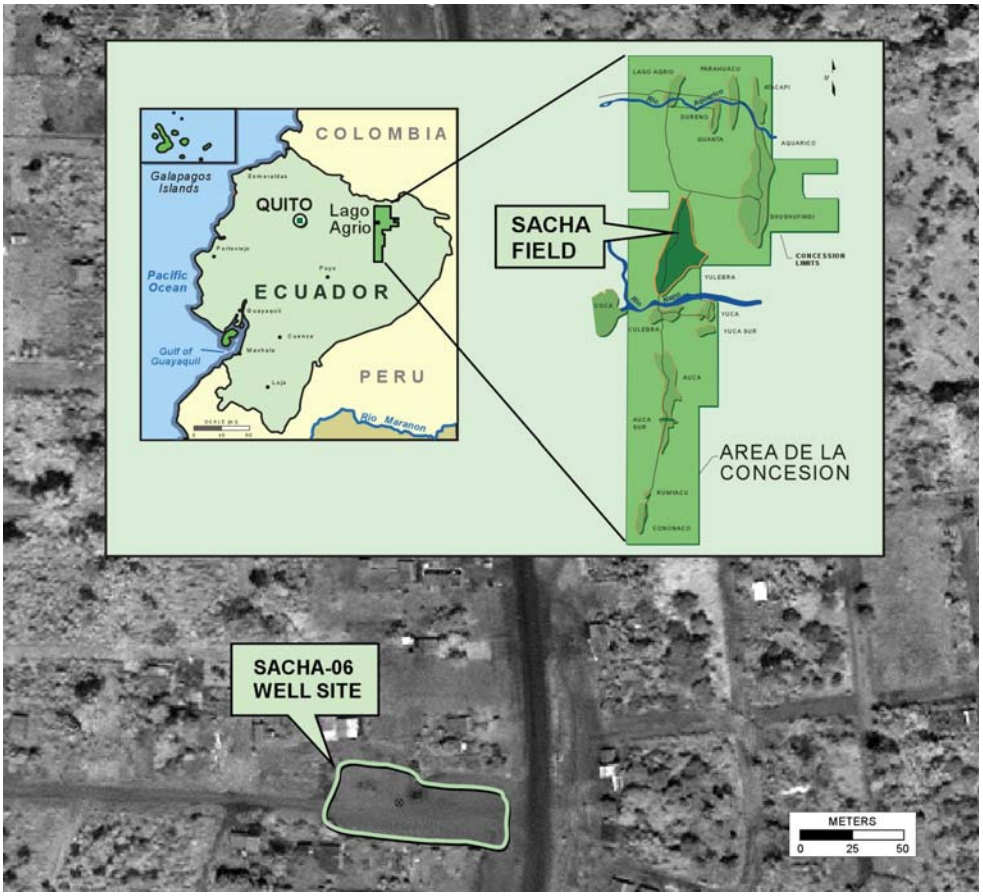
Expert Report of
John A. Connor, P.E., P.G., D.E.E.

Judicial Inspection of Well Sacha-06

Maria Aguinda et al. vs. ChevronTexaco Corporation,
Superior Court of Justice, Nueva Loja, Ecuador
Case No. 002-2003



January 7, 2005

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1.0 EXECUTIVE SUMMARY

1.1 Statement of Purpose

I, John A. Connor, have been retained to conduct environmental investigations on behalf of the President of the Superior Court of Justice of Nueva Loja, Ecuador, related to Case No. 002-2003, Maria Aguinda et al vs. ChevronTexaco Corporation. For the purpose of this case, a series of judicial inspections is being conducted to evaluate environmental conditions at a total of 122 oilfield properties located in the former Petroecuador–Texpet Concession area in the Oriente Region of Ecuador.

On August 18, 2004, the President of the Court initiated a judicial inspection of the Sacha 6 well site, located in the city of La Joya de Los Sachas, Province of Orellana. This judicial inspection was directed toward the specific information requests of the Acta de Inspección Judicial issued by the Court for the Sacha 6 well site on August 18, 2004, including a particular focus on: i) the remedial actions conducted by Texpet at this location in 1996 and ii) alleged impacts on human health and the environment associated with the former operations of the Petroecuador-Texpet Consortium at this site.

Section 1.0 of this expert report summarizes the scope and principal findings of this site investigation. Section 2.0 provides background information regarding the history of the Petroecuador-Texpet Concession and the remediation project conducted by Texpet during the period of 1994 to 1998. Section 3.0 outlines the scope of work that I have conducted in order to respond to the technical questions posed by the Court with regard to the Sacha 6 well site, including historical research, field sampling activities, and laboratory testing. In Section 4.0, I provide detailed technical responses to each of the questions posed by the Court, as documented in the Acta de Inspección Judicial issued for the Sacha 6 well site on August 18, 2004. Section 5.0 provides a glossary of technical terms used throughout this document. Supporting information for my responses, including consultation provided by other experts in the fields of environmental science, toxicology, and chemistry, is provided in Appendices A through U of this report. Appendix V provides documentation of all laboratory test results and related Quality Control/Quality Assurance (QA/QC) records.

1.2 Personal Qualifications and Experience

I am President of GSI and have over 24 years of experience in environmental engineering, specializing in the areas of environmental site investigation, human and

ecological risk assessment, and remedial action design and implementation. I am a Registered Professional Engineer (P.E.), Professional Geoscientist (P.G.), and a Diplomate in the American Academy of Environmental Engineering (D.E.E.). I received an M.S. in Civil Engineering from Stanford University in 1979, and I served as an Instructor in the Graduate Environmental Engineering Program at the University of Houston. Under contract from the U.S. Environmental Protection Agency (USEPA) and the American Society of Testing & Materials (ASTM), I served as a Certified Trainer for the national Risk-Based Corrective Action (RBCA) Training Initiative, and I have conducted training and/or assisted in development of risk-based regulatory programs in approximately 15 states across the U.S.

I am the principal author of the "RBCA Tool Kit for Chemical Releases," one of the most widely used software programs for evaluation of environmental remediation sites, in use in over 21 nations worldwide. In addition, I have authored numerous technical publications regarding natural attenuation, chemical fate and transport modeling, environmental risk assessment, and remediation technologies, and I have developed and presented technical training programs on these topics throughout the U.S., Canada, and abroad.

In my 24 years of experience in the environmental field, I have personally conducted environmental site investigations on numerous oilfield facilities in the U.S., Canada, and Latin America, including assessment of the environmental fate and transport of petroleum, evaluation of associated human health or environmental risks, and application of appropriate remediation technologies.

For the purpose of this Judicial Inspection, I have also called upon the assistance of other recognized experts in the fields of environmental chemistry, petroleum fate and transport, international environmental regulations and practices, crude oil composition, environmental remediation, health effects of natural biological agents and pesticides, and crude oil effects on plants and livestock. Supporting information supplied by these experts, including the qualifications and experience of the authors, is provided in the Appendices attached to this report.

1.3 Summary of Investigation and Principal Findings

The results of this Judicial Inspection show that Texpet completed the pit closures at the Sacha 6 well site in 1996 in full compliance with the procedures and criteria specified in the Remedial Action Plan and in a manner consistent with the applicable technical criteria and technologies in use internationally at that time and, in many cases, even today. During the recent Judicial Inspection, subsurface soils beneath the pits remediated by Texpet in 1996 and at other locations near the Sacha 6 well site were found to contain moderate concentrations of highly weathered petroleum, which laboratory tests show to be non-soluble, non-volatile, and essentially immobile within the soil matrix. These subsurface soils pose no risk to human health or the environment because: i) a clean soil cover overlies all such subsurface soil areas, preventing direct exposure of humans or animals to the weathered petroleum, and ii) the composition and concentration of the weathered petroleum measured in these subsurface soils is such

that, even if exposure were to occur, no harmful effects would be anticipated for humans, animals, or plants.

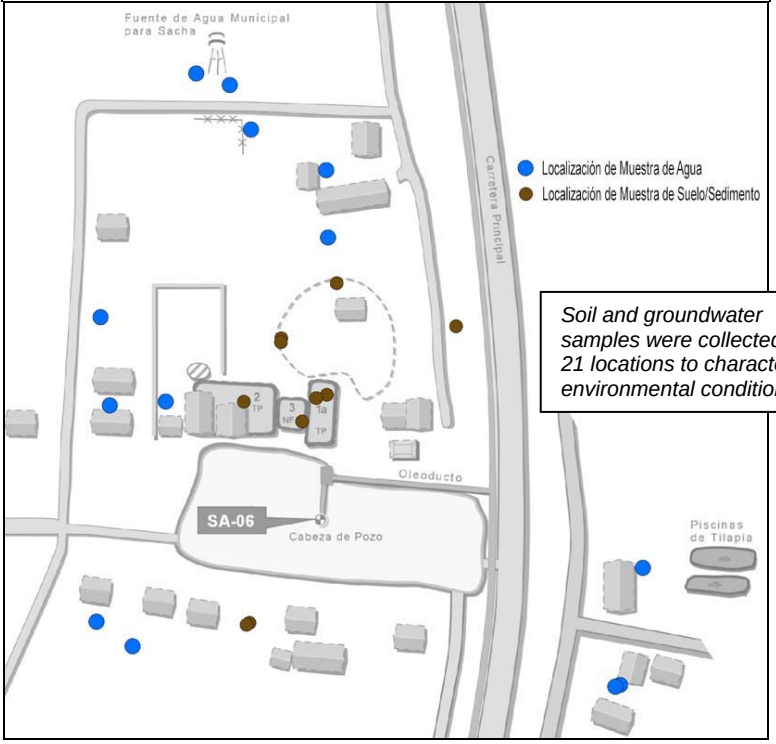
Sampling and testing of 11 local water wells also confirmed that there are no concentrations of petroleum constituents present in these water supply wells in excess of drinking water standards issued by the USEPA or World Health Organization (WHO). However, elevated levels of coliform bacteria, which are indicative of poor sanitation practices and are in no way associated with petroleum operations, were found in several household water wells at concentrations likely to cause symptoms such as diarrhea, vomiting, fever, and headache, as well as more serious illnesses.

The following paragraphs provide further discussion of each of the principal findings of this Judicial Inspection. Detailed responses to each of the technical questions posed by the Court with regard to the Sacha 6 well site are provided in Section 4.0 of this report.

1.3.1 Scope of the Judicial Inspection

During the period of August 18 through August 26, 2004, environmental sampling and testing activities were conducted at the Sacha 6 well site by two separate site investigation teams directed by two experts appointed by the Court, one directed by me and the other directed by Mr. Charles Calmbacher and Ms. Jennifer Bilbao. In order to address the technical questions posed by the Court, I conducted drilling and soil sampling at 10 locations in the vicinity of the Sacha 6 well site and submitted 31 soil samples for laboratory analysis of petroleum constituents. In addition, I collected groundwater samples from a total of 11 water wells and from 2 temporary wellpoints located within 150 meters of the Sacha 6 well platform, and I submitted these water samples for laboratory analysis of petroleum constituents and other water quality indicators. All field and laboratory activities conformed with the procedures specified in the Sampling Plan and the Analysis Plan mandated for use in this project pursuant to the Terminos de Referencia signed by both parties and approved by the Court.

Locations of Soil and Groundwater Samples During Judicial Inspection



More detailed discussion of the full range of activities conducted for the purpose of this Judicial Inspection is provided in Section 3.0 of this report. Results of the field and laboratory analyses are presented on Tables 1 through 4 and Figures 1 through 11.

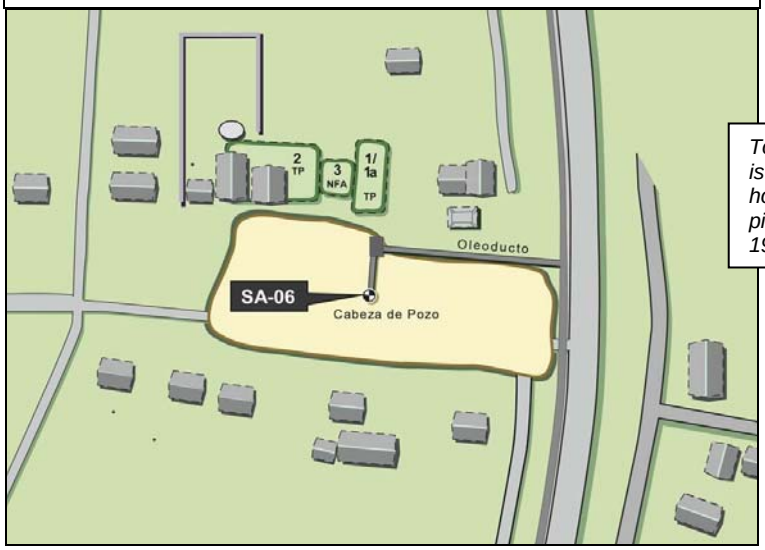
1.3.2 Site Description

The Sacha 6 well site is located in the north-central portion of the town of La Joya de Los Sachas, within the Sacha oilfield in the Province of Orellana in northeastern Ecuador (see Figure 1). The well was drilled in May 1971, and, today, the well site consists of an active oil well located in an open, 0.4-hectare, gravel platform, with a roadway passing across the southern boundary (see Figures 2, 3, and 4). As shown on Figure 2, a developed urban area surrounds this well site over a distance of approximately 300 meters on all sides, consisting of roadways and residential and commercial structures within the township of La Joya de Los Sachas. Beyond the township area, the land has been platted and cleared for agricultural use by local residents and presently consists of cropland, open grass fields, and secondary forest growth (see Figure 2 and see Land Use Classification Image in Appendix A).

Review of historical aerial photographs shows that urban development in the area of the Sacha 6 well site occurred principally after 1990, with a number of the present-day structures built after completion of the Texpet remediation program in 1996 (see Figures 3.1, 3.2, 3.3, and 3.5 for the years 2000, 1999, 1986, and 1975). Today, no open oil pits are present at the Sacha 6 well site. Rather, the former pit locations, which bordered the

north side of the platform area (see Figure 4), are covered by firm ground with thick vegetation and/or new structures, with no sign of the former pits.

Plan of Sacha 6 Well Site



Today the Sacha 6 well site is surrounded by new homes with NOT sign of the pits closed by Texpet in 1996.

1.3.3 Current Environmental Site Conditions

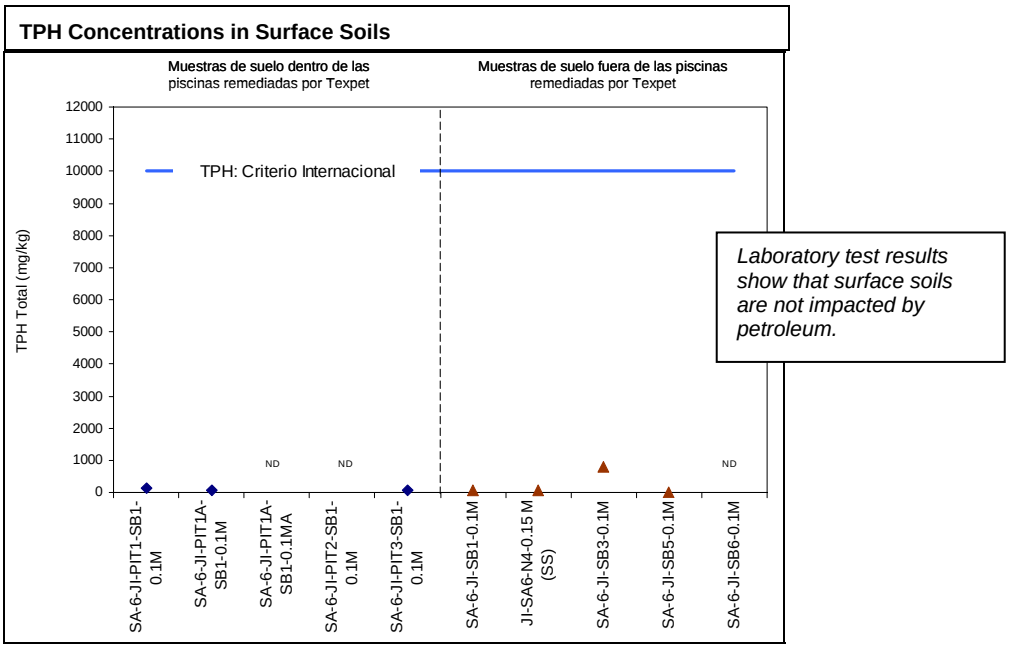
Results of field and laboratory analyses conducted for the purpose of this Judicial Inspection provide the following information regarding environmental conditions in the vicinity of the Sacha 6 well site:

a) Surface Soil: Visual inspection indicates that the surface soil in the vicinity of the Sacha 6 well site consists of a brown silty clay soil, that is free of petroleum impacts, except for: i) minor oil spills in the vicinity of the Petroecuador oil well, and ii) minor debris near soil borings recently completed by the site investigation team directed by Mr. Calmbacher. During this Judicial Inspection, I collected a total of 10 samples of surface soils (0 to 30 cm below ground surface) from 9 soil boring locations and submitted these samples for laboratory analysis of a broad range of petroleum constituents to evaluate surface soil conditions.

The results of these laboratory tests (see Tables 2A, 2B, 3A, and 3B) are consistent with visual observations and show that the surface soils are free of petroleum impacts, with the exception of the locations noted previously (see Section 4.1.28 for further discussion). Total Petroleum Hydrocarbon (TPH) results show no significant presence of petroleum in these soils, with Gasoline Range Organics (GRO) at non-detectable levels and Diesel-Range Organics (DRO) ranging from non-detectable to only 130 mg/kg, a minor concentration possibly associated with natural background levels. Furthermore, BTEX (benzene, ethylbenzene, toluene, and xylenes) and PAHs (polycyclic aromatic hydrocarbons), the principal toxic components of petroleum, are at non-detectable levels in all surface soils or are present at very minor levels that are

thousands of times below international criteria established for remediation of oilfield properties and protection of human health.

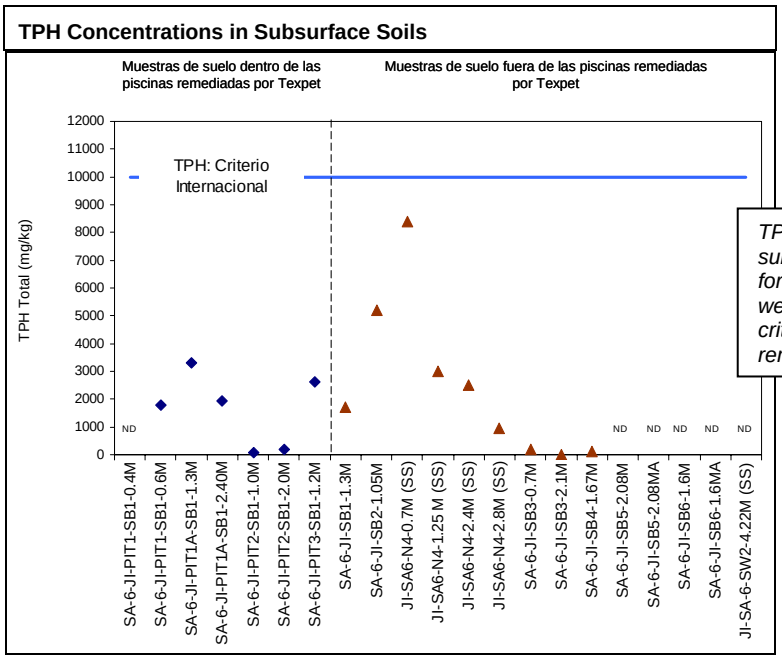
Finding: *No surface soil impacts, except for recent oil spills at the active wellhead operated by Petroecuador and minor debris near recent soil borings.*



b) Subsurface Soil: Subsurface soils in the vicinity of the Sacha 6 well site consist of brown silty clay extending to a depth of 2 m, where a silty sand unit is encountered. Subsurface soils were found to contain moderate concentrations of weathered petroleum at the following locations: i) beneath the former pits remediated by Texpet in 1996 (i.e., Pits 1/1A, 2, and 3), located immediately north of the northern edge of the well platform; ii) in an area 50 m to 80 m to the north of the platform, at the location of a former pit closed prior to 1990; and iii) in an area approximately 40 m to the south of the well platform. At all of these locations, the subsurface soils containing weathered petroleum are overlain by a cover of clean surface soil, ranging in thickness from 0.35 to 1.76 m.

During the Judicial Inspection, I collected a total of 21 subsurface soil samples from 12 locations in the vicinity of the Sacha 6 well site and submitted these samples for analysis of a broad range of petroleum constituents. The results of these laboratory tests show the subsurface soils in the areas listed above contain TPH concentrations ranging from non-detectable (<6.064 mg/kg) to 3,312 mg/kg within the area of the pits closed by Texpet in 1996 and from non-detectable (<3.056 mg/kg) to 8,401 mg/kg within the other areas. At these concentrations, the petroleum is not a mobile liquid but, rather, is retained in the soil matrix by the effects of sorption and capillary tension (see Section 4.1.27 for further discussion). Furthermore, laboratory tests confirm the petroleum to be highly weathered, consisting principally of heavy hydrocarbons (i.e., C16 to C35

organics comprise 69% to 100% of the TPH mass), with over 98% depletion of gasoline-range organics (GRO: C6 to C10 which includes BTEX and other components of gasoline) and 20% to 60% depletion of diesel-range organics (DRO: C10 to C28 which includes PAH compounds, when present) relative to fresh Sacha crude oil (see Section 4.1.45 for further discussion).



TPH concentrations in subsurface soils in former pit areas are well below international criteria for oilfield remediation.

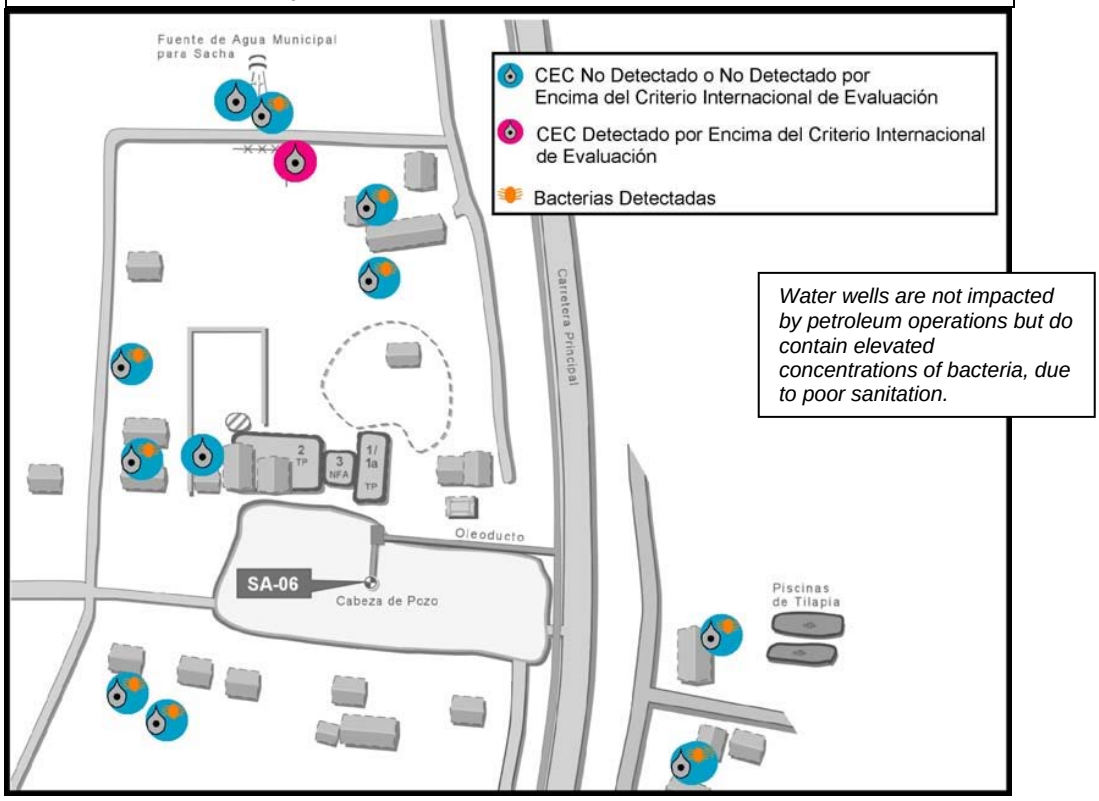
The weathering processes acting on the subsurface soils have also had the effect of reducing the concentrations the principal toxic constituents of petroleum, i.e., BTEX and PAHs. Concentrations of the 16 PAH compounds identified as Priority Pollutants by the USEPA are depleted by 54% to 92% in the subsurface soils relative to concentrations present in fresh Sacha crude. Benzene, ethylbenzene, and xylenes are not detectable in any subsurface soil sample, and toluene is present only at very minor levels. All BTEX and PAH concentrations measured in subsurface soil samples at the Sacha 6 site are significantly less than the concentrations determined to be safe for chronic daily contact by human beings, subject to international risk-based evaluation criteria (see Tables 2A, 2B, 3A, and 3B and Appendices J and K).

The weathered petroleum present in subsurface soils at the Sacha 6 site is relatively insoluble and non-volatile and is therefore not amenable to migration via air, surface water runoff, or groundwater flow. Further discussion of the chemical composition and transport characteristics of these petroleum compounds is provided in Section 4.1.32.

Finding: *Subsurface soils contain no free, mobile oil liquids. At certain locations, weathered petroleum is present in subsurface soils at concentrations below international criteria for remediation of oilfields and protection of human health.*

c) Groundwater: During this Judicial Inspection, I collected groundwater samples from a total of 11 existing water supply wells located within approximately 150 m of the Sacha 6 well platform (10 active or abandoned household water wells and 1 municipal water supply well) and submitted these water samples for laboratory analysis of a broad range of petroleum constituents and water quality parameters. Results of these laboratory tests found the water within all of these wells to meet all applicable USEPA and WHO drinking water criteria, with the exception of coliform bacteria (see Tables 4A and 4B and Sections 4.1.38 through 4.1.44 for further information). Elevated coliform levels are likely caused by poor sanitation practices, such as the absence of secure surface seals on the wells and the close proximity of septic tank systems to the water wells, and are in no way related to oilfield operations. Concentrations of petroleum constituents in these water wells were either non-detectable or at trace levels below relevant drinking water standards, indicating that petroleum operations have not adversely impacted drinking water sources.

Results of Water Well Analyses



During the Judicial Inspection, the site investigation team directed by Mr. Calmbacher also collected groundwater samples directly from boreholes drilled into subsurface soils containing weathered petroleum. These samples were observed to be extremely muddy, containing high levels of oily soil particles. Laboratory analysis of such soil and water mixtures does not provide a

representative measure of actual groundwater conditions, as the petroleum sorbed to the soil particles causes an extreme over-estimation of the petroleum present in the water itself. In fact, the laboratory analyses of subsurface soils from these locations show that, given the non-water-soluble nature of the weathered petroleum present in subsurface soils, soil leachate could not cause an impact on groundwater quality in excess of USEPA or WHO drinking water limits (see Section 4.1.32 for further discussion).

Finding: *No evidence of groundwater impacts by petroleum operations at this site. However, coliform bacteria, which is associated with poor sanitation practices and unrelated to oilfield activities, is present in a number of local water supply wells at levels which could cause health effects (e.g., diarrhea, vomiting, fever, and headache, as well as more serious illnesses).*

d) Surface Water: There are no surface streams or other natural surface water bodies in close proximity to the Sacha 6 well site that could be impacted by surface water runoff. Furthermore, surface soils (0 to 30 cm depth) at the Sacha 6 well site are clean, with i) no visual evidence of petroleum impacts, and ii) either non-detectable or minor levels of petroleum constituents at concentrations that are significantly below applicable international evaluation criteria (see Tables 2A, 2B, 3A, and 3B and Sections 4.1.28 and 4.1.32 for further discussion). Consequently, there is no potential for rainwater runoff to contact contaminated surface soils and subsequently impact nearby surface water streams, even if they were to exist in the area. Recent, minor oil spills have been observed at the active wellhead and meter station operated by Petroecuador. However, given the small size of these spills and the rapid rate of petroleum weathering in this environment, these spills are not likely to result in significant effects on rainwater runoff.

Finding: *No potential for surface water impacts from surface or subsurface soils at this site.*

e) Air: Surface soils (0 to 30 cm depth) at the Sacha 6 well site are clean, and residual petroleum associated with past petroleum operations is limited to weathered petroleum present on subsurface soils which are overlain by a clean soil cover that is 0.35 to 1.76 m in thickness (see Tables 2A, 2B, 3A, and 3B, and Sections 4.1.28 and 4.1.32, and 4.1.45 for further discussion). No evidence of odor or other indications of organic vapor release from these subsurface soils to ambient air were noted during the Judicial Inspection. The presence of the clean soil cover serves to impede the release of dust particles or organic vapors from the subsurface soils. In addition, extensive laboratory testing of these subsurface soils shows the weathered petroleum to consist of non-volatile, heavy-end hydrocarbons (69% to 100% of total petroleum mass), with no significant volatile organic fraction (see Section 4.1.45 and Appendix P). Given the absence of volatile organic compounds and the very low volatility of the weathered petroleum present on these subsurface soils, soil vapors cannot impact overlying air. Recent surface spills of fresh crude oil have been observed at the active wellhead and meter station operated by Petroecuador. However,

given the relatively small volume of these fresh oil spills and the rapid rate of petroleum weathering in this environment, significant vapor release would not be expected from these locations.

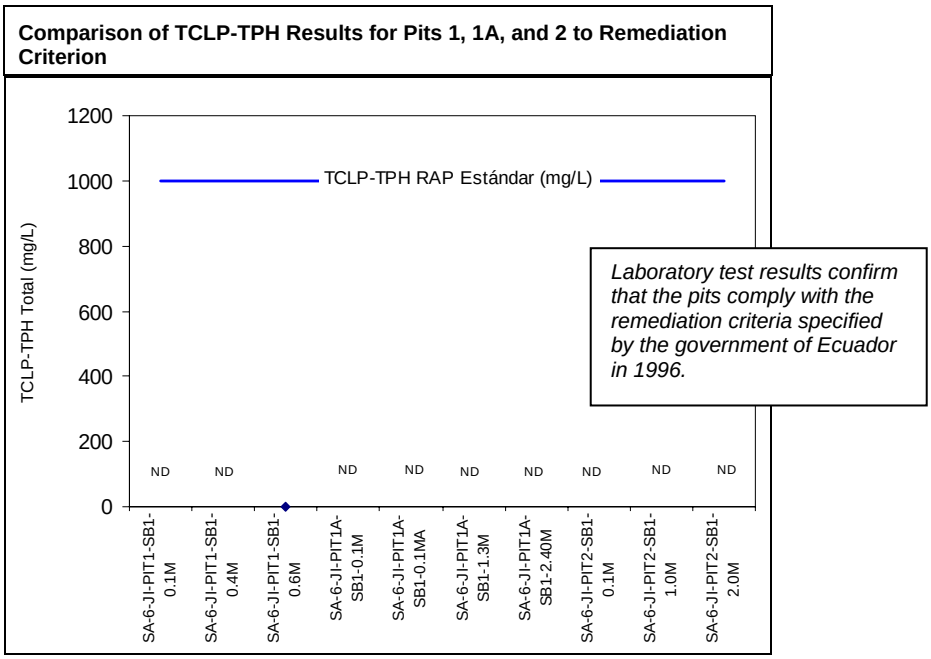
Finding: *No potential for air impacts from surface or subsurface soils at this site.*

1.3.4 Proper Completion of Texpet Remediation Program

To evaluate the remediation work conducted by Texpet at the Sacha 6 well site in 1996, I have reviewed historical documents, including the project report and related government Actas, and I have conducted drilling and sampling at the locations of the former on-site Pits 1, 1A, 2, and 3 to evaluate current conditions. The results of this investigation show that Texpet completed the pit closures at the Sacha 6 well site in full compliance with the procedures and criteria specified in the Remedial Action Plan and in a manner consistent with the applicable technical criteria and technologies in use internationally at that time and, in many cases, even today.

For Pits 1, 1A, and 2, the principal remediation steps involved: i) clearing of vegetation, ii) removal of debris, iii) removal and recovery of crude oil, iv) treatment of pit water by filtration, flocculation, and/or aeration, as needed to meet the criteria of Acuerdo 621, prior to discharge, v) treatment of oily soils and sediments to meet applicable remediation criteria by means of either soil washing (Pits 1 and 2) or in-situ stabilization (Pit 1A), vi) backfilling of the pit to establish a clean soil cover, properly graded for drainage, and vii) revegetation of the former pit area with native plant species. Pit 3 was determined to require "No Further Action" because it contained no visible petroleum and the TPH content of the underlying soils was less than the TPH action level of 5000 mg/kg, as specified in the Remedial Action Plan approved by the government of Ecuador. Based upon site inspections and evaluation of test results, proper remediation of former Pits 1, 1A, 2, and 3 was confirmed by Actas issued by the government of Ecuador on November 22, 1996, and March 20, 1997. Further discussion of the remedial action program implemented at the Sacha 6 well site by Texpet is provided in Sections 2.0 and Sections 4.1.3 through 4.1.8 of this report.

Today, these former pit areas are overlain by a firm, ground surface and thick vegetation or newly built structures, with no sign of the former pits. Soil borings conducted during the Judicial Inspection found soils at the former pit locations to consist of: i) a surface cover of clean, firm, brown, silty clay soils, ranging in thickness from 0.6 to 1.76 m and underlain by ii) a layer of dark grey, silty clay containing weathered petroleum, which corresponds to the remediated pit soils in former Pits 1, 1A, and 2, and the in-place soils beneath former Pit 3. Laboratory analyses of these subsurface soils confirm compliance with the remediation criteria specified in the Remedial Action Plan, as: i) the TPH of soil leachate prepared using the Toxicity Characteristic Leaching Procedure (TCLP) was no greater than 0.43 mg/L in soil samples from Pits 1, 1A, and 2 (approximately 2000 times less than the TPH-TCLP criterion of 1000 mg/L) and ii) the TPH of soils obtained from Pit 3 were less than 1679 mg/kg on a wet weight basis (approximately 3 times below the TPH action level of 5000 mg/kg wet weight). Further discussion of the results of the recent investigation of the former pit locations conducted for the purpose of this Judicial Inspection is provided in Sections 4.1.17, 4.1.18, and 4.1.28 of this report.



My review of applicable standards for remediation of oilfield pits in Ecuador and in other oil-producing nations during the period of the Texpet remediation project (1994 through 1998) shows that the remediation criteria used in the Texpet remediation project were either more stringent or functionally equivalent to the international standards in use at that time or, in some cases, even today. The action level used to trigger pit remediation during the Texpet project (TPH > 5000 mg/kg wet weight or approximately 7140 mg/kg dry weight) was significantly lower than that used in the U.S. and other countries (e.g., TPH > 10,000 mg/kg dry weight) at that same time, providing a more stringent basis for pit closures. At the same time, the limit used by Texpet for the allowable TPH concentration in a TCLP soil leachate (1000 mg/L) was considerably higher than that specified for stabilized soils in the U.S. and elsewhere (10 mg/L). However, at the time of the remediation work in 1996, TPH was never measured at a concentration in excess of a detection limit of 5 mg/L in *any* soil leachate sample from the Sacha 6 pits (see Figure 6 and Appendix D). In testing conducted during the recent Judicial Inspection of August 2004, the maximum reported TPH value for TCLP leachate for the remediated pit soils was 0.43 mg/L. These data show that the soils remediated by Texpet did comply with the international criterion of 10 mg/L for TCLP, even though a higher limit was specified for the Texpet remediation project. Further discussion of the remediation criteria applied during the Texpet remediation project and comparison to relevant international criteria is provided in Section 4.1.26 and Sections 4.1.46 through 4.1.48 of this report.

In addition, the remediation technologies employed by Texpet for closure of Pits 1, 1A, and 2 at the Sacha 6 well site have been proven effective on hundreds of remediation projects world-wide and have been approved and promoted by regulatory agencies such as the USEPA (see Sections 4.1.49 and 4.1.50 for further discussion).

Finding: *Texpet completed the pit closures at the Sacha 6 well site in full compliance with the procedures and criteria specified in the Remedial Action Plan approved by the government of Ecuador and in a manner consistent with the applicable technical criteria and technologies in use internationally at that time and, in many cases, even today.*

1.3.5 Petroleum in Areas Not Included in Texpet Remediation Program

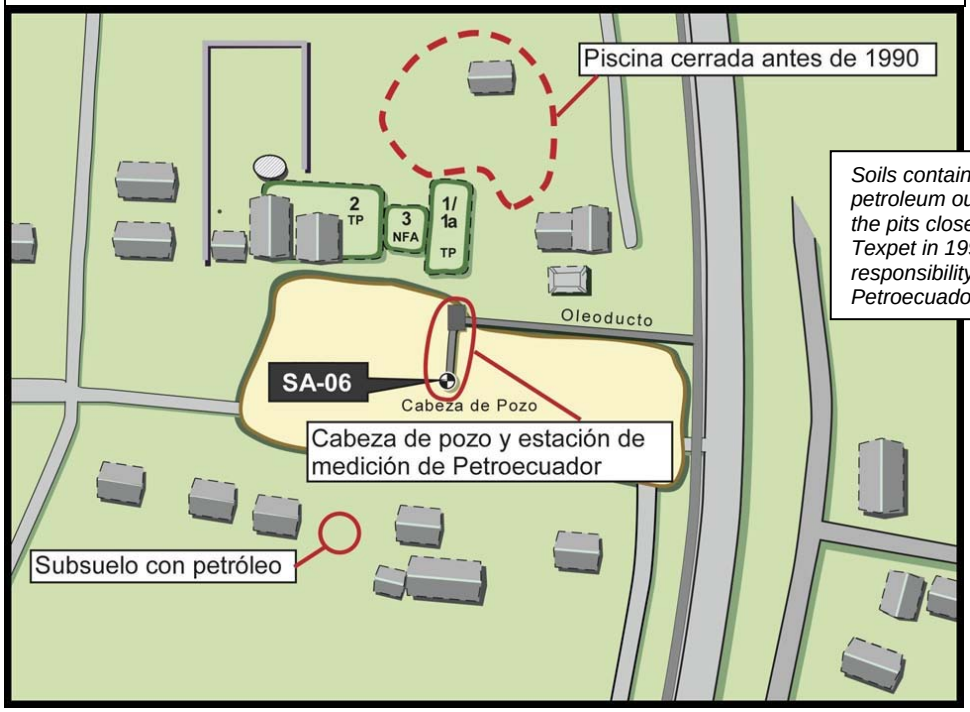
At the Sacha 6 well site, petroleum has been detected in soils outside of the areas of the pits remediated by Texpet, at the following specific locations:

- ***Subsurface Soils, North of Pits Remediated by Texpet:*** Beneath a clean soil cover ranging from 0.3 to 1.7 m in thickness, subsurface soils containing highly weathered petroleum are present in an area extending approximately 50 to 80 m to the north of the platform, approximately 20 m north of the pits remediated by Texpet. This area corresponds to the former location of a pit visible on a 1975 and 1986 aerial photograph of the Sacha 6 well site (see Figures 3.3 and 3.5). As shown by subsequent aerial photographs and topographic maps (see Figures 3.1, 3.2, and 3.4), this pit was no longer present by 1990. Furthermore, there was no sign of this former pit present at the time of the Texpet remediation project in 1996, as demonstrated by site inspection records and photographs, and this pit was not included in the Remedial Action Plan approved by the government of Ecuador.

- ***Subsurface Soils, South of Well Platform:*** Beneath a soil cover with no visible sign or odor of petroleum to a depth of 1.2 m, subsurface soils containing highly weathered petroleum are present in an area approximately 20 m south of the current well platform. No pits or spills are visible at this location on historical photographs or topographic maps (see Figures 3.1, 3.2, and 3.4), and the source of this weathered petroleum at this location is not known. There was no sign of petroleum impacts in this area at the time of the Texpet remediation project in 1996, as demonstrated by site inspection records and photographs, and no action was required for this area in the Remedial Action Plan approved by the government of Ecuador.

- ***Sacha 6 Wellhead Area:*** Asphaltic material and fresh oil stains associated with oil spills from the active oil well operated by Petroecuador are present within an approximate 2 m radius surrounding the wellhead and the adjacent meter station.

Soils Containing Petroleum Outside of Pits Remediated by Texpet in 1996



No action was required for these three areas in the Remedial Action Plan approved by the government of Ecuador in 1995. Therefore, according to the terms of the Contrato del 4 de Mayo de 1995, all of these areas are the exclusive responsibility of Petroecuador. The fresh crude oil at the wellhead and meter station is associated with the on-going operations of Petroecuador, the owner and operator of this well site. At those locations where petroleum has been detected in subsurface soils, the overlying clean soil cover ranges from 0.35 to 1.7 m in thickness (see Figure 8), preventing potential exposure of humans or livestock, contact with rainwater runoff, or vapor release to ambient air. Furthermore, laboratory test results show that neither the clean soil cover nor the subsurface soils at these locations contain petroleum concentrations in excess of international evaluation criteria for remediation of oilfields or protection of human health. Further discussion of these areas is provided in Sections 4.1.10, 4.2.2, and 4.2.4 of this report.

Finding: *Fresh oil spills are present near the active well operated by Petroecuador, and subsurface soils containing weathered petroleum have been encountered at locations north and south of the well platform. These areas were not included in the Texpet remediation program and are the sole responsibility of Petroecuador. Nevertheless, petroleum concentrations measured in subsurface soils do not exceed international criteria for remediation of oilfields and protection of human health.*

1.3.6 Evaluation of Risks to Human Health Posed by Historical Oilfield Operations

Beneath a clean soil cover, subsurface soils have been found to contain weathered petroleum at the locations of the pits remediated by Texpet in 1996 and at other locations in the vicinity of the Sacha 6 well site. However, evaluation of these soil conditions in accordance with risk assessment procedures accepted throughout the world shows that these soils pose no risk to human health, because: i) there is no active mechanism for human exposure to the affected subsurface soils, and ii) the composition and concentration of the weathered petroleum contained in these soils would not cause negative health effects even if exposure were to occur.

All areas where subsurface soils containing weathered petroleum have been encountered are overlain by a clean soil cover ranging in thickness from 0.35 to 1.76 m, serving to prevent direct human contact with the weathered petroleum. Furthermore, the weathered petroleum is relatively insoluble and non-volatile and therefore cannot result in human exposure via dissolution to surface water or groundwater or volatilization to air. Finally, no petroleum constituents (particularly BTEX and PAH compounds) are present in soil or groundwater at this site at concentrations that could have a toxic effect on humans living at this site, even in the event of daily exposure. Further discussion of chemical toxicity, human exposure, and risk characterization for the Sacha 6 well site is provided in Section 4.1.53 of this report.

Finding: *Environmental conditions associated with historical oilfield operations at the Sacha 6 well site do not pose a risk of negative effects on the health of persons living in this area.*

1.3.7 Evaluation of Risks to Animals or Vegetation Posed by Historical Oilfield Operations

At the Sacha 6 well site, potential animal contact with petroleum in subsurface soils is prevented by a clean soil cover that is present throughout the locations of the former pit areas remediated by Texpet and the other areas where soils have been found to contain weathered petroleum. In the absence of exposure to these soils, no potential impact on livestock or wildlife can occur.

Furthermore, concentrations of weathered petroleum measured in subsurface soils at the Sacha 6 well site (i.e., maximum TPH of 3300 mg/kg in subsurface soils within pits remediated by Texpet; maximum of 8400 mg/kg in subsurface soils elsewhere; see Tables 2A and 3A) are significantly below the concentration limits determined to be safe for contact and inadvertent ingestion by cattle or poultry. Pigs may be exposed to soils containing over 19,000 mg/kg of fresh crude oil without harmful effects, while the safe concentrations for fresh crude oil in soils for cattle and chickens are over 44,000 and 50,000 mg/kg, respectively (see Appendix S of this report). Weathered petroleum, such as is present in subsurface soils at the Sacha 6 well site, is less hazardous than fresh crude oil. Consequently, even if livestock or poultry were to be exposed to subsurface soils containing petroleum at this site, no harm would be expected to occur.

Research has also shown that crude oil is not harmful to plants at TPH concentrations below 10,000 mg/kg in soil (see Appendix T of this report). Even at initial concentrations in the range of 1% to 5% (i.e., TPH concentrations of 10,000 to 50,000 mg/kg in soil), plant growth has been observed to recover within a single growing season. Recent studies have shown that heavy-end hydrocarbons, such as are present in the subsurface soils at the Sacha 6 site, have less effect on plant germination than light-end hydrocarbons. Consequently, given the absence of TPH concentrations in excess of 10,000 mg/kg in soils at this site, no impacts would be anticipated even for those plants directly in contact with soils containing petroleum. Indeed, no stressed vegetation has been observed in these areas.

Finding: *Given the composition and concentration of the weathered petroleum contained in subsurface soils and the presence of a clean soil cover, environmental conditions associated with historical oilfield operations pose no risk of harm to livestock or vegetation at the Sacha 6 well site.*

1.3.8 No Technical Basis for Claims of Damages by Plaintiffs

In a database of claims compiled on behalf of the Plaintiffs by Roberto Bejarano in 2003, two local property owners, Sr. Torres and Sr. Zurita, are reported to have made a variety of claims regarding damages caused by oilfield operations at this site, including water well impacts, health effects, loss of livestock, and loss of crops. Based upon the results of this Judicial Inspection, there is no technical basis for these damage claims, as: i) all water wells, including the well owned by Sr. Torres, have been shown to contain no petroleum constituents in excess of international drinking water criteria (and Sr. Zurita, in fact, has no water well); ii) the subsurface soils containing petroleum at this site are overlain by a clean soil cover, preventing contact with the affected soils; iii) the concentration and chemical composition of the weathered petroleum present in subsurface soils at this site would not be harmful to humans or livestock were incidental contact to occur; and iv) weathered petroleum at the concentrations observed is not harmful to plants.

However, human health effects such as diarrhea, vomiting, fever, and headache, as well as more serious illnesses, could result from consumption of well water containing elevated levels of coliform bacteria, as have been detected in several household wells in the vicinity of the Sacha 6 site. These elevated coliform bacteria levels are indicative of poor sanitation practices (e.g., absence of proper surface seal, close proximity of septic system to water well, etc.) and are in no way related to oilfield operations. At the present time, most households in the vicinity of the Sacha 6 site obtain water from the Sacha municipal water system. Results of sampling and testing conducted during this Judicial Inspection show the water from this municipal system to be free of coliform impacts and to contain no petroleum constituents in excess of drinking water guidelines established by the USEPA and WHO. However, several residents informed me that they use water from their household water wells in the event of a disruption in service for the municipal supply. Consumption of water from a household well containing the coliform levels observed during this investigation could result in serious health effects, including some of those of which local residents have complained according to the database of claims prepared by Mr. Bejarano.

Finding: *The claims made by Plaintiffs regarding alleged damages caused by the operations of the former Petroecuador-Texpet Consortium are not supported by the actual technical information collected in this Judicial Inspection of the Sacha 6 site. However, analyses of local water wells indicate that health effects such as diarrhea, vomiting, fever, headache, or other more serious illnesses, could result from consumption of well water found to contain elevated levels of coliform bacteria. This bacterial contamination is most likely related to poor sanitation practices and is in no way associated with oilfield operations at this site.*