

## DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

### RCRA Corrective Action Environmental Indicator (EI) RCRAInfo code (CA725)

#### Current Human Exposures Under Control

**Facility Name:** Commonwealth Oil and Refining Company, Inc. (CORCO)  
**Facility Address:** State Road 127, Peñuelas, Puerto Rico  
**Facility EPA ID #:** EPA ID No. PRD091017228

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

1. Has **all** available relevant/significant information on known and reasonably suspected releases to

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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?

If yes - check here and continue with #2 below.

If no - re-evaluate existing data, or

If data is not available, skip to #six and enter "IN" (more information needed)

status code.

**BACKGROUND**

The facility is located approximately 7 miles west of the city of Ponce, on State Road 127 in the Municipio (town) de Peñuelas. The facility was formerly a large petroleum refinery supplying refined feedstock to an adjacent petrochemical manufacturing complex. The northern part of the 800-acre CORCO site is hilly, and contains most of the facility's numerous storage tanks. The southern part, which borders the Caribbean Sea, consists of filled land that is relatively flat. This is the location of the former hazardous waste treatment units. Since 1982, CORCO has been inactive as a refinery and now functions as a terminal for the marine transportation and land-based storage of crude oil and petroleum products. During many of the years of its operation as a refinery, CORCO was involved in joint business ventures with adjacent chemical and petroleum refining facilities which partially make up the petrochemical complex. These facilities are either no longer operating or operating at much reduced capacities. CORCO retains ownership of some of these facilities, e.g., Oxochem and Caribe Isoprene. The regional land use outside the boundaries of the former petrochemical complex is residential and agricultural.

CORCO began investigating the site with the submittal of an RFA in March 1994, which was revised in August 1994. The subsurface free phase hydrocarbon investigation began in May 1994 and the plume delineated in November 1994. The data for the investigation of the Western Lagoons was finalized in December 1994. Closure plans for the regulated units identified in the 1990 Settlement Agreement, Tanks 1008/1030 and the Eastern Oil Lagoon, were submitted in February 1995. The respective risk assessments were submitted in April 1995. There was a follow-up subsurface DNAPL investigation in May 1995. Closure plans for the Western Lagoons were submitted in February 1997. Four design reports, as elements of the subsurface petroleum recovery system, were submitted between June 1996 and August 1998. In January 1999, CORCO informed EPA that CORCO was undergoing a comprehensive re-evaluation of its property and petroleum terminaling business. The re-evaluation included a re-assessment of the closure plans and re-assessment of the remediation of the plume of subsurface petroleum. In April 1999, CORCO submitted their revised closure and remediation strategy. CORCO's Revised RCRA Solid Waste Management Units Closure Work Plan was submitted in May 2, 2000, with an Addendum in December 2001. In April 2004, CORCO submitted a detailed response to EPA's §3007 Information Request. This response identified five new Solid Waste Management Units (SWMUs) and included a historical free product analysis and a Phase II Environmental Site Assessment done by the Commonwealth of Puerto Rico. In February 2005, CORCO submitted an analysis of existing data and the data gaps required to be supplied for the completion of the Current Human Exposures Under

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Control environmental indicator (CA 725). The report supplying the results of investigations attempting to supply the needed data as submitted in September 2005.

The major source of contamination on the site is a subsurface plume of free-phase petroleum and petroleum products (undissolved phase) with associated contaminated groundwater (dissolved phase). Because of its relatively high salt content, the groundwater is not currently used for drinking. There are also five surface impoundments that are required to be closed.

A 1990 Settlement Agreement requires that the facility submit, for EPA's approval, closure plans for the seven hazardous waste management units (HWMUs), consisting of five surface impoundments and two tanks, and a subsurface oil investigation plan for the facility. The closure plans were required to include groundwater monitoring and an implementation schedule. When approved, the closure plans will be implemented. During subsequent investigations, five additional SWMUs have been identified. All these units are identified in Table 1, below:

**Table 1. - HWMUs and SWMUs**

<b>HWMUs</b>	<b>Corrective Action and Current Status</b>
Slop Oil Tank 1008	The tank received and stored API oil/water separator sludge and DAF float from the wastewater treatment system. The clean closure plan is undergoing final approval
Slop Oil Tank 1030	The tank received and stored API oil/water separator sludge and DAF float from the wastewater treatment system. The clean closure plan is undergoing final approval
Aeration Basin	The unit is part of the Western Lagoon Area, which operated as a part of the hazardous waste wastewater treatment system. The unit stopped treating hazardous waste in 1982, when CORCO ceased operating as a refinery. The unit has been investigated and is pending closure under a 1990 Settlement Agreement.
East Cooling Water Basin	The unit is part of the Western Lagoon Area, which operated as a part of the hazardous waste wastewater treatment system. The unit stopped treating hazardous waste in 1982, when CORCO ceased operating as a refinery. The unit has been investigated and is pending closure under a 1990 Settlement Agreement.
West Cooling Water Basin	The unit is part of the Western Lagoon Area, which operated as a part of the hazardous waste wastewater treatment system. The unit stopped treating hazardous waste in 1982, when CORCO ceased operating as a refinery. The unit has been investigated and is pending closure under a 1990 Settlement Agreement.

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Oxidation Basin	The unit is part of the Western Lagoon Area, which operated as a part of the hazardous waste wastewater treatment system. The unit stopped treating hazardous waste in 1982, when CORCO ceased operating as a refinery. The unit has been investigated and is pending closure under a 1990 Settlement Agreement.
Eastern Oil Lagoon	This unit is location on leased land outside the facility boundaries. It was used for the disposal of API Separator sludge. The unit reportedly stopped receiving waste before CORCO ceased operating as a refinery. The unit has been investigated and is pending closure under a 1990 Settlement Agreement.
<b>SWMUs</b>	<b>Corrective Action and Current Status</b>
CORCO Main Site	The area contains subsurface free-phase petroleum and associated contaminated groundwater from the systematic release from petroleum storage tanks located in the upland and upgradient portion of the facility. The area has undergone investigation and is being remediated under a 1990 Settlement Agreement.
Jakes Lagoon	The area represents subsurface free-phase petroleum and associated contaminated groundwater from the systematic release of petroleum.
Flores Park	The area contains buried surface impoundments, the soils of which have been investigated.
Oxochem and Caribe Isoprene	The area, owned by CORCO, is separate from the main CORCO facility and contains two surface impoundments (ponds).
Former Effluent Channel	The unit is a functional part of the Western Lagoon Area, which operated as a part of the hazardous waste wastewater treatment system. The unit stopped transporting hazardous waste in 1982, when CORCO ceased operating as a refinery. CORCO holds a perpetual easement to this area. The area contains sediments which have been investigated.

Interim Corrective Measures consist of the ongoing recovery of subsurface free phase petroleum for the purpose of containing the petroleum's further migration. It is estimated that more than 5.8 million gallons of petroleum have been recovered so far. The seven units which are currently identified as hazardous waste management units lost their permit to operate in 1985.

2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be "**contaminated**"<sup>1</sup> 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)?

Yes    No    ?                      Rationale / Key Contaminants

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Groundwater	<input checked="" type="checkbox"/> ___ ___	<p>For the CORCO Main Site, released subsurface petroleum, the key contaminants are: benzene, toluene, ethylbenzene, and xylene (BTEX), naphthalene, arsenic, lead, mercury, selenium, and thallium. For the Western Lagoon Area (Aeration Lagoon, Oxidation Lagoon, East Cooling Water Lagoon, West Cooling Water Lagoon, Jakes Lagoon, and the Former Effluent Channel) the key contaminants are: benzene, trimethylbenzene, antimony, beryllium, cadmium, lead, selenium, and thallium. For Flores Park, the key contaminants are: benzene, antimony and thallium. For Oxochem and Caribe Isoprene, the key contaminant is thallium. For the Eastern Oil Lagoon, the key contaminants are: arsenic, cadmium, lead, thallium, trichloroethylene, and vinyl chloride.</p>
Air (indoors) <sup>2</sup>	<input checked="" type="checkbox"/> ___ ___	<p>For the CORCO Main Site, the key contaminants are: benzene, toluene, ethylbenzene, xylene, and naphthalene, and potentially impact administration workers in the occupied Administration Building.</p>
Surface Soil (e.g., <2 ft)	<input checked="" type="checkbox"/> ___ ___	<p>For the CORCO Main Site (which includes the former leaded fuel tank containment), the key contaminants are: lead, arsenic, trimethylbenzene, benzene, and ethylbenzene. For the Western Lagoons, the key contaminants are: arsenic, benzene, ethylbenzene, tetrachloroethylene, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene, and PCBs (Arochlor 1254). For Flores Park, the key contaminants are: arsenic, benzo(a)pyrene, and benzo(b)fluoranthene. For Oxochem-Caribe Isoprene, the key contaminant is arsenic. For the Eastern Oil Lagoon, the key contaminants are: arsenic, BTEX, benzo(a)anthracene, and benzo(b)fluoranthene.</p>
Surface Water	<input checked="" type="checkbox"/> ___ ___	<p>For the Western Lagoon Area (specifically, Jakes Lagoon) key contaminants are benzene,</p>

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trimethylbenzene, antimony, beryllium, cadmium, lead, selenium, and thallium, which are potentially transferred from groundwater into adjacent surface waters. For Flores Park, the key contaminants are: benzene, antimony and thallium potentially transferred from groundwater into adjacent surface waters. For Oxochem and Caribe Isoprene, the key contaminant is thallium potentially transferred from groundwater into adjacent surface waters.

Sediment	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<p>For the Western Lagoon Area, the key contaminant is benzene (from the Former Effluent Channel) and BTEX and lead (from Jakes Lagoon) potentially transferred from groundwater into adjacent surface waters (Guayanilla Bay). For Flores Park, the key contaminants are BTEX and diesel range hydrocarbons, potentially transferred from groundwater to the surface waters of Guayanilla Bay. For Oxochem and Caribe Isoprene, the key contaminant is thallium, potentially transferred from groundwater into the surface waters of the Tallaboa River, and arsenic, potentially transferred from surface soil to the Tallaboa River by flooding.</p>
Subsurf. Soil (e.g., >2 ft)	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<p>For the CORCO Main Site, the key contaminants are: BTEX, trimethylbenzene, and lead. For the Western Lagoons, the key contaminants are: BTEX and lead. For Flores Park, the key contaminants are: arsenic, benzo(a)pyrene, and benzo(b)fluoranthene. For the Eastern Oil Lagoon, the key contaminants are: arsenic, BTEX, benzo(a)anthracene, and benzo(b)fluoranthene.</p>
Air (outdoors)	<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<p>For the CORCO Main Site, the key contaminants are: benzene, toluene, ethylbenzene, xylene, and naphthalene, and potentially impact maintenance workers on the site who are exposed to contaminated outdoor</p>

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air derived from the subsurface plume of petroleum hydrocarbons and associated contaminated groundwater.

- \_\_\_\_\_ 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.
- 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):**

Only those contaminants in media are noted that have been detected above their respective Region 9 Preliminary Remediation Goals (PRGs) for industrial sites at a  $1 \times 10^{-5}$  risk level, unless otherwise noted.

Groundwater: There were systematic releases of subsurface free-phase petroleum in the CORCO Main Site and in a separate location of the Western Lagoon Area (Jakes Lagoon). The constituents in groundwater consist of benzene, toluene, ethylbenzene, and xylene, i.e., BTEX and naphthalene. For Jakes Lagoon, benzene, ethylbenzene, xylene and diesel range hydrocarbons were detected in one groundwater well. BTEX and other diesel range hydrocarbons were also detected in Flores Park. In the Eastern Oil Lagoon, trichloroethylene and vinyl chloride were detected above MCLs (DSM Environmental Services, Groundwater Risk Evaluation Eastern Oil Lagoon Area, April 1995; DSM Environmental Services, Phase II - Subsurface Product Delineation Report, February 1996; DSM Environmental Services, Phase II - Subsurface Product Delineation and Formation Evaluation Work Plan; Letter Report on the Findings of the Off-Property Subsurface Product Delineation Program, February 23, 1998; NewFields, Inc., Revised RCRA Solid Waste Management Units Closure Work Plan, May 2, 2000; NewFields, Inc., Response to §3007 Request - Attachment 2 - Historical Free Product, April 2004; NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment (November 2000), April 2004; NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005; and NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005).

Indoor air: For the CORCO Main Site, there are three to five feet of free-phase petroleum beneath the CORCO Administration Building. The building is air conditioned and occupied during the work day. There are also workers in other open and partially occupied buildings nearby. The

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Union Carbide Caribe facility Administration Building is immediately downgradient from the CORCO facility and is evaluated in the separate Human Exposure Environmental Indicator Determination for Union Carbide Caribe (GDC Engineering, Inc., Site Assessment Report, March 24, 1994; GDC Engineering, Inc.; Revised Site Assessment Report with Data Validation Report, August 31, 1994; NewFields, Inc., Response to §3007 Request - Attachment 2 - Historical Free Product, April 2004; NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment (November 2000), April 2004; NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005; On-site Environmental, Tier 2 and 3 Subsurface Vapor Intrusion Screening at CORCO, August 15, 2005; and NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005).

Surface soil (e.g., <2 ft): For the CORCO Main Site, samples of lead were taken from the areas surrounding the former leaded gasoline storage tanks 955 through 958 and Tanks 1001 through 1006. Only the area surrounding Tank 955 had lead concentrations above the PRG. Arsenic has been detected throughout the CORCO Main Site. For the Western Lagoon Area, organic constituents detected are in concentrations below their respective PRGs. For Flores Park, BTEX, diesel range hydrocarbons, dieldrin, and Arochlor 1254, do not exceed their respective PRGs. No surface soil sampling has been done for Oxochem/Caribe Isoprene, but subsurface soil has been sampled; BTEX and lead were not detected; and PAHs compounds, benzo(a)pyrene and benzo(b)fluoranthene are below their respective PRGs at the  $1 \times 10^{-5}$  industrial risk levels. For the Eastern Oil Lagoon, some samples of BTEX and benzo(b)anthracene were detected above PRGs (GDC Engineering, Inc., Site Assessment Report, March 24, 1994; GDC Engineering, Inc., Revised Site Assessment Report with Data Validation report, August 31, 1994; DSM Environmental Services, Groundwater Risk Evaluation Eastern Oil Lagoon Area, April 1995; DSM Environmental Services, Groundwater Risk Evaluation Western Lagoon Area, April 1995; DSM Environmental Services, Attachment 1 to the Amended Eastern Oil Lagoon Unit Closure Plan (Revised Risk Assessment), December 1995; NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment (November 2000), April 2004; NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005; and NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005).

Surface water: Units have been investigated for their potential impacts to surface water from the transfer of NAPL and dissolved contaminants in groundwater to adjacent surface waters. For the Western Lagoon Area (Jakes Lagoon), Flores Park, and Oxochem/Caribe Isoprene. There are no reported seeps or oil sheens from Jakes Lagoon, Flores Park or Oxochem/Caribe Isoprene. For Jakes Lagoon, groundwater sampling along the shoreline indicates one sample which detected ethylbenzene and diesel range hydrocarbons above the recreational PRGs. For Oxochem/Caribe Isoprene, no surface water has been sampled from the two surface impoundments (Former Fire Water/Cooling Water Pond and Wastewater Pond) (NewFields, Inc., Revised RCRA Solid Waste Management Units Closure Work Plan, May 2, 2000; NewFields,



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Inc., Response to §3007 Request - Attachment 2 - Historical Free Product, April 2004; NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment (November 2000), April 2004; NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005); and NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005).

Sediments: Units have been investigated for their potential impacts to surface water from the transfer of NAPL and dissolved contaminants in groundwater to adjacent sediments. For the Western Lagoons Area (Former Effluent Channel), benzene exceeded PRGs for one sediment sample. For sediments waterward of Flores Park, the key contaminants were all below PRGs. For the Oxochem/Caribe Isoprene surface impoundments (Former Fire Water/Cooling Water Pond and Wastewater Pond), no sampling of the sediments was done (NewFields, Inc., Revised RCRA Solid Waste Management Units Closure Work Plan, May 2, 2000; NewFields, Inc., Response to §3007 Request - Attachment 2 - Historical Free Product, April 2004; NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment (November 2000), April 2004; and NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005); and NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005).

Subsurface soil (e.g., >2 ft): For the CORCO Main Site, the subsurface contains BTEX and naphthalene that are above PRGs. For the Western Lagoons Area there is BTEX and lead above the PRGs (GDC Engineering, Inc., Site Assessment Report, March 24, 1994; GDC Engineering, Inc., Revised Site Assessment Report with Data Validation report, August 31, 1994; DSM Environmental Services, Groundwater Risk Evaluation Eastern Oil Lagoon Area, April 1995; DSM Environmental Services, Groundwater Risk Evaluation Western Lagoon Area, April 1995; DSM Environmental Services, Attachment 1 to the Amended Eastern Oil Lagoon Unit Closure Plan (Revised Risk Assessment), December 1995; NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment (November 2000), April 2004; NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005; and NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005).

Air (outdoors): Surface soil data do not indicate concentrations of contaminants above their respective PRGs for air (GDC Engineering, Inc., Site Assessment Report, March 24, 1994; GDC Engineering, Inc., Revised Site Assessment Report with Data Validation report, August 31, 1994; DSM Environmental Services, Groundwater Risk Evaluation Eastern Oil Lagoon Area, April 1995; and DSM Environmental Services, Attachment 1 to the Amended Eastern Oil Lagoon Unit Closure Plan (Revised Risk Assessment), December 1995); Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment (November 2000), April 2004; and NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005; On-Site Environmental, Health and Safety Plan, September 2005; and NewFields, Inc., Letter Report - Environmental Indicators, September 23,

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2005).

Footnotes:

<sup>1</sup> “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 identifies risks within the acceptable risk range).

<sup>2</sup> Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggests 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.

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 <sup>3</sup>
Groundwater	No	No	No	No	No	No	No
Air (indoors)	No	No	No	No	No	No	No
Soil (surface, e.g., <2 ft)	No	No	No	No	No	No	No
Surface Water	No	No	No	No	No	No	No
Sediment	No	No	No	No	No	No	No
Soil (subsurface e.g., >2 ft)	No	No	No	No	No	No	No
<del>Air (outdoors)</del>	<del>No</del>	<del>No</del>	<del>No</del>	<del>No</del>	<del>No</del>	<del>No</del>	<del>No</del>

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors’ spaces for Media which are

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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).
- 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):**

For all media, the entire facility, including the separate Eastern Oil Lagoon and Oxochem/Caribe Isoprene site, is surrounded by fencing designed to prevent casual trespass, is subject to 24-hour site security, and is subject by a site-wide Health and Safety Plan for on-site workers.

Groundwater: A water well survey indicates that there are no municipal, private, or agricultural groundwater wells down-gradient of the CORCO (Environmental Indicators, Compilation of Existing Data and Identification of Data Gaps, September 23, 2005). There are few personnel at CORCO, which is a partially closed industrial facility. Drinking water is supplied by upgradient wells operated by the Puerto Rico Aqueduct and Sewer Authority (PRASA). The groundwater is not known to be used for industrial purposes that would allow worker exposure. The site has no nearby residences, none are downgradient, and the site is secured against casual trespass. The only potential exposure would be through direct contact to workers/ construction workers excavation activities. Exposures to workers and construction workers from direct contact with groundwater at the entire facility are controlled through designated work procedures identified in the CORCO Health & Safety Plan. Any potential exposures from soil or groundwater not addressed by the CORCO general Health & Safety Plan will be addressed by a task specific Health & Safety Plan (NewFields, Inc., Response to §3007 Request - Attachment 2 - Historical Free Product, April 2004; NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA

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Phase II Environmental Site Assessment (November 2000), April 2004; and NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005; On-Site Environmental, Health and Safety Plan, September 2005; and NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005).

Indoor air: The only potential exposures are occupational which are covered by the Occupational Safety and Health Administration (OSHA) which has been notified of the conditions at the site, and therefore this is not an issue. In addition, the only building that is not routinely open to the outside air and/or is occupied full time is the Administration Building and represents the worst case in terms of potential exposure to contaminants in indoor air. The plume of free-phase petroleum is 36 feet beneath the Administration Building. A risk assessment has concluded that exposure levels are within a risk of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ . Benzene concentrations are two orders of magnitude below the OSHA time weighted average exposure limits set as a maximum limit for benzene for workers (Response to §3007 Request - Attachment 2 - Historical Free Product, April 2004; NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment [November 2000], April 2004; and NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005; On-Site Environmental, Tier 2 and 3 Subsurface Vapor Intrusion Screening at CORCO, August 2005; and NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005).

Surface soil (e.g., <2 ft): There is no anticipated inhalation risk because work performed at the CORCO Main Site does not involve soil disturbance. The site has controlled access. The soils are located within the secondary containment areas of the tanks and therefore are not subject to soil erosion. The uniform and ubiquitous nature of the arsenic detections indicate that this element is likely at background concentrations in this area and in the Western Lagoons Area. The Health and Safety Plan provides guidance to minimize exposure to the contaminated surface soils. All individuals conducting intrusive activities conducted at the facility must first obtain a permit from the facility, which is reviewed by facility Health and Safety personnel. At SWMUs 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. Additionally, no construction activities are currently planned in the areas of concern. Therefore, construction worker exposure to groundwater contamination is not currently expected to be significant. For Flores Park, recreational users are prevented from access to a separate dredged spoil impoundment and scrap yard, by fencing, which contain surface soil with BTEX and diesel range hydrocarbons in concentrations that exceed the PRGs. The Eastern Oil Lagoon, like the rest of the CORCO site, is fenced and subject to security patrols which limits casual trespass. Exposures to workers and construction workers from direct contact with surface soil and groundwater at the Main Site, Flores Park, Jakes Lagoon, Eastern Oil Lagoon, and Oxochem/Caribe Isoprene (i.e., the entire facility) are controlled through designated work procedures identified in the CORCO Health & Safety Plan. Any potential exposures from soil or groundwater not addressed by the CORCO

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general Health & Safety Plan will be addressed by a task specific Health & Safety Plan (NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005). (NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment (November 2000), April 2004; NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005; NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005).

Surface water: Along the shore of Jakes Lagoon, there was one groundwater monitoring well that had a detection of ethylbenzene and diesel range hydrocarbons above the recreational PRGs. The surface waters adjacent to this area have the potential to be used for recreation or by local subsistence fishermen from the local community of Playa de Guayanilla, although they are not routinely observed fishing in this area. Access to Jakes Lagoon is restricted by a fence, by site security patrols, and by signage that either prevents or discourages fishing in this industrial area. Reportedly, there is also local knowledge about the past history of the site. The groundwater concentrations for Jakes Lagoon for ethylbenzene is less than ten times the surface water standards (Commonwealth of Puerto Rico Office of the Governor, Environmental Quality Board, Environmental Policy Act [Law No. 9 of June 18, 1970, as Amended], Puerto Rico Water Quality Standards Regulation, as Amended, March 2003). Therefore, there is no exposure pathway that exceeds risk-based standards for surface water. The surface impoundments (ponds) of the Oxochem/Caribe Isoprene site are closed systems, not connected to any other surface water, have high walls for the retention of stormwater, and dry out during the dry weather season. The site is closed and fenced against trespass (NewFields, Inc., Revised RCRA Solid Waste Management Units Closure Work Plan, May 2, 2000; The Commonwealth of Puerto Rico Office of the Governor, Environmental Quality Board, Environmental Policy Act [Law No. 9 of June 18, 1970, as Amended], Puerto Rico Water Quality Standards Regulation, as Amended, March 2003; NewFields, Inc., Response to §3007 Request - Attachment 2 - Historical Free Product, April 2004; NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment (November 2000), April 2004; and NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005; and NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005).

Sediments: Exposures to workers and construction workers from direct contact with sediments in the Former Effluent Channel are controlled through designated work procedures identified in the CORCO Health & Safety Plan. All individuals conducting intrusive activities conducted at the facility must first obtain a permit from the facility, which is reviewed by facility Health and Safety personnel. At SWMUs 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. Additionally, no construction activities are currently planned in the areas of concern. Therefore, construction worker exposure to groundwater contamination is not currently expected to be significant. Exposures during non-routine procedures will be addressed by task specific Health &

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Safety Plans. Exposure to trespassers and recreational users through direct contact with sediments in Guayanilla Bay, outside the fencing at Flores Park and Jakes Lagoon, is not determined to be significant based on the sampling data. Exposure to potential trespassers and recreational users is also prevented, as with surface water, through the use of fencing, site security patrols, signage, and local knowledge of the past history of the site. The sediments in the ponds at Oxochem/Caribe Isoprene limit access by fencing and security patrols. There is a potential exposure through the consumption of land crabs that have been exposed to sediments at Flores Park, Jakes Lagoon, and the Former Effluent Channel. Trapping of crabs is known to occur in these areas. CORCO has produced a report entitled: Screening Level Human Health Risk Evaluation of Land Crab Consumption (in NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005). The exposure pathway contaminants investigated were diesel range hydrocarbons and polyaromatic hydrocarbons (PAHs). The evaluation concluded that the consumption of land crabs is not a complete pathway for the ingestion of these contaminants because: (1) there is a small tendency for these compounds to bioaccumulate based upon their chemical and physical properties; (2) PAHs are effectively excreted and depurated by higher level aquatic species; (3) the crabs would not normally ingest the affected sediments (the main mode of ingestion of the contaminants) and would not effectively ingest them through the plants that the crabs normally eat; (5) crabs are partially depurated before consumption; and (6) access is controlled at the Former Effluent Channel by physical barriers - the discharge point of the channel is accessible to trespassers, but the PAH concentrations are the lowest there. (NewFields, Inc., Response to §3007 Request - Attachment 2 - Historical Free Product, April 2004; NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment (November 2000), April 2004; NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005; and NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005).

Subsurface soil (e.g., >2 ft): For the CORCO Main Site and the Western Lagoons Area, there are potential exposures to workers and construction workers through direct contact during excavation/soil disturbance activities, in the areas of the subsurface plumes of petroleum, as part of their regular work duties. Exposures to workers and construction workers from direct contact during excavation/soil disturbing activities are controlled through designated work procedures identified in the CORCO Health & Safety Plan. All individuals conducting intrusive activities conducted at the facility must first obtain a permit from the facility, which is reviewed by facility Health and Safety personnel. At SWMUs 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. Additionally, no construction activities are currently planned in the areas of concern. Therefore, construction worker exposure to groundwater contamination is not currently expected to be significant (Environmental Indicators, Compilation of Existing Data and Identification of Data Gaps, September 23, 2005).

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<sup>3</sup> 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”**<sup>4</sup> (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)?

\_\_\_\_\_ 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 and Reference(s):

<sup>4</sup> 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.

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\_\_\_\_\_ If unknown (for any potentially “unacceptable” exposure) - continue and enter “IN” status code.

Rationale and Reference(s): N/A

6. Check the appropriate RCRAInfo 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):

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 Commonwealth Oil and Refining Company, Inc. facility, EPA ID # PRD091017228, located at State Road 127, Peñuelas, 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 \_\_\_\_\_

Richard F. Krauser  
Project Manager/ Geologist  
Caribbean Section (RPB/DEPP)  
EPA Region 2

Supervisor \_\_\_\_\_ Date \_\_\_\_\_

Dale Carpenter  
Chief, Caribbean Section (RPB/DEPP)  
EPA Region 2



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Supervisor      Original was signed by: \_\_\_\_\_      Date: 9/30/2005  
Adolph Everett, P. E.  
Chief, RCRA Program Branch (DEPP)  
EPA Region 2

Cited References:

- Site Assessment Report, March 24, 1994, GDC Engineering, Inc.;
- Revised Site Assessment Report with Data Validation Report, August 31, 1994;
- DSM Environmental Services, Groundwater Risk Evaluation Eastern Oil Lagoon Area, April 1995;
- DSM Environmental Services, Groundwater Risk Evaluation Western Lagoon Area, April 1995;
- DSM Environmental Services, Attachment 1 to the Amended Eastern Oil Lagoon Unit Closure Plan (Revised Risk Assessment), December 1995;
- DSM Environmental Services, Phase II - Subsurface Product Delineation Report, February 1996;
  
- DSM Environmental Services, Phase II - Subsurface Product Delineation and Formation Evaluation Work Plan; Letter Report on the Findings of the Off-Property Subsurface Product Delineation Program, February 23, 1998;
- NewFields, Inc., Revised RCRA Solid Waste Management Units Closure Work Plan, May 2, 2000;
- Commonwealth of Puerto Rico Office of the Governor, Environmental Quality Board, Environmental Policy Act [Law No. 9 of June 18, 1970, as Amended], Puerto Rico Water Quality Standards Regulation, as Amended, March 2003;
- NewFields, Inc., Response to §3007 Request - Attachment 2 - Historical Free Product, April 2004;
- NewFields, Inc., Response to §3007 Request - Attachment 4 - PREPA Phase II Environmental Site Assessment (November 2000), April 2004;
- NewFields, Inc., Report - Environmental Indicators - Compilation of Existing Data and Identification of Data Gaps, February 16, 2005;
- On-Site Environmental, Inc., Tier 2 and 3 Subsurface Vapor Intrusion Screening at CORCO, August 2005;
- NewFields, Inc., Letter Report - Environmental Indicators, September 23, 2005.

Locations where References may be found:

EPA Region 2, RCRA Records Room, 15<sup>th</sup> floor, 290 Broadway, New York, NY 10007  
EPA Region 2, RCRA Programs Branch Records Room, 22<sup>nd</sup> floor, 290 Broadway, New York, NY 10007  
EPA Region 2, Caribbean Environmental Protection Division, Centro Europa Building, Suite 417, 1492 Ponce de Leon Avenue, San Juan, Puerto Rico 00907-4127

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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.**