



Texpet's Remediation and Revegetation of Oilfield Pits in the Ecuadorian Amazon



Project History

The former Petroecuador-Exxon Petroleum Company's (Texpet) concession lies in the northern Ecuadorian Amazon. The concession area covered roughly 440,000 hectares (about 1,700 square miles). Texpet secured rights to the concession as a minority partner with the national Ecuadorian oil company — Petroecuador. As part of a 1995 Remediation Action Plan agreement, Texpet remediated 161 of 430 identified oilfield pits (and 7 spill areas), a proportion that was equal to their share in the consortium.

What are oilfield pits?

During the drilling of oil wells, earthen pits were used to hold and re-circulate drilling fluids. The use of open-air, unlined earthen pits to store drilling fluids was a standard industry practice in both the United States and Latin America during the time of the Petroecuador-Exxon concession, and is still an acceptable practice in the U.S. today. In 1990, Texpet turned over all operations in Ecuador to Petroecuador.

What was done about these pits?

Texpet agreed to remediate their proportional share of pits, as defined in the Remedial Action Plan (RAP) that was drafted and signed by Texpet, Petroecuador, and representatives for the Ecuadorian government. Between 1995 and 1998, Texpet remediated 161 pits and 7 spill areas using technologies that were commonly used in the U.S., meeting all contractual and environmental requirements. In total, Texpet spent \$40 million to remediate the oilfield pits and support improvement projects for the local community. Texpet conducted the remediation in accordance with existing Ecuadorian law governing environmental regulations for hydrocarbon activities (Ministerial Decision No. 621), as well as with the terms agreed upon with the government of Ecuador and Petroecuador.

What were the results?

After remediation, all pits were sampled and were determined to meet the closure criteria specified in the RAP. Between 2004 and 2006, many of the remediated pits were sampled again as part of a Judicial Inspection (JI) process to ensure that Texpet's remediation was carried out properly. Results from the Judicial Inspections showed that greater than 98% of the remediated pits inspected complied with the Government of Ecuador (GOE) closure criteria.

Are there health risks?

Chevron conducted a comprehensive human health risk assessment at every Judicial Inspection site and determined that soils that were previously remediated by Texpet do not present a significant health threat to local residents. All health risk assessments were included in the reports submitted to the Court.

Furthermore, 172 drinking water samples were collected and analyzed during the Judicial Inspections. More than 99% of these samples were free of petroleum-related compounds that exceed World Health Organization or United States Environmental Protection Agency

(USEPA) drinking water standards.

The sum of all this evidence is that the people of the region face no significant petroleum-related health risk from the areas remediated by Texpet.

Has the GOE approved the remediation?

Yes. Remediation was completed in 1997 and approved in 1998. The Government of Ecuador — represented by the Ministry of Energy and Mines — and Petroecuador certified that every one of the 168 areas remediated by Texpet was completed in accordance with the Ecuadorian law governing environmental regulations for hydrocarbon activities, as well as with the terms agreed upon with the Government of Ecuador and Petroecuador.

Petroecuador's responsibility

Petroecuador has accepted its responsibility to remediate the remaining 264 pits identified in the RAP (*El Comercio*, 5 Oct 2006). Petroecuador is using the same proven technologies that Texpet used, with an average remediation cost of approximately \$80,000 per pit (*El Comercio*, 29 Oct 2006).



Texpet Remediation Approval and Certification

RAP contract: Texpet agreed to undertake the environmental remedial work in consideration for being released and discharged of all its legal and contractual obligations and liability for environmental impacts arising out of the consortium's operations.

RAP remediation confirmation: Remediation was approved by the Government of Ecuador by means of 19 intermediate inspection certificates and the final certificate of approval on 30 September 1998.

Final signatures: The remediation was approved by the Ministry of Energy and Mines, Petroecuador, Petroproducción, the Vice President of Texpet, and the legal representative of Texpet, as shown below.



8 Step Remediation

Texpet followed an 8-step remediation process, as shown in the figures on these pages. During remediation process Step 5, the soil was treated by one or more of the three methods listed below:

Surfactant enhanced recovery loosened oil from soil particles by agitation with aid of a detergent-like agent. The crude oil was then skimmed off and transported to the production stations for further treatment.

In-situ stabilization immobilized petroleum constituents by chemical bonding or encapsulation. Soils from pits were mixed with a stabilization agent, such as cement or a proprietary chemical.

Bioremediation involved hauling pit soils off-site for treatment. The soils at 'Biocell-1' were continuously tilled to promote natural hydrocarbon degradation by bacteria until TPH concentrations reached acceptable levels.

After soils in the bottom of the pit were sampled and confirmed to meet RAP standards, the remediated pits were backfilled/capped with approximately one meter of clean soil.

1 Clear the area around the pit



2 Removal of debris, cleaning and/or incineration



3 Removal of crude oil



4 Water treatment



5 Soil treatment to remove and/or stabilize the crude



6 Sampling of remediated material



7 Backfilling with clean dirt



8 Revegetation with native plant species



Between 1995 and 1998, all of the 161 pits and 7 spill areas mandated by the Ecuadorian government were remediated, revegetated and met all closure criteria.

Results of Remediation

- During the Judicial Inspections greater than 98% of the remediated pits met all closure criteria.
- All 210 soil samples from within the remediated pits met the closure criteria* (see chart below) for Toxicity Characteristic Leaching Procedure for Total Petroleum Hydrocarbons (TPH-TCLP).
- Metals concentrations in the remediated pits meet pit closure requirements in the U.S. and Latin America.
- Both groundwater and soil samples taken at depth around the remediated pits showed no evidence of migration or leaching from the pits.
- Remediated pits do not pose a risk to human health.

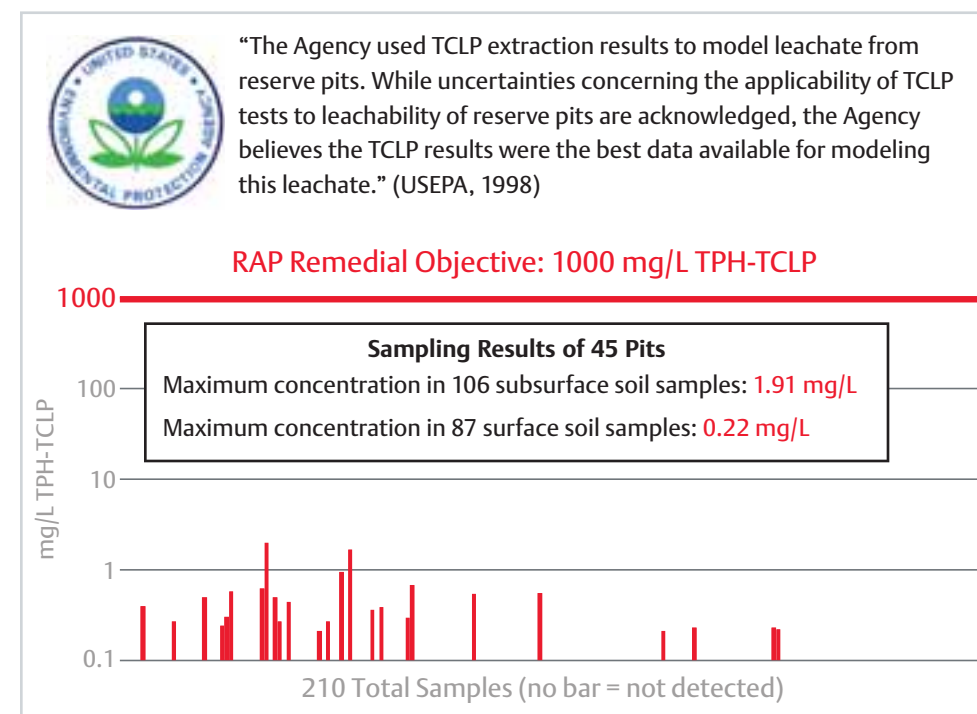
Background on the remediation requirements

The RAP required that soil samples collected from remediated pits do not exceed 1,000 milligrams per liter (mg/L) TPH-TCLP. As the chart below shows, all samples taken during the JI process were well below this criteria, with a maximum concentration of 1.91 mg/L.

The TPH-TCLP test

The TPH-TCLP test was specified for use in the original RAP governing Texpet's remediation as required by the Government of Ecuador, and is still authorized today for use in Ecuador under existing regulations. It is an analytical test developed to protect potential drinking water sources by

predicting the leachability of organic and inorganic compounds from a waste material to groundwater. In Ecuador, the environmental regulation in place today — Decree 1215 — still requires an analysis of TPH-TCLP to determine if drilling muds exceed the permissible limits for hydrocarbons.



*After March 1997, an additional requirement of TPH <5,000 ppm was added.

Have these results been independently confirmed?

In their Settling Report for well site Sacha-53, the Judge's experts* agreed that:

“The analytical results for the samples taken from pits 1 and 2 were within the limits agreed to in 1996.”

Judge's Experts SA-53 Settling Report

Several outside experts have studied the Judicial Inspection results and the Sacha-53 report from the Judge's settling experts, and they all agree that the remediation was carried out properly, there is low threat to human health, it was approved by the government, and it meets RAP and international standards.

“The TPH-TCLP (< 5 mg/L) results indicate that pits 1 and 2 comply with Resolution 621 ‘Environmental Law for Ecuadorian Hydrocarbon Operations.’”

“The remediation performed at site Sacha-53 by Texpet in 1996 appears to have been adequately carried out and conformed with practices at that time.”

“It is very unlikely that the remaining metals and hydrocarbons at the Sacha-53 well site cause adverse effects to human health.”

Dr. Raymond C. Loehr
 H. M. Alharthy Centennial Chair and Professor Emeritus, Civil Engineering Department, University of Texas in Austin, Texas

“Mr. Baca [the Court-approved expert acting on behalf of Chevron]...used criteria that were protective of human health and environmental receptors. The potential risk for human health is low. No further action is required for pits 1 and 2.”

“The levels of hydrocarbon compounds that remain in pits 1 and 2 are very low. TPH and individual compounds (such as metals, benzene, and polycyclic aromatic hydrocarbons) were not detected or were detected at levels much less than the criteria used by the Texas Railroad Commission or the international criteria provided by Mr. Baca.”

Maria A. Remmert
 M.S., DABT
 Former regulator for the Texas Railroad Commission and a Board Certified toxicologist

“The recent analytical results also indicate that the closure of the Sacha-53 pits would comply with international regulatory standards and those of Louisiana in 1996 for oil, grease (TPH), and metals...”

“Pits 1 and 2 were remediated using procedures and technologies commonly used in Louisiana to close oil-field pits in accordance with regulatory standards.”

Carroll Wascom
 Former director of the Injection and Mining Division for the Louisiana Department of Natural Resources

“It is impossible for hydrocarbons from either remediated or un-remediated pits at well sites in the Oriente to contaminate groundwater either now or in the future.”

“For approximately 99% of the samples, even groundwater in direct contact with the oil-impacted soil could not exceed drinking water criteria.”

Dr. Carlos Molano and Dr. Kirk O'Reilly
 “Method for Predicting the Risk for Groundwater Contamination from Oil Impacted Soils: A Case Study Using Soil and Groundwater Samples at Oil Production Sites in Ecuador,” September 2006

*Note: The “settling experts” are a group of five independent 3rd party technical experts that were appointed by the Judge.

Petroecuador's Remediation Efforts



Petroecuador remediating a pit and spill area at Cononaco 6 in 2006.

According to Ecuador's Energy Minister Miguel Muñoz, Director of National Environmental Protection Management, Ministry of Energy, in an appearance before Congress on May 10, 2006:

“Using their methods, Texaco conducted the remediation of the pits under the company’s responsibility, which was 33% of the total. For over 30 years Petroecuador has done absolutely nothing to remediate those pits under its responsibility.”



“Through a 1995 agreement between the Ecuadorian State and Texaco, the company [Texaco] started an Environmental Remediation plan in order to correct the effects of its operations by remediating 165 pits. The State-owned Petroecuador, through its subsidiary Petroproducción, continues with the cleanup of the remaining 264 pits which [due to the agreement’s provisions dividing responsibility for the cleanup] were not treated by Texaco.”

On October 5, 2006, Petroecuador published a special supplement in the country’s leading newspaper, *El Comercio*, acknowledging its intent to finally fulfill its contractual responsibility to remediate its majority share of oilfield sites.

