DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

RCRA Corrective Action
Environmental Indicator (EI) RCRIS Code (CA725)
Current Human Exposures Under Control

Facility Name: PUMA Energy Caribe, LLC
Facility Address: Road PR-28, km 2, Luchetti Industrial Park, Bayamon, Puerto Rico
Facility EPA ID#: PRD000632182

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EIs) are measures being used by the Resource Conservation and Recovery Act (RCRA) Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved) to track changes in the quality of the environment. The two EIs 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 objectives of the RCRA Corrective Action program, the EIs 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 is for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and does 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 determination status codes should remain in the Resource Conservation and Recovery Information System (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 Information

The PUMA Energy Caribe, Inc. facility is located at Road PR-28, km 2, in the Luchetti Industrial Park in Bayamón, Puerto Rico. It is approximately 3 miles south of the Atlantic Ocean coast. The land use

surrounding the site is primarily industrial and commercial (Ref. 5). Fort Buchanan is located to the east, Highway PR-22 is to the north, and additional commercial and industrial properties are located south and west of the site (Ref. 5).

The site is located approximately 10 to 35 feet above Mean Sea Level (MSL) and generally slopes to the north. The area to the north is undeveloped and relatively flat, consisting primarily of wetlands. Las Lajas Creek originates south of the facility and flows through the wetlands and ultimately discharges to San Juan Bay. The facility is also bordered to the west by Diego Creek (100 meters west of the site) and 140 meters to the east by Santa Catalina Creek (Ref. 3).

Las Lajas Creek, which flows through the wetland areas, is a low-flow shallow perennial stream that discharges into San Juan Bay. The creek receives stormwater runoff from both the nearby residential and commercial areas. The water is channeled underground as it enters the PUMA facility and returns to open channels at the north of the facility's waste water treatment plant (WWTP). PUMA has a National Pollutant Discharge Elimination System (NPDES) permit for this discharge (Ref. 3).

The PUMA site is located on alluvium deposits of clay, sand, and sandy clay. The overburden thickness is approximately 90 feet at the northern perimeter and about 10 feet at the southern perimeter. A layer of carbonate sediments is located beneath the clay soils overlying the limestone bedrock. The regional topography includes mogotoes from the limestone formations in the area (Ref. 3).

Two general hydrogeologic units underlie the facility. The uppermost unit is a low permeability clay unit that contains a semi-perched layer and a permeable carbonate water bearing zone referred to as zone A. Groundwater flow direction in zone A is to the north, although some mounding does occur in the central portion of the site. Zone B, which underlies zone A, is a carbonate sediment layer that contains a water bearing zone which flows to the north northwest (Ref. 3). Groundwater in zone B is semi-confined, which often results in the potentiometric surface of groundwater wells completed in this zone having a higher water level than Zone A (Ref. 5). Due to the nature of the soils and geology in the area, water migration from surface soils is slow (Ref. 4).

Currently, the facility encompasses 179 acres, of which 115 acres are developed as a petroleum products storage facility that includes administrative offices, parking areas, and a wastewater treatment plant to the north (Ref. 5). The other 64 acres is the wetlands areas located to the north (Ref. 6). The facility has an aboveground pipeline for the transfer of fuel from loading docks on San Juan Bay and to customers at the Luis Munoz Marin Airport (LMMIA). A liquid propane gas storage and distribution area is also included as part of the facility. The rest of the property is undeveloped. Figure 1 shows the general location of the facility and surrounding areas (Ref. 6).

Initial petroleum refining operations first began at the site under the name of the Caribbean Refining Corporation (Ref. 1). In 1962, Gulf Oil purchased the site and changed the name to Caribbean Gulf Refining Corporation. Chevron acquired the site in 1984 and owned it until 1987 when First Oil Corporation purchased the site. The site operated until 2000, refining approximately 48,000 barrels of petroleum a day (Ref. 2).

While operating as a refinery, the facility imported crude oil and used it to produce petroleum distillates, leaded/unleaded gasoline, kerosene, and residual oils (Ref. 4). Hazardous wastes historically managed at the site also 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) (Ref. 2).

By 2008, both the CA725 and CA750 Environmental Indicator (EI) determinations were achieved (Refs. 1, 2). However, in October 2009 a series of explosions and fires damaged the site and destroyed many storage tanks. An unknown quantity of petroleum was released at the site and some of the materials were released to Las Lajas Creek and the associated wetlands areas to the north of the site. The fire occurred in the Tank Farm, which was comprised of 48 tanks used to store petroleum products (Ref. 1). Due to the explosions, a unilateral order was issued and EPA began conducting cleanup operations of the site. This included removal of contaminated soil tank bottoms and dismantling of damaged tanks (Ref. 3).

In 2010, the facility (named Caribbean Petroleum Refinery at the time) filed for bankruptcy and PUMA Energy Caribe acquired the site. In May 2011, PUMA entered into a RCRA Agreement to implement corrective action activities. This agreement was a modification to the October 1995 Administrative Order of Consent executed by EPA and Caribbean Petroleum Refinery (CPR) to investigate 35 Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs). The Order also required a site-wide hydrogeologic investigation. RCRA Facility Investigation (RFI) activities had been conducted at the site from 1998 until the explosions in 2009 (Ref. 2).

As part of the 2011 agreement with EPA, PUMA prepared a Current Conditions Report (CCR). Based on the CCR, PUMA prepared and submitted the 2013 RFI Work Plan to EPA. The RFI Work Plan focused on expediting the investigation of the site and employed a holistic approach to the remediation of the facility as opposed to a SWMU by SWMU approach. Once the RFI Work Plan was approved and implemented, the 2015 RFI Report (Ref. 6) was prepared. Upon review of the RFI Report, EPA requested a supplemental sampling investigation to address a few outstanding concerns (Ref. 7). The supplemental sampling investigation was approved and implemented in 2016 (Ref. 8). In addition to the supplemental sampling, EPA requested that PUMA prepare an updated screening evaluation (Ref. 9) using 2016 risk-based screening values to evaluate the 2015 RFI Report. The RFI was approved in January 2017. Based on this approval of the RFI, it was recommended that the new CA725 and CA750 EI determinations be prepared based on current conditions, as the CA725 and CA750 EIs on file were for the site prior to the explosions and fires which impacted site conditions.

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 (SWMUs), regulated units (RUs), and areas of concern (AOCs)), 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

Summary of Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs):

An Administrative Order on Consent was executed by EPA and CPR in October 1995 to investigate 32 SWMUs/AOCs, Las Lajas Creek Sediment, the facility Process Sewer, and the groundwater beneath the site (Ref. 2). The following is a list of the original SWMUs and AOCs, as well as the current status of the SWMUs and AOCs. The attached Figure 18 from the RFI depicts the original location of the SWMUs and AOCs, and Figure 7 from the RFI includes the status of the SWMUs and AOCs as presented in the 2015 RFI Report (Ref. 6).

SWMU 1: Container Storage Area
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

SWMU 2: Slop Oil Tank 1000
Cleaned and demolished in 2014 under the Work-Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 3: Slop Oil Tank 1001
Cleaned and demolished in 2014 under the Work-Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 4: Solids Knockout Pit
Cleaned and demolished in 2014 under the Work-Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 5: Surge Tank ET-1
Cleaned and demolished in 2014 under the Work-Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 6: API Separator
Cleaned and demolished in 2014 under the Work-Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 7: Corrugated Plate Interceptor
Cleaned and demolished in 2014 under the Work-Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 8: Equalization Basin
Closed RCRA unit that operated as an unlined surface impoundment that managed D018 and F038 wastes until ceasing operation in 1993. The unit was RCRA closed and approved by EPA in 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. In 1991, six wells were installed as part of a groundwater monitoring program for the unit. The monitoring system was integrated into the Site Wide Groundwater Monitoring Plan (SWGMP) as part of corrective action in 2002 (Ref. 2). Historically, benzene had been detected in groundwater, but as of March 2009, no constituents were detected in monitoring wells associated with the basin (CCR).

SWMU 9: Inlet basin to Biological Reactor #1
Cleaned and demolished in 2014 under the Work-Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 10: Digester
Cleaned and demolished in 2014 under the Work- Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 11: Old Oil Lagoons area
ICM implemented in December 2006, which involved removal of and off-site disposal of impacted soil (CCR). Soil sampling conducted during RFI and Supplemental RFI, approved January 2016.

SWMU 12: Old East Separator
Previously removed by CPR prior to the explosion of October 2009.

SWMU 13: Slop Oil Tank 452
Cleaned and demolished in 2014 under the Work-Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 19: Natural Aeration Basins
Cleaned and demolished in 2015 under the Work-Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 21: IAF Unit
Cleaned and demolished in 2014 under the Work-Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 22: Process Sewer
Flushed and manholes sealed in 2014 in accordance with the Final RFI Work Plan, approved on March 19, 2013. Letter Report submitted to EPA on February 17, 2014.

SWMU 23: Crude Oil 101
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

SWMU 24: Sulphur Pit
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

SWMU 26: Sulphur Recycling Plant
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

SWMU 27: Tank 481
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

SWMU 29: Storage Area – Particulate
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

SWMU 31: Flare
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

SWMU 32: Old Landfill Area
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

SWMU 33: Non-Hazardous Disposal
Soil sampling conducted during RFI and Supplemental RFI. Approved January 2016.

SWMU 34: Sulphur Lagoon
Soil sampling conducted during RFI and Supplemental RFI. Approved January 2016.

SWMU 35: Catalytic Waste Pond
Soil sampling conducted during RFI and Supplemental RFI. Approved January 2016.

SWMU 37: Sulphur Drum Storage Area
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

SWMU 38: Centrifuge
Cleaned and demolished in 2014 under the Work-Plan Decommission and Demolition of the Industrial Wastewater Treatment Plant, approved by EPA on June 17, 2014.

SWMU 39: Gravity Thickener Yard
Cleaned and demolished in 2014 as part of the CWA, RCRA orders, and under the Phase I of the Decommissioning and Demolition of the Industrial Wastewater and Treatment Plant. Approved October 13, 2013.

SWMU 40: Scrap Metal
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 1: Crude Unit Charge Pump Area
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 2: Fuel Oil Transfer Pump (Cummins) Area
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 3: Fuel Oil Transfer Pump Area near Tank 603
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 4: Asphalt Heater Unit
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 5: Fuel Oil Loading Rack Pump Area
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 6: Debutanizer Re-Boiler Area
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 7: FCC Unit Compressor Lube System Area
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 8: Heat Exchanger Bundles at Heavy Cycle Steam Generator
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 9: Crude Unit Num. 1 Area
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 10: Crude Unit Num. 1 near Heat Exchanger Bundle Area
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 11: Fuel Oil Pipeline Spill Areas
Removed and demolished during demolition of the refinery in 2012 under the CERCLA Order. This work was summarized in The Final Completion Report, dated October 18, 2013, and approved by EPA on September 15, 2014.

AOC 12: Old Loading Rack
Soil sampling conducted during RFI and Supplemental RFI. Approved January 2016.

Groundwater Investigations
Contaminants of concern identified at the AOCs and SWMUs are primarily total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), and metals (e.g., arsenic, vanadium, lead) (Ref. 5). Numerous groundwater investigations have also been conducted at the site. A comprehensive groundwater sampling event was conducted in 2003. At that time, groundwater samples were collected from 51 monitoring wells and 11 direct-push locations (Ref. 2).

Petroleum hydrocarbons are present in upper clayey sediment and carbonate sediment water-bearing zones at concentrations high enough to create light non-aqueous phase liquids (LNAPLs) (Ref. 2). Interim activities at the site have consisted of measurement and recovery of petroleum hydrocarbon LNAPL and groundwater monitoring. LNAPL measurements were performed at 129 monitoring wells situated throughout the facility. Groundwater sampling (VOCs, arsenic, lead, and/or mercury) was performed on a semi-annual basis. Semi-annual groundwater sampling (BTEX) was also performed at 6 wells at the former facility equalization basin. Historical groundwater contamination identified at the site prior to the fire includes:

- LNAPL in the upper clayey sediment (Zone A) and carbonate sediment (Zone B) water-bearing zones. Reportedly five LNAPL bodies existed, generally within the tank farm and WWTP areas (Ref. 5). Figure 6 from the RFI (Ref. 6) presents the pre-fire locations of the LNAPL plume.

- Dissolved groundwater constituents above the applicable screening criteria:
    - Zone A: benzene, toluene, xylenes, 1,2-dichloroethane (1,2-DCA), 2 -methylnaphthalene, naphthalene, methyl-tert-butyl-ether (MTBE), benzo(a)pyrene, chrysene, fluorene, total and dissolved arsenic, total barium, total beryllium, total chromium, total and dissolved lead, dissolved mercury, total vanadium

    - Zone B: trichloroethene (TCE), tetrachloroethene (PCE), vinyl chloride (VC), cis/trans-1,2-dichloroethene (1,2-DCE), 1,2-dichloropropane, benzene, ethylbenzene, arsenic.

Prior to the 2009 fire, 16 monitoring wells were sampled annually (Ref. 5). These wells were selected to provide information for evaluating downgradient migration. Five of the wells were located in the upper clayey sediment (Zone A), and 11 wells monitored conditions in the carbonate zone (Zone B; Ref. 5). These 16 wells selected were intended to provide information for evaluating potential downgradient migration of dissolved constituents from the LNAPL plume at the facility. Historically, the following areas of the facility were considered contaminated with dissolved constituents (Ref. 5):

- SWMU 22, Process Sewer Area – Zone A has reported detections of benzene, 1,2-DCA,

2-methyl-naphthalene, and naphthalene

- AOC 12, Old Loading Rack – Zone A has reported detections of benzene, naphthalene, and arsenic
- Wastewater Treatment Plant – Zone A has reported benzene, 2-methylnapthalene, chrysene, arsenic, chromium, and vanadium
- SWMU 11, Old Oil Lagoons – Zone A has reported detections of benzene, naphthalene, arsenic, and benzo(a)pyrene
- SWMU 34, Sulfur Lagoon – Zone A has reported detections of arsenic
- Northeast facility – TCE and degradation products in Zone B
- Area M, Northern Tank Farm – Arsenic plume in Zone B

Historically, LNAPL has also existed at the terminal floating both in the clay soil layer and from the carbonate layer. No off-site groundwater contamination had been identified historically as a result of the site contamination (Ref. 6).

Interim measure activities consisted of measurement and recovery of petroleum hydrocarbon LNAPL and groundwater monitoring. The groundwater recovery monitoring system consisted of 131 groundwater monitoring wells, 16 of which were sampled in March and 10 of which were sampled in September of every year to assess the downgradient migration of dissolved constituents from the LNAPL plumes. In addition, quarterly water level and/or product thickness measurements were also collected at the 131 monitoring wells. Monthly measurements were made at 63 of the wells (Ref. 2). LNAPL was routinely recovered at 60 wells. Twenty-two of the 60 recovery wells were equipped with pneumatic ejector pumps. Additional product was recovered from the remaining 38 wells by manual bailing. For the reporting period of October through December 2007, 873 gallons of product were recovered, and for the reporting period of January through March 2008, 265 gallons of product were recovered. As of March 2008, the total amount of product recovered since October 1991 was 80,368 gallons (Ref. 2).

Post 2009 Investigations

In 2009 at the time of the explosion, the site consisted of 42 aboveground storage tanks (ASTs). Areas specifically impacted or suspected of impact from the fire were:

- Northern Tank Farm
- Vicinity of WWTP
- Stormwater channels with the active portion of the facility
- Portions of the undeveloped area (e.g., wetlands).

Immediately following the 2009 explosions, EPA began recovering free product and contaminated soil. This included two areas with LNAPL that were excavated to water table depth, and both contaminated soil and water were removed. Several removal actions were also conducted by EPA during 2010. See attached Tables 9 and 10 from the CCR (Ref. 4) that summarize the activities conducted by EPA and contractors. After the fire, EPA also constructed a gabion retaining wall and earthen berm containing a flow control structure (underflow dam) across Las Lajas Creek to help restrict potential downgradient migration of released petroleum products (RFI Work Plan). Note that in 2014 the gabions were removed by PUMA (Ref. 5).

In May 2011, PUMA (with concurrence from EPA) began assessing site conditions holistically rather than on a SWMU by SWMU approach (Ref. 6), as many of the SWMUs and AOCs had been addressed (Ref. 4). In 2013, PUMA conducted underground storage tank (UST) investigations and removal of a 7,000-gallon diesel UST, a former 4,000-gallon gasoline UST, and a 6,000-gallon gasoline UST located on Avenue B south of the site and north of a former warehouse building. Note that both the 7,000-gallon

and the 4,000-gallon USTs were not found. The 7,000-gallon UST was reportedly already removed in April 1993 and the 4,000-gallon was not found. The 6,000-gallon UST was removed and excavation was conducted in January 2014. Groundwater was not detected in the excavation and the post-excavation samples were not detectable or below applicable screening levels for petroleum products (Ref. 6). Note that lead was detected at concentrations of 3.32 parts per million (ppm) and 13.5 ppm.

Between October and November 2013, soil sampling was also conducted in Area M. Area M consisted of soils piled up about 30 feet (approximately 168,000 cubic yards) which were a result of construction activities at the site. Sampling of the soils identified metals (aluminum, barium, chromium, iron, lead magnesium, manganese, and zinc) in concentrations below background. Soil was recommended for reuse at the terminal (Ref. 6).

In 2013, the RFI Work plan (Ref. 5) was scoped to assess the most current SWMUs and AOCs with documented contamination. Soil sampling was conducted in the following areas:

- Southern and eastern perimeter areas – 18 soil samples were collected to determine the extent of soil contamination in and along the facility boundary in the southern and eastern part of the site
- Avenue D – five soil borings were collected in the central portion of the facility, as this was the area identified to have the highest contamination prior to fire
- Undeveloped wetland areas – four sediment samples collected to address possible contamination in wetlands
- Las Lajas Creek – three sediment samples collected from the creek in northern portion of the facility.

Soil sampling results for Avenue D and the southern/eastern perimeter area identified primarily metals. Sediment samples in wetland areas and Las Lajas Creek also identified metals and TPH. Site-wide groundwater results identified VOCs and metals. In addition to dissolved constituents, LNAPL was detected in three monitoring wells, two of which were located in the tank farm area and one of which was located west in the area of Avenue D (Ref. 5).

Soil sampling results identified metals (e.g., lead, vanadium, chromium) in the vicinity of the southern and eastern perimeter areas. Additionally, TPH-diesel range organics (DRO) and TPH-oil range organics (ORO) were identified in some samples. Similar constituents were reported for Avenue D soil samples and the wetland and Las Lajas Creek sediment sample results (Ref. 5).

After completion of the RFI in 2015, based on historical soil results and the RFI results, an additional supplemental sampling investigation was conducted to address data gaps identified by EPA in and around SWMUs 11, 33, 34, 35. Specifically, two soil samples were collected at SWMU 11 and four samples were collected at SWMUs 33, 34 and 35 (Ref. 8). TPH-gasoline range organics (GRO), TPH-DRO, and TPH-ORO were identified in several of the samples surrounding these SWMUs.

The 2015 RFI also investigated groundwater conditions at the site. Dissolved constituents and LNAPL have been present in groundwater at the site since before the 2009 fire and explosion (Ref. 5). The 2015 RFI evaluated the current condition of the groundwater. Seventy groundwater samples were collected (Ref. 5). VOCs (e.g., benzene, ethyl benzene, MTBE, TCE, naphthalene) were detected along with metals (arsenic, chromium, lead and vanadium).

In addition to the LNAPL plumes and site-related contamination, there is information that a groundwater plume from the nearby Fort Buchanan site may be contributing to contamination (Ref. 5). Specifically, TCE and vinyl chloride have been identified along the eastern boundary of the PUMA site, but is believed to be part of a larger plume located on Fort Buchanan property (Refs. 2 and 5). Figure 18 of the RFI (Ref.

6) is attached, which depicts the plume maps for the site. Additional details regarding site-wide groundwater contamination are discussed in Question No. 2. However, the 2015 RFI concludes that dissolved constituents are not migrating significantly in groundwater, and that LNAPL is not anticipated to migrate in groundwater based on hydrogeologic conditions. The RFI also indicates that semi-annual and annual groundwater monitoring will be conducted over the next three years to ensure that migration is not occurring.

EPA approved the RFI and supplemental RFI in 2016, indicating that site characterization was complete. EPA also concurred with PUMA's recommendation to conduct periodic groundwater sampling to demonstrate that the EIs had been achieved (Ref. 5). Additional details regarding site-wide contamination are discussed in Question No. 2.

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, LNAPL, Metals, MTBE, petroleum hydrocarbons
Air (indoors)[2]	X			BTEX, TCE
Surface Soil (e.g., <2 ft)	X			Arsenic,
Surface Water		X		Lead below human health screening criteria
Sediment	X			Ethyl benzene, lead, vanadium, mercury
Subsurface Soil (e.g., >2 ft)	X			Arsenic, lead, and vanadium
Air (Outdoor)		X		

___ 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:
In 2016, EPA requested that PUMA conduct an updated screening evaluation (Ref. 9) to compare the RFI analytical results presented in the 2015 RFI Report to updated risk based screening levels (i.e., May 2016 EPA Regional Screening Levels [RSLs]). The following discussion provides historical data along with results of the updated screening evaluation.

Groundwater
Two general water-bearing units are present beneath the PUMA facility: an upper overburden clay unit (Zone A) and an underlying carbonate sediment unit (Zone B). Groundwater flow in Zone A is to the north, and in Zone B, to the north/northwest. Well yields in the overburden (Zone A) are generally less

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[1] "Contamination" and "contaminated" describe 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 Department 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.

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 (Zone B) varies from semi-confined to confined (Ref. 1).

Groundwater on site is contaminated above the EPA 2016 RSLs (Ref. 9) for several dissolved VOC and inorganic constituents. Additionally, LNAPL has existed in different portions of the terminal both on groundwater and in the clay soil later and from the carbonate sediment layer (Refs. 1 and 5). The LNAPL is pushed upward against the overlying clay soils due to undulations of the carbonate sediment layer (Ref. 5). It is believed that the floating free product in the carbonate sediments is unable to migrate (Ref. 1).

Numerous groundwater investigations have been conducted at the facility since 1980. Approximately 1,000,000 gallons of petroleum product and/or groundwater has been removed from the site (Ref. 4). Beginning in 1988, a groundwater assessment was initiated to delineate the extent of LNAPL at the site. As of 1989, 131 groundwater monitoring wells were monitored across the site. Of these 131 wells, 60 wells were used to recover product. Between 1991 and September 2009, approximately 80,000 gallons of product were removed from the site (Ref. 4).

In 2003, groundwater samples were collected and analyzed for VOCs, base neutral acids (BNAs), and/or metals at 51 monitoring wells and at 11 direct-push locations. VOCs, BNAs, and metals were detected in both Zones A and B. No off-site migration was identified. Table 1 below compares the historical maximum contaminant concentrations detected during this event and presented in the 2008 EI (Ref. 1) to the 2016 screening groundwater levels identified in the PUMA Energy Caribe, LLC, Updated Site Screening Evaluation (Ref. 9). As evident in Table 1, constituents exceeded at least one of the applicable screening levels: 2016 EPA Vapor Intrusion Screening Level (VISL), 2016 EPA Maximum Contaminant Level (MCL), or 2016 EPA tap water Regional Screening Level (RSL).

Table 1. Historical Groundwater Data from 2008 Environmental Indicators CA725

Groundwater Contaminant	2016 Tap Water RSL (µg/L)	2016 EPA MCL (µg/L)	2016 EPA Commercial VISL (µg/L)	Maximum Concentration (µg/L)	Monitoring well Or Direct Push Location
Benzene	0.46	5	6.9	2910	Well MW-91A
1,2-DCA	17	5	9.8	6.9 J	DP location PS-15G
Methyl Tertiary-Butyl Ether	14	-	200	652	Well B-2
Naphthalene	0.017	-	20	358 J	Direct-push location PS-16G
Cis-1,2-DCE	3.6	70	-	71.7	Well MW-75B
TCE	28	5	2.2	154 J	Well MW-83B1
Vinyl Chloride	0.019	2	2.5	5.8	Well MW-75B
Arsenic	0.052	10	-	121	Well MW-110B
Chromium	2200	100	-	248	Well MW-110B
Mercury	0.57	2	-	3.4	Well MW-21B
Vanadium	6.6	-	-	408	Well MW-110B

Source: Ref. 1
J = Estimated value
- = Not available

As indicated previously, groundwater conditions were uncertain after the 2009 fire. As such, PUMA conducted a groundwater sampling investigation as part of the RFI activities in 2014, and in 2016 conducted additional groundwater sampling as part of the recently implemented groundwater monitoring program (Ref. 11). Groundwater results from the December 2016 Ground Water Monitoring Report

(GWMR) (Ref. 11) and the 2015 RFI (Ref. 6) were compared to screening levels. Table 2 identifies those constituents that exceed relevant screening levels for groundwater, demonstrating that groundwater is still contaminated above applicable standards.

Table 2. December 2016 Groundwater Monitoring Results

Constituent	2016 Tap Water RSL (µg/L)	2016 EPA MCL (µg/L)	2016 EPA Commercial VISL (µg/L)	Maximum Concentration 2014 RFI (µg/L)	Location of 2014 Maximum Detection (µg/L)	Maximum Concentration 2016 GWMR (µg/L)	Location of 2016 Maximum Detection (µg/L)
Arsenic	0.052	10	-	276	MW-AD-2	9.6	MW-MP3
Lead	15	15	-	41.3	MW-AD-2	31	MW-48A
Mercury	0.57	2	-	1150	MW-AD-2	22	MW-MP3
Vanadium	6.6	-	-	7.8	PMW-124	56	MW-B1
Naphthalene	0.017	-	20	59.5	MW-91A	210	MW-91A
Benzene	.46	5	6.9	2430	MW-91A	1080	MW-91A
Chloroform	0.22	80	3.6	-	-	0.56	MW-118
Cis-1,2 DCE	3.6	70	-	-	-	8	MW-118
Ethyl benzene	1.5	700	15	767	MW-91A	690	MW-91A
MTBE	14	-	200	62.4	MW-EB104	61.2	MW-EB104
Trichlorethene	28	5	2.2	65.1	MW-18D	72.3	MW-118
m/p xylenes	19	10,000	160	-	-	63.6	MW-91A
O xylene	19	10,000	210	-	-	16.7	MW-91A

Source: Ref. 6, 9 and 11
- = Not available

As shown above, groundwater is considered contaminated above applicable criteria. Additionally, it should be noted that groundwater is contaminated with LNAPL in monitoring wells MW-42B, MW-40B, MW-T9 and MW-114A. The maximum LNAPL detected during the December 2016 monitoring event was 1.41 feet of LNAPL in monitoring well MW-40B. Although there are no screening levels for LNAPLs, it does pose a risk for ingestion, dermal exposure, and inhalation.

Air (Indoors)

As shown above in Tables 1 and 2, current and historical groundwater contamination has been identified above the EPA 2016 Commercial VISLs. Additionally, LNAPL is present in MW-42B, MW-40B, MW-T9 and MW-114A, which has the potential to cause indoor air concerns.

Surface Soil (< 2 Feet)

Surface soil is considered contaminated above applicable standards. Prior to the fire, surface soil samples were collected at 25 SWMUs/AOCs/areas as part of RFI activities (Ref. 1). The samples were analyzed for VOCs, BNAs, and/or metals. Only arsenic was identified as exceeding applicable criteria with levels ranging up to 93.2 mg/kg. Table 3 below compares the historic arsenic results for each SWMU to the 2016 RSLs. As shown in Table 3, arsenic exceeds the Industrial RSL in most locations, but only exceeded site-specific background at AOCs 2, 3, 11 and the Tank 203 area. Recent sampling results from the 2014 RFI investigation are depicted in Table 4 for surface soil samples. Soil samples were collected to determine the extent of soil contamination in and along the facility boundary in the southern and eastern part of the site, as well as Avenue D in the central portion of the facility. As shown in Table 4, arsenic exceeded the industrial RSL and its site-specific background level.

Table 3. Historical Surface Soil Arsenic Levels from 2008 Environmental Indicators CA725

Area	Arsenic (mg/kg)
EPA 2016 Industrial RSL	3
Site Specific Background	45
SWMU 1	44.4 J
SWMU 2	8.6J
SWMU 3	16
SWMU 4	-
SWMU 5	-
SWMU 6	15.3 J
SWMU 7	9.3 J
SWMU 10	14.7 J
SWMU 11	NS
SWMU 12	63.2
SWMU 13	68.3
SWMU 32	NS
SWMU 33	13.2
SWMU 34	27.9
SWMU 35	24.5 J
SWMU 40	23.8
AOC 1	43.6 J
AOC 2	75
AOC 3	82.3
AOC 4	3.7 J
AOC 5	13.1
AOC 6	<26.6
AOC 7	32.9
AOC 8	< 29
AOC 9	9.5
AOC 10	17.3
AOC 11	93.2
AOC 12	44.3
Tank 203	61.9

Source Ref. 1

Table 4. Maximum Contamination Detected in 2014 RFI Report Surface Soil

Constituent	2016 EPA Residential RSL (mg/kg)	2016 EPA Industrial RSL (mg/kg)	Site Specific Background (mg/kg)	SB-P-119 0-1 ft 1/30/2014	SB-P-116 1-2 ft 1/27/2014
Arsenic	0.68	3	45	81.7	17.4
Vanadium	39	580	250	135	130
Lead	400	800	92	45	40

Source: Ref. 6

Subsurface Soil (> 2 ft)

Subsurface soil is also considered contaminated above applicable criteria. Prior to the fire, subsurface soil samples were collected at 30 SWMUs/AOCs/areas as part of RFI activities (Ref. 1). The samples were analyzed for VOCs, BNAs, and/or metals. Table 5 reports the historic results as compared to 2016 EPA RSLs on a SWMU by SWMU basis. In addition, during the 2014 RFI activities, soil samples were collected. Table 6 depicts exceedances of applicable criteria identified in the RFI (Ref. 6).

Table 5. Historical Subsurface Soil Results from 2008 Environmental Indicators CA725

Area	Arsenic (mg/kg)	Vanadium (mg/kg)	Benzo (a)anthracene (mg/kg)	Benzo(a) pyrene (mg/kg)
EPA 2016 Industrial RSL	3	580	2.9	0.29
Site Specific background	45	250	-	-
SWMU 1	41.2 J	-	-	-
SWMU 2	9.7 J	-	-	
SWMU 3	16.8	-	-	730
SWMU 4	-	-	-	-
SWMU 5	10.7	-	-	-
SWMU 6	7.7	-	-	-
SWMU 7	16 J	-	-	-
SWMU 10	9.4	-	-	-
SWMU 11	60.1 J	-	9900	8200
SWMU 12	44.1	-	-	-
SWMU 13	94.7	-	-	-
SWMU 32	18.1	-	-	-
SWMU 33	41.5J	-	-	-
SWMU 34	56.6	1350	-	-
SWMU 35	66.1 J	-	-	-
SWMU 40	5 J	-	-	-
AOC 1	15.2 J	-	-	-
AOC 2	87 J	-	-	-
AOC 3	79.6 J	-	-	-
AOC 4	11.5 J	-	-	-
AOC 5	28.8	-	-	-
AOC 6	30.8 J	-	-	-
AOC 7	23.9 J	-	-	-
AOC 8	36.6	-	-	-
AOC 9	13	-	-	-
AOC 10	54.9	-	-	-
AOC 11	92.4	-	-	-
AOC 12	90.6	-	-	-
Tank 203	138	-	-	-
Process Sewer Area A	65.5	-	-	-
Process Sewer Area B	45	-	-	-
Process Sewer Area C	25.4	-	-	-

Source: Ref. 1

Table 6. Subsurface Soil Maximum Detections During 2014 RFI

Constituent	2016 EPA Residential RSL (mg/kg)	2016 EPA Industrial RSL (mg/kg)	Site Specific Background (mg/kg)	SB-P-119 10-11 ft 1/30/2014
Arsenic	0.68	3	45	43.1
Vanadium	39	580	250	185
lead	400	800	92	5.47

Source: Ref. 6

Soil samples were also collected during the supplemental field investigation at SWMU 11, 33, 34, 35, and the WWTP in 2016. As shown, one sample in the WWTP area exceeded screening levels.

Table 7. 2016 Supplemental Soil Sampling Detections

Constituent	TPH GRO (mg/kg)	TPH DRO (mg/kg)	TPH ORO (mg/kg)	Xylenes (mg/kg)
2016 EPA Industrial RSL	42	440	3,500,000	250
Sample FOL -1 16 ft bgs 04/13/16	19.2	11.5	ND	ND
Sample FOL -2 16 ft bgs 04/13/16	22.2	15	ND	ND
WWTP SB- 1 2-3 feet 4/11/16	15.5	3240	664	20.6
WWTP SB-2 Dup 4-5 ft bgs 4/11//16	ND	146	120	ND
Wetland soil #4 5-5-16	ND	58.2	63.7	ND

Source: Ref. 8

Sediment

Contamination above applicable criteria has been detected in sediment samples in the wetlands and Las Lajas creek. Sediment sampling was conducted in 1990 and 2002 at 9 locations (Ref. 4). Table 8 reports detected metal concentrations as compared to 2016 site specific background and EPA Soil RSL. One sample exceeded both the site-specific background and 2016 RSL criteria for arsenic.

Table 8. Historical Sediment Sampling Results (mg/kg)

Constituent	May 2016 Industrial RSL	Site Specific Back-ground	LLC-1	LLC-2	LLC-3	LLC-4	LLC-5	LLC-6	LLC-7	LLC-8	LLC-9
			7/22/99	7/22/99	7/22/99	7/22/99	7/22/99	7/22/99	7/22/99	6/24/02	6/24/02
Arsenic	3	45	7.3	23.9	71.2	26.6	24.4	23.1	15.5	22.1	21.9
Chromium	180,000	86	13.5	49.2	127	148	119	108	86.6	84.9	127
Vanadium	580	250	35.9	141	189	246	215	285	151	251	246

Source: Ref. 4

Additionally, during the 2014 RFI investigation activities, sediment samples were collected in the Las Lajas Creek and wetland areas. Diesel and oil range organics were detected in sediment samples, along with VOCs (acetone and ethyl benzene) and a few inorganics (arsenic, lead, mercury and vanadium). As shown in Table 9, arsenic exceeded the EPA 2016 RSL, but did not exceed background values. None of the inorganic concentrations or the VOCs exceeded human health risk-based values or calculated background values. The detected diesel and oil range organics were also less than the 2016 residential RSLs. Note that diesel and oil hydrocarbon results were compared to the TPH for medium and high aliphatics. Based on the results, arsenic is the only constituent of concern for sediment.

Table 9. 2016 RFI Sediment Sampling Results (mg/kg)

Constituent	2016 EPA Industrial RSL	Site Specific Back-ground	SELC01 (0-2) 5/06/14	SELC02 (0-2) 5/06/14	SELC03 (0-2) 5/06/14	SeW01 (0-2) 5/09/14	SeW02 (0-2) 5/09/14	SeW03 (0-2) 5/09/14	SeW04 (0-2) 5/09/14
Arsenic	3	45	5.1	3.3	3.8	3.3	2.5	2.8	0.98
Chromium	180000	86	22.9	14.8	21.3	12.3	21.8	6.4	2.9
Lead	800	92	17.2	11.7	8.0	13.6	14.7	10.5	2.6
Mercury	35	0.34	0.082	0.064	0.043	0.22	0.10	0.043	0.016 U
Vanadium	580	250	68.1	65.6	60.6	40.8	56.5	33.7	10.2
Diesel c10-c28	440	NA	66.0	9 U	9.7 U	14	16	9.8	71.1
Oil c28-c40	3,500,000	NA	153	64.8	52.3	49.6 U	48.2 U	48.4 U	73.0
Acetone	67,000	NA	0.0296	0.0298	0.0195	0.01 U	0.01 U	0.01 U	0.01 U
Ethyl Benzene	25	NA	0.00556 U	0.0049 U	0.0045	0.0050 U	0.0050 U	0.0050 U	0.0050 U

Source: Ref. 9
U = Undetected at reported concentration
NA = Not Available

Surface Water

Surface water samples were collected in 2014 from the Las Lajas Creek and the wetland areas. VOCs, semi-volatile organic compounds (SVOCs), and petroleum hydrocarbons were not detected in the surface water samples. Lead was detected in two samples with a maximum concentration of 0.0056 mg/L, which is below the human health risk based value of 0.015 mg/L. As such, surface water is not considered contaminated above applicable criteria for human exposure (Ref. 5).

Air (Outdoors)

No recent assessment of the impacts to outdoor air from groundwater have been conducted at the site since the 2008 EI (Ref. 1) which indicated that outdoor air was not a concern. Additionally, migration of VOCs from groundwater is not expected to be a concern based on natural dispersion of contaminants as they reach the surface.

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	Trespasser	Recreation	Food[3]
Groundwater	No	No	No	Yes	No	No	No
Air (indoor)	No	No	No	No	No	No	No
Surface Soil (e.g. < 2 ft)	No	Yes	No	Yes	No	No	No
~~Surface Water~~							
Sediment	No	No	No	Yes	No	No	No
Subsurface Soil (e.g., > 2 ft)	No	No	No	Yes	No	No	No
~~Air (outdoors)~~							

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. These spaces instead have dashes ("--"). 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:
The site is surrounded by Puerto Rico Road PR-22 and commercial warehouse to the north, Road PR-22 and Fort Buchanan to the east, Road PR-28, Fort Buchanan and the Julio Monagas Park to the south, and

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

the Luchetti Industrial park to the west. The nearest residence is 0.1 mile south on the Fort Buchanan Facility. Residential properties are also located approximately 1,000 feet downgradient of the property boundary. The PUMA site is currently utilized for industrial purposes only, thus no residents or day-care receptors are exposed to on-site contamination.

Groundwater

On-Site Receptors and Pathways
The carbonate sediment is the water-bearing zone most likely to be used for water resource development. There is a production well near the southern perimeter that is only used for firefighting measures. The well is not used for potable uses. In addition, water is provided to the facility by Puerto Rico Aqueduct and Sewer Authority (PRASA). As such, no route for ingestion, inhalation, or dermal contact exists for on-site office workers. On-site exposure, however, is possible for construction workers as they may be exposed to site-related constituents during excavation or construction (Ref. 5).

Off-Site Receptors and Pathways
Off-site impacts are not likely. The nearest downgradient resident is 1,000 feet from the property boundary. As dissolved contaminants and LNAPL are contained within the facility, impact to downgradient receptors is unlikely. The plume locations are generally within the Tank Farm and WWTP areas of the facility. The plumes are stable (Refs. 1 and 5) and unlikely to cause off-site impacts. Additionally, no exposure to downgradient residents is indicated as there are no downgradient water supply wells. Furthermore, the low yield of the overburden (Zone A) makes it unlikely for water resource development (Ref. 1).

With regard to Zone B, none of the contaminants in the carbonate sediment water-bearing zone, other than the TCE plume at the northeast area of the facility, occur off site. The TCE source, which has been attributed to Fort Buchanan, is still under investigation by Fort Buchanan (Refs. 1 and 5).

Surface/Subsurface Soil
Access to the facility is limited to PUMA 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 also generally inaccessible in the undeveloped area of the facility north of the operations area due to a natural wetland barrier. The Puerto Rico Highway Authority maintains a security fence adjacent to Highway 22, which borders the undeveloped area. Furthermore, access to the site and exposure at the northeastern undeveloped area of the facility property is also unlikely due to fence lines and natural barriers. The wetland areas are unstable by foot and contain abundant vegetation (Ref. 5). Machetes are required to traverse this area, which means that trespassing is unlikely. As such, exposure to surface soil on site is only possible for on-site workers and construction workers. On-site construction workers may also be exposed to subsurface constituents during excavation or construction. No off-site soil contamination has been identified and as such, no off-site pathways would be considered complete.

Indoor air
Data from the RFI Report collected in 2014 reported concentrations of benzene, ethyl benzene, and naphthalene above the VISL at AD-4 and MW-91A. TCE was also above the VISL in monitoring wells MW-118, MW-83B2 and MW119. In addition to dissolved constituents, low levels of LNAPL have been detected in monitoring wells MW-42B, MW-40B, MW-T9 and MW-114A. Although there are no VISLs for LNAPL it still poses a risk for inhalation. However, according to the 2017 screening evaluation (Ref. 11), there are currently no occupied buildings overlying or within 100 feet of these impacts at the facility, and therefore, the vapor intrusion pathway is incomplete for on-site workers (Ref. 11). No off-site

migration has occurred from the groundwater plumes on site so no impacts to off-site receptors are currently possible.

The Fort Buchanan TCE plume along the northeast border does migrate through the facility and off site. However, this plume is down gradient of any buildings and not within 100 feet of a building. The residential community of Puente Blanco is located about 1200 ft north of well MW-75B, at which chlorinated hydrocarbons (TCE, 1,2-DCE, 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. Therefore, no impact is likely (Ref. 1) because no complete pathways currently exist for indoor air.

Sediment

Arsenic exceedances have been identified in sediment samples. However, sediment is considered inaccessible to workers, visitors, contractors and trespassers. Access to the facility is limited to PUMA employees and their contractors and visitors. The perimeter of the operations area of the facility is fenced and guarded 24 hours a day. Additionally, 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. Exposure to sediment in Las Lajas Creek at the northeastern undeveloped area of the facility property is unlikely due to fence lines and natural barriers. The wetland areas are unstable by foot and contain abundant vegetation (Ref. 5). Machetes are required to traverse this area, which means that exposure is unlikely. As such, the only complete exposure pathway would be for on-site construction workers.

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 cannot 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:

Groundwater

As discussed in response to Question 3, the potential for on-site construction workers (remedial workers) to come in direct contact with contaminated groundwater is being considered a potentially complete exposure pathway at this time. However, any exposures that may occur are not expected to be significant because remedial workers wear personal protective equipment (PPE) and adhere to strict Occupational Safety and Health Administration (OSHA) guidelines to minimize exposure to contamination, per the Health and Safety Plan that is required by PUMA Caribe for any future remedial work (Ref. 1). Additionally, if construction work is planned in areas of impacts, air monitoring is also conducted and dewatering will likely be implemented if excavation below the water table is planned (Ref. 6).

Surface Soil

On-site workers may be exposed to site-related contaminants in surface soil via dermal, ingestion, or inhalation of outdoor particulate/volatile emissions during normal work activities. The potential for on-site workers to be exposed to surface soil is also a complete pathway for arsenic (Ref. 6). However, the 2008 EI Evaluation (Ref. 1) calculated risk for the on-site worker using the historical maximum detected concentration of arsenic (93.2 ppm). The risk was 3.7×10^{-5} and is within the EPA acceptable target cancer risk range of 1×10^{-4} to 1×10^{-6}. This calculation assumed a 40 hour per week exposure to arsenic, which is extremely conservative. Therefore, on-site industrial workers risk associated with exposure to surface soil contamination is not expected to be significant (Refs. 1 and 5).

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[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.

On-site construction workers may also be exposed to site-related surface soil contamination during construction and excavation activities. However, any exposures that may occur are not expected to be significant because remedial workers are assumed to wear PPE and adhere to strict OSHA guidelines to minimize exposure to contamination, per the Health and Safety Plan that is required by PUMA Caribe for any future remedial work (Ref. 5).

Sediment

Construction workers may also be exposed to sediments during construction and excavation activities. However, any exposures that may occur are not expected to be significant because construction and remedial workers wear PPE and adhere to strict OSHA guidelines to minimize exposure to contamination, per the Health and Safety Plan that is required by PUMA Caribe (Ref. 5).

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:

This question is not applicable. See the response to Question 4.

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 PUMA Energy Caribe LLC site, EPA ID# PRD000632182 located at Road PR-28, km 2 Luchetti Industrial Park, in Bayamon, 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: Connie Crossley Date: 9/20/17

Connie Crossley
Associate
Booz Allen Hamilton

Reviewed by: Amy Brezin Date: 9/20/17

Amy Brezin
Lead Associate
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Also reviewed by: David N. Cuevas-Miranda Date: 9/28/2017

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EPA Region 2

Approved by: Teresita Rodríguez Date: 9/29/2017

Teresita Rodríguez, Chief
Response and Remediation Branch
Caribbean Environmental Protection Division,
EPA Region 2

Locations where references may be found:

References reviewed to prepare this EI determination are identified on the following page. Reference materials are available at Puerto Rico Environmental Quality Board.

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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.

References

1. Documentation of Environmental Indicator Determination, RCRA Correction Action CA725 Current Human Exposures Under Control, Caribbean Petroleum Refinery, Bayamon, Puerto Rico, 2008.

2. Documentation of Environmental Indicator Determination, RCRA Correction Action CA750 Migration of Groundwater Under Control, Caribbean Petroleum Refinery, Bayamon, Puerto Rico, 2008.

3. Memorandum from David Cuevas, Caribbean Environmental Protection Division to File, Re: Status of RCRA Corrective Action Environmental Indicators (EIs), Caribbean Petroleum Refining (CPR), Status of RCRA Corrective Action Environmental Indicators (EIs), Caribbean Petroleum Refining (CPR), LP (PRD000632182), December 29, 2010.

4. PUMA Energy Caribe, LLC Current Conditions Report, Former Caribbean Petroleum Refining Facility, Bayamon, Puerto Rico. Prepared by Arcadis. Revised May 2012.

5. PUMA Energy Caribe, LLC, RFI Work Plan Former Caribbean Petroleum Refining Facility. Prepared by Arcadis. Dated September 2013.

6. PUMA Energy Caribe, LLC, RCRA Facility Investigation Report, Former Caribbean Petroleum Refining Facility. Prepared by Arcadis. Dated September 2015.

7. Letter from Brenda Torano Diaz, PUMA Energy Caribe, Inc.to David Cuevas, Caribbean Environmental Protection Division re: Responses and RCRA RFI Implementation Final Report for Former Capeco Site Facility, Bayamon, Puerto Rico. Dated January 21, 2016.

8. PUMA Energy Caribe, LLC, RCRA Facility Investigation Supplemental Sampling Report, Former Caribbean Petroleum Corporation Refinery/Terminal – Bayamon, Puerto Rico. Prepared by Arcadis. Dated November 2016.

9. PUMA Energy Caribe, LLC, Updated Site Screening Evaluation, RCRA Corrective Action at Puma Energy Caribe, LLC (Former Caribbean Petroleum Corporation) Bayamón, Puerto Rico EPA ID PRD000632182. Prepared by Arcadis. Dated March 2017.

10. Semi-Annual Sampling Report June 2016, Former Caribbean Petroleum Corporation Refinery/Terminal – Bayamon, Puerto Rico. Prepared by Arcadis. Dated March 2017.

11. Semi-Annual Sampling Report December 2016, Former Caribbean Petroleum Corporation Refinery/Terminal – Bayamon, Puerto Rico. Prepared by Arcadis. Dated April 2017.

Figures

The following figures have been provided to support this EI determination:

1. Figure 1 from the RCRA Facility Investigation Report, Former Caribbean Petroleum Refining Facility. Prepared by Arcadis. Dated September 2015. Referenced in Facility Information section.
2. Figure 6 from the RCRA Facility Investigation Report, Former Caribbean Petroleum Refining Facility. Prepared by Arcadis. Dated September 2015. Referenced in Question 1.
3. Figure 7 from the RCRA Facility Investigation Report, Former Caribbean Petroleum Refining Facility. Prepared by Arcadis. Dated September 2015. Referenced in Question 1.
4. Figure 18 from the RCRA Facility Investigation Report, Former Caribbean Petroleum Refining Facility. Prepared by Arcadis. Dated September 2015. Referenced in Questions 1 and 3.