaminants once they reach the surface. Also, since assessment of VOCs to indoor air as discussed above does not indicate any impact, exposure to outdoor air is not expected due to its greater dispersion.

References:

1. Anderson, Mulholland & Associates, Inc. (AMAI), 2001. RCRA Facility Investigation Work Plan (Revision 2), Caribbean Petroleum Refining LP, Bayamón, Puerto Rico.

2. Anderson, Mulholland & Associates, Inc. (AMAI), 2002. Sitewide Groundwater Monitoring Program Work Plan, Caribbean Petroleum Refining LP, Bayamón, Puerto Rico. (Revised in accordance with EPA's comments dated July 1, 2002, an August 8, 2002 teleconference and minutes, and Addendum 1.)

3. Anderson, Mulholland & Associates, Inc. (AMAI), 2000. Technical Memorandum: RCRA Facility Investigation, Phase IA Soil Investigation Results. Caribbean Petroleum Refining LP, Bayamón, Puerto Rico.

4. Anderson, Mulholland & Associates, Inc. (AMAI), 2000. Technical Memorandum: RCRA Facility Investigation, Phase II Wastewater Treatment Plant Soil Investigation Results, Revision 1.0. Caribbean Petroleum Refining LP, Bayamón, Puerto Rico.

5. Anderson, Mulholland & Associates, Inc. (AMAI), 2000. Technical Memorandum: RCRA Facility Investigation, Phase I Wastewater Treatment Plant Soil Investigation Results, Revision 1.0. Caribbean Petroleum Refining LP, Bayamón, Puerto Rico.

6. Anderson, Mulholland & Associates, Inc. (AMAI), 2001. Technical Memorandum: RCRA Facility Investigation, Phase IB and 2A Soil Investigation Results. Caribbean Petroleum Refining LP, Bayamón, Puerto Rico.

7. Anderson, Mulholland & Associates, Inc. (AMAI), 2002. Technical Memorandum: RCRA Facility Investigation, Phase 3 Soil Investigation Results. Caribbean Petroleum Refining LP, Bayamón, Puerto Rico.

8. Anderson, Mulholland & Associates, Inc. (AMAI), 2003. Phase II Process Sewer Assessment Report, Revision 2. Caribbean Petroleum Refining LP, Bayamón, Puerto Rico.

9. Anderson, Mulholland & Associates, Inc. (AMAI), 2003. Las Lajas Creek Assessment, Supplemental Bank and Sediment Sampling Report (Revision 1). Caribbean Petroleum Refining LP, Bayamón, Puerto Rico.

10. Anderson, Mulholland & Associates, Inc. (AMAI), 2004. Sitewide Groundwater Monitoring Program, Draft Final Report, Caribbean Petroleum Refining LP, Bayamón, Puerto Rico.

11. September 20, 2004, Groundwater sampling results from six newly installed monitoring wells, Sitewide Groundwater Monitoring Program, submitted to EPA as preliminary data tables.

12. Anderson, Mulholland & Associates, Inc. (AMAI), 2004. Baseline Risk Assessment, Part 1, RAGS D Tables 0-2, Caribbean Petroleum Refining LP, Bayamón, Puerto Rico.

13. United States Geological Survey. 2002. Geology and Hydrogeology of the Caribbean Islands Aquifer System of the Commonwealth of Puerto Rico and the U.S. Virgin Islands. USGS Professional Paper 1419. Reston, Virginia.

14. U.S. Environmental Protection Agency (EPA), 1997. Drinking Water Advisory: Consumer Acceptability Advice and Health Effects Analysis on Methyl Tertiary-Butyl Ether (MTBE). Office of Water. EPA-833-F-97-009.

15. United States Environmental Protection Agency (EPA), 2001. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

3. Are there complete pathways between "contamination" and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table

Potential **Human Receptors** (Under Current Conditions)

"Contaminated" Media	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food
Groundwater	NO	NO	NO	YES	--	--	NO
~~Air (indoors)~~	___	___	___	--	--	--	--
Soil (surface, e.g., <2 ft)	NO	YES	NO	YES	NO	NO	NO
~~Surface Water~~	___	___	--	--	___	___	___
Sediment	NO	YES	--	--	NO	NO	NO
Soil (subsurface e.g., >2 ft)				YES			NO
Air (outdoors)	NO	NO	NO	YES	NO		

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors' spaces for Media which are not "contaminated") as identified in 2 above.

2. Enter "yes" or "no" for potential "completeness" under each "Contaminated" Media – Human Receptor combination (Pathway).

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

_____ If no (pathways are not complete for any contaminated media-receptor combination) - skip to #6, and enter "YE" status code, after explaining and/or referencing condition(s) in-place, whether natural or man-made, preventing a complete exposure pathway from each contaminated medium (e.g., use optional pathway Evaluation Work Sheet to analyze major pathways).

_X_ If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) - continue after providing supporting explanation.

_____ If unknown (for any "Contaminated" Media - Human Receptor combination) - skip to #6 and enter "IN" status code

Rationale and Reference(s):

The CPR site is currently utilized for industrial purposes only, thus no residents or day-care receptors are exposed to on-site contamination. The carbonate sediment is the water-bearing zone most likely to be used for water resource development. None of the contaminants in the carbonate sediment water-bearing zone, other than the TCE plume at the northeast area of the facility, appear to occur off-site. The TCE source, which may be from off-site, and extent of the TCE plume is under investigation; CPR is making a diligent effort to gain off-site access to an upgradient facility. The arsenic plume in the carbonate sediment water-bearing zone does not appear to be migrating off-site since arsenic levels at downgradient border monitoring wells are below screening levels. Mercury (3.4 ug/L) is also present above its screening level (2 ug/L) at the northeast boundary of the CPR property. However, residents are not exposed to contaminated groundwater since there are no known downgradient water supply wells used for public or private drinking water supplies.

Arsenic was detected at overburden well MW-112A (28.1 ug/L total, 16.9 ug/L dissolved, screening level of 10 ug/L) at the SWMU 11 area (Old Oil Lagoons) (Ref. 1). Naphthalene was detected at overburden well MW-113A (9.3 ug/L, screening level of 6.5 ug/L). Wells MW-112A and MW-113A are located near the property boundary. The extent of the naphthalene plume appears to be limited since it is not detected at nearby well MW-112A. The arsenic plume also appears to be limited since arsenic is not detected at nearby wells MW-113A and MW-114A, which are located about 100 ft south and north, respectively (Ref. 1). Naphthalene at well MW-113A and arsenic at well MW-112A do not significantly exceed their screening levels, the plumes appear limited, and the overburden has low permeability. Consequently, the plumes appear to be stable, and migration appears to be under control. Additionally, no exposure to downgradient residents is indicated because there are no downgradient water supply wells; the low yield of the overburden additionally makes it unlikely for water resource development.

Access to the facility is limited to CPR employees and their contractors and visitors. The perimeter of the operations area of the facility is fenced and guarded 24 hours a day. Access is generally inaccessible to the undeveloped area of the facility north of the operations area due to a natural wetland barrier. Additionally, the Puerto Rico Highway Authority maintains a security fence adjacent to Highway 22, which borders the undeveloped area. Therefore, trespassers are not expected to gain access to the facility and are not expected to become exposed to impacted on-site soil. Additionally, trespassers exposure to sediment in Las Lajas Creek at the northeastern undeveloped area of the facility property is unlikely due to fencelines and natural barriers.

The remaining potential receptors are discussed below.

Workers via "contaminated":

Groundwater - no completed pathway occurs since there are no on-site wells for production or water supply or other opportunities for production workers to ingest contaminated groundwater. Drinking water for the facility is from a municipal supply.

Surface Soil - exposure to contaminated surface soil may occur to workers from concentrations of arsenic at 25 SWMUs/AOCs/areas that occur above screening levels. Arsenic levels occur up to 93.2 mg/kg. Table 1 (attached) shows the maximum detected arsenic concentrations that exceed its screening level at the SWMUs/AOCs/areas.

Sediment – exposure to contaminated sediment in Las Lajas Creek may occur to workers. Arsenic levels occur up to 71.2 mg/kg occur in the sediment (Ref. 2). Incidental exposure may also occur to off-site workers at the industrial facilities located to the southwest of CPR, through which Las Lajas Creek traverses. The off-site facilities are fenced in with access only to their workers. Additionally, the Creek area is located at the eastern extremities of these facilities that exhibits scant worker activity.

Outdoor Air - Benzene at SWMU 1 (Container Storage Area) exceeds its inhalation screening level (1000 ug/kg) at only 1 out of 10 sampling locations at SWMU 1. The concentrations in the surface soil (1.5-2 ft) and subsurface soil (4-4.5 ft) are 1700 and 2400 ug/kg, respectively. SWMU 1 is paved with concrete, which inhibits escape of vapors from the soil. Also, any minor escape of vapors through any cracks in the concrete is not likely to be of any significance due to natural dispersion of contaminants once they reach the surface. Therefore, no current worker exposure to outdoor air is indicated.

Construction Workers via "contaminated":

Groundwater - Construction workers may potentially come in direct contact with contaminated groundwater during intrusive activities.

Surface Soil - Exposure to surface soil may occur to construction workers from arsenic concentrations above screening levels at 25 SWMUs/AOCs/areas. Arsenic levels occur up to 93.2 mg/kg. Table 1 (attached) shows the maximum detected arsenic concentrations that exceed its screening level at the SWMUs/AOCs/areas.

Subsurface Soil - Exposure to subsurface soil may occur to construction workers from concentrations above screening levels of arsenic at 30 SWMUs/AOCs/areas, vanadium at SWMU 34, benzo(a)anthracene at SWMU 11, and benzo(a)pyrene at SWMUs 3 and 11. Table 2 (attached) shows the maximum detected concentrations that exceed screening levels at the SWMUs/AOCs/areas. Exposure to LNAPL in shallow plumes may also occur to construction workers.

Outdoor Air - Benzene at SWMU 1 exceeds its inhalation screening level (1000 ug/kg) at only 1 out of 10 sampling locations at SWMU 1. The concentrations in the surface soil (1.5-2 ft) and subsurface soil (4-4.5 ft) are 1700 and 2400 ug/kg, respectively.

References:

1. September 20, 2004, Groundwater sampling results from six newly installed monitoring wells, Sitewide Groundwater Monitoring Program, submitted to EPA as preliminary data tables.

2. Anderson, Mulholland & Associates, Inc. (AMAI), 2003. Las Lajas Creek Assessment, Supplemental Bank and Sediment Sampling Report (Revision 1). Caribbean Petroleum Refining LP, Bayamón, Puerto Rico.

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[3] Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

4. Can the exposures from any of the complete pathways identified in #3 be reasonably expected to be "significant"4 (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

   __X__ If no (exposures can not be reasonably expected to be significant (i.e., potentially "unacceptable") for any complete exposure pathway) - skip to #6 and enter "YE" status code after explaining and/or referencing documentation justifying why the exposures (from each of the complete pathways) to contamination" (identified in #3) are not expected to be "significant."

   _____ If yes (exposures could be reasonably expected to be "significant" (i.e., potentially "unacceptable") for any complete exposure pathway) - continue after providing a description (of each potentially "unacceptable" exposure pathway) and explaining and/or referencing documentation justifying why the exposures (from each of the remaining complete pathways) to "contamination" (identified in #3) are not expected to be "significant."

   _____ If unknown (for any complete pathway) - skip to #6 and enter "IN" status code

Rationale and Reference(s):

All individuals conducting intrusive activities conducted at CPR must first obtain a permit from the facility, which is reviewed by facility Health and Safety personnel. At SWMUs/AOCs/areas with contamination above relevant screening criteria, this process provides for protection of construction workers through adherence to applicable OSHA regulations (e.g., PPE use) or by not allowing intrusive activities or disturbances to occur. Therefore, construction worker exposure to surface soil, subsurface soil, or groundwater contamination is not currently expected to be significant.

The maximum total excess lifetime cancer risk to on-site workers from exposure to surface soil contaminated with arsenic is estimated to be 4.9×10^{-5}. This estimate is based on exposure to the maximum detected arsenic concentration of 93.2 mg/kg in the surface soil at the facility. (The risk estimate was obtained by proportioning the EPA Region 3 risk based level of 1.9 mg/kg, which is based on a risk of 1×10^{-6}.) The risk estimate is conservative as it is likely that worker exposure would not occur only at the area of maximum concentration. Actual worker exposure to arsenic in the surface soil would be less since a worker would be exposed to average soil concentrations, which are less than the maximum. Nevertheless, the conservative risk estimate of 4.9×10^{-5} is within the USEPA acceptable target cancer risk range of 1×10^{-4} to 1×10^{-6}. Therefore, on-site industrial workers risk associated with exposure to surface soil contamination is not expected to be significant.

The maximum total excess lifetime cancer risk to on-site workers from exposure to sediment contaminated with arsenic is estimated to be 3.7×10^{-5}. This estimate is based on exposure to the maximum detected arsenic concentration of 71.2 mg/kg in the sediment. (The risk estimate was obtained by proportioning the EPA Region 3 risk based level of 1.9 mg/kg, which is based on a risk of 1×10^{-6}.) The risk estimate is conservative as it is likely that worker exposure would not occur only at the area of maximum concentration. Actual worker exposure to arsenic in the sediment would be less since a worker would be exposed to average sediment concentrations, which are less than the maximum. Nevertheless, the conservative risk estimate of 3.7×10^{-5} is within the USEPA acceptable target cancer risk range of 1×10^{-4} to 1×10^{-6}. Therefore, industrial worker risk associated with exposure to surface soil contamination is not expected to be significant.

4 If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

5. Can the "significant" **exposures** (identified in #4) be shown to be within **acceptable** limits?

   _____ If yes (all "significant" exposures have been shown to be within acceptable limits) - continue and enter "YE" after summarizing and referencing documentation justifying why all "significant" exposures to "contamination" are within acceptable limits (e.g., a site-specific Human Health Risk Assessment).

   _____ If no (there are current exposures that can be reasonably expected to be "unacceptable")- continue and enter "NO" status code after providing a description of each potentially "unacceptable" exposure.

   _____ If unknown (for any potentially "unacceptable" exposure) - continue and enter "IN" status code.

Rationale and Reference(s):

6. Check the appropriate RCRIS status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

_X_ YE - Yes, "Current Human Exposures Under Control" has been verified. Based on a review of the information contained in this EI Determination, "Current Human Exposures" are expected to be "Under Control" at the **Caribbean Petroleum Refining, LP** facility, EPA ID # **PRD00632182**, located in Bayamón, Puerto Rico under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

____ NO - "Current Human Exposures" are NOT "Under Control."

____ IN - More information is needed to make a determination.

Completed by _____ Date 9/29/2004
Sam Ezekwo, Project Manager
RCRA Programs Branch

Supervisor _____ Date 9/29/2004
Dale J. Carpenter, Section Chief
RCRA Programs Branch
EPA Region 2

Approved by _____ Date 9/29/2004
Adolph Everett, Chief
RCRA Programs Branch
EPA Region 2

Locations where References may be found:

U.S. Environmental Protection Agency - Region 2
RCRA File Room
290 Broadway - 15th Floor
New York, New York 10007

Contact telephone and e-mail numbers:

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FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.

TABLE 1
Surface Soil - Maximum Concentrations that Exceed Screening Levels
Caribbean Petroleum Refining LP

Soil Contaminant	EPA Region 3 industrial risk-based concentration (RBC)	Units	SWMU 1	SWMU 2	SWMU 3	SWMU 4	SWMU 5	SWMU 6	SWMU 7	SWMU 10	SWMU 11	SWMU 12	SWMU 13	SWMU 32	SWMU 33	SWMU 34	SWMU 35	SWMU 40
Arsenic	1.9	mg/kg	44.4 J	8.6 J	16	--	--	15.3 J	9.3 J	14.7 J	NS	63.2	68.3	NS	13.2	27.9	24.5 J	23.8

Soil Contaminant	EPA Region 3 industrial risk-based concentration (RBC)	Units	AOC 1	AOC 2	AOC 3	AOC 4	AOC 5	AOC 6	AOC 7	AOC 8	AOC 9	AOC 10	AOC 11	AOC 12	Tank 203	Process Sewer Area A	Process Sewer Area B	Process Sewer Area C
Arsenic	1.9	mg/kg	43.6 J	75	82.3	3.7 J	13.1	<26.6 J	32.9	< 29	9.5	17.3	93.2	44.3	61.9	NS	NS	NS

Note:

NS (not sampled) - indicates that the contaminant was not sampled for that medium and receptor

-- indicates that the contaminant was not detected above the risk-based screening level

TABLE 2
Subsurface Soil - Maximum Concentrations that Exceed Screening Levels
Caribbean Petroleum Refining LP

Soil Contaminant	EPA Region 3 industrial risk-based concentration (RBC)	Units	SWMU 1	SWMU 2	SWMU 3	SWMU 4	SWMU 5	SWMU 6	SWMU 7	SWMU 10	SWMU 11	SWMU 12	SWMU 13	SWMU 32	SWMU 33	SWMU 34	SWMU 35	SWMU 40
Arsenic	1.9	mg/kg	41.2 J	9.7 J	16.8	--	10.7	7.7 J	16 J	9.4 J	60.1 J	44.1	94.7	18.1	41.5 J	56.6	66.1 J	5 J
Vanadium	1000	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	1350	--	--
Benzo(a)anthracene	3900	ug/kg	--	--	--	--	--	--	--	--	9900	--	--	--	--	--	--	--
Benzo(a)pyrene	390	ug/kg	--	--	730	--	--	--	--	--	8200	--	--	--	--	--	--	--

Soil Contaminant	EPA Region 3 industrial risk-based concentration (RBC)	Units	AOC 1	AOC 2	AOC 3	AOC 4	AOC 5	AOC 6	AOC 7	AOC 8	AOC 9	AOC 10	AOC 11	AOC 12	Tank 203	Process Sewer Area A	Process Sewer Area B	Process Sewer Area C
Arsenic	1.9	mg/kg	15.3 J	87 J	79.6 J	11.5 J	28.8	30.8 J	< 23.9 J	36.6	13	54.9	92.4	90.6	138	65.5	45	25.4
Vanadium	1000	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	3900	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	390	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Note:

-- indicates that the contaminant was not detected above the risk-based screening level