

Critical Analysis of Chevron's Science: Submission 2

TEXACO'S WASTE MANAGEMENT PRACTICES IN ECUADOR WERE ILLEGAL AND VIOLATED INDUSTRY STANDARDS

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I. INTRODUCTION

Texaco (now Chevron) was obligated under Ecuadorian law and its contracts with the government to use state-of-the-art practices and equipment in their exploration and production (E&P) operations in the Ecuador concession area.¹ However, a review of the practices used by Texaco in the concession² area indicates that the company did not conduct its waste management practices consistent with U.S. state regulations nor with state-of-the-art practices current in the late 1960s and early 1970s, when Texaco's E&P operations commenced in Ecuador. Texaco's decision to use sub-standard technologies in the Amazon has had dire consequences for the rainforest ecosystem and its inhabitants. Residents of the Amazon obtain all their water from surface waters, like rivers, or from local wells which draw on groundwater – water for drinking, cooking, bathing, and washing. In particular, the five indigenous groups who inhabited the concession have relied for centuries on these water sources for daily use and have historically fished in these waters. Nonetheless, Texaco chose to use waste management practices – already prohibited in major U.S. oil producing states – which were certain to cause extreme contamination of surface waters and groundwater, damaging the ecosystem and exposing the inhabitants to toxins.

CONCLUSION

For the reasons stated below, we conclude that Texaco's Ecuadorian operations in the 1960s and the 1970s would have been in violation of the regulations then in effect in major oil producing U.S. states (e.g. Louisiana, Texas, and California) and did not meet well-known and accepted industry standards. Considering Texaco's own practices in the U.S. during this time period, we conclude that Texaco *knowingly* used sub-standard technology in Ecuador and *knowingly* put the environment and human health at great risk.

This report, and the conclusions herein, are based on: (1) an analysis of regulations in major oil-producing U.S. states; and (2) a survey of Texaco's own practices in these major oil-producing

¹ Ley de Hidrocarburos, D.S. 1459, R.O.322 (October 1, 1971), Art. 29 (“Contractors are obligated to: (e) employ modern and efficient machinery; (s) adopt necessary methods to protect plants, animals, and other natural resources ; (t) avoid contamination of waters, air and lands”) (translated by authors); Contrato para exploración y explotación de hidrocarburos entre Texaco Petroleum Company y Ecuadorian Gulf Oil Company, Decreto 925, (August 16, 1973). The language in the contract reflects the prohibitions included in the law.

² The concession area is known as “Block 13.” The concession consists of 1 million hectares located primarily in the provinces of Orellana and Sucumbios in Ecuador's Amazon region.

states; as compared with (3) a review of Texaco's actual waste management practices in Ecuador. In particular, this report considers the laws in the major oil-producing states of Louisiana, Texas and California. Louisiana standards are relevant because the regulations apply to climate and terrain conditions³ similar to the Ecuadorian concession area, and Texaco chose to use Louisiana standards as the framework to define remediation efforts in Ecuador in 1995-1998. Texas standards are relevant because Texas Railroad Commission standards were also referenced by Texaco as justification for pit closure limits. Lastly, California standards are relevant because Texaco and predecessor companies were conducting extensive E&P operations in California many years before beginning operations in Ecuador.

II. QUALIFICATIONS

This report was prepared by Mark Quarles, a registered professional geologist, and William Powers, a registered professional engineer with expertise in the petroleum field. Mr. Quarles has more than 20 years experience conducting environmental investigations, including designing and implementing field sampling and analysis plans and corrective actions for petroleum hydrocarbons and inorganic contaminants. In addition, he has published peer-reviewed papers on contaminant fate and transport and corrective actions for petroleum hydrocarbons and volatile organic compounds. Mr. Powers has more than two decades of experience in environmental testing with emphasis in oilfield equipment, production fields, and oil refineries. He formerly worked for the Department of Defense retrofitting combustion processes and air contaminant emission control systems, and is a member of the Air & Waste Management Association and American Society of Mechanical Engineers. Mr. Powers developed and led major hazard pollutant emission characterization programs for oil and gas production operations in Kern County, California. He also led an oilfield emission reduction workshop for PEMEX engineers in Mexico City. In addition, Mr. Powers has extensive experience in oilfield and energy project assessment in Peru, Mexico, Venezuela, and Chile.

III. FACTS ABOUT TEXACO'S WASTE MANAGEMENT PRACTICES IN ECUADOR: Discharge of Produced Water and the Use of Open, Unlined Pits and Horizontal Flares

Texaco began E&P operations in the concession area in 1964. The company conducted its Ecuador operations in a manner that routinely used earthen pits for oil and waste storage, although at the time earthen pits were either completely banned (Texas) or were banned at sites where the pit contents could contaminate freshwater or groundwater (Louisiana and California). Earthen pits are simply dug directly into the ground; they do not have liners or barriers and are not covered or closed. These pits were used to store drilling fluid used during well drilling

³ Both the Amazon region and the southern portion of Louisiana have tropical or subtropical climates, marked by high temperatures and high humidity and a season of heavy rainfall, which causes flooding. In addition, geographically, both areas are flat lowlands are river basins. The Amazon region is actually the Amazon River basin: the area is crossed by the Napo, Putumayo, Pastaza, Aguarico, Coca, and Shushufindi rivers, which ultimately drain into the Amazon. Similarly, southern Louisiana, marked by its coastal marshes and bayous and the Mississippi Delta, is crossed by the Red, Black, Atchafalaya, Old, Pearl, Calcasie, and Sabine rivers, which drain into the Gulf of Mexico or the Mississippi River. See Ministry of Tourism of Ecuador, Amazon Rainforest, 2004, available at <http://www.vivecuador.com/html2/eng/amazon.htm>; Southern Regional Climate Center, Climate Synopsis for Louisiana, 2004, available at <http://www.srcc.lsu.edu/southernClimate/atlas/ladescription>.

operations, crude oil produced during initial well testing at each well, and crude by-products at each transfer station.

Texaco drilled approximately 340 wells in the concession area, and nearly every well had two to five earthen pits that were used to store drilling mud, crude oil and well maintenance by-products. Earthen pits were also used at 18 production stations, where they were used to process produced water, a primary waste product of the oil-water separation process, which typically contains unsafe levels of toxic heavy metals (some known carcinogens) and petroleum in emulsion, as well as high levels of salts present as dissolved solids. Texaco directed the produced water from the primary oil-water separator to pits and then dumped it directly onto the ground or into surface waters. In total, there were approximately 800 – 1,000⁴ earthen pits constructed by Texaco in the concession area. These pits -- open, unlined, and without barriers - - overflowed onto the ground and into surface waters and leached into the surrounding soil and groundwater. In addition to the harms caused by overflow and leaching, Texaco used horizontal flares on the produced water pits to burn off the top layer of petroleum, resulting in the continuous release of dense smoke throughout the concession when the flares were used.

IV. TEXACO'S WASTE MANAGEMENT PRACTICES IN ECUADOR WERE ILLEGAL IN THE MAJOR OIL-PRODUCING STATES

Although Chevron claims that there were no meaningful regulations or standards for conducting E&P operations in Ecuador, there is ample evidence to the contrary. Ecuadorian laws required actions be taken to protect the environment, without identifying specific protective measures.⁵ In the U.S., oil and gas industry standards⁶ of the 1960s and 1970s demonstrated a clear and unambiguous understanding that E&P operations are harmful to the environment and, consequently, protective measures are necessary. Texaco was accustomed to meeting performance standards and permit conditions in the United States that effectively mitigated adverse effects to human health and the environment. Those standards were very specific, effectively banning earthen pits – like those used in Ecuador -- wherever fresh surface water or

⁴ We do not know the exact number of pits that Texaco created because the company has either failed to document or has failed to make public this information, which is critical to public health and safety.

⁵ See, e.g., Ley de Yacimientos (December 17, 1921) (“... the right to use waters, for purposes of exploitation and in the necessary quantities, without depriving the waters of their qualities of potability and purity”) (translated by authors); Ley de Hidrocarburos, D.S. 1459, R.O.322 (October 1, 1971); Ley de Hidrocarburos, D.S. 803, R.O.616 (August 14, 1974), Art. 30 (“Contractors are obligated to: (e) employ modern and efficient machinery; (s) adopt necessary methods to protect plants, animals, and other natural resources ; (t) avoid contamination of waters, air and lands”) (translated by authors).

⁶ In addition to violating state regulations, permit restrictions and accepted practices, Texaco's waste management practices violated accepted industry practices established in guidance and training manuals. The 1978 American Petroleum Institute (API) vocational training manual for oil and gas operations is explicit in stating that “extreme care must be exercised in handling and disposition of produced water not only because of possible danger to agriculture, but also because of the possibility of polluting lakes and rivers which provide water for drinking, as well as irrigation sources.” The API manual goes on to explain that produced water should be injected into underground formations. Texaco's methods of disposing of produced water – passing through unlined pits or discharging directly onto the ground or into surface waters – clearly ignored the standard operating procedures being taught by API to new workers in the 1970s. Committee on Vocational Training & Executive Committee on Training & Development, American Petroleum Institute, *Primer of Oil and Gas Production – Book 1 of Vocational Training Series*, 1978, at 46-48.

groundwater could be contaminated and requiring produced water reinjection for the same reason.

Chevron had been complying with regulatory standards that were protective of human health and the environment in its U.S. E&P operations for many years prior to the commencement of operations in Ecuador – Chevron simply elected to ignore these standards in Ecuador. Chevron was unquestionably aware that the waste disposal practices used in Ecuador would have been in gross violation of the standards required in similar environments in U.S. oilfields where the company was operating at the time.

A. Texaco Knowingly Used Harmful Practices Which Were Illegal in Louisiana in 1942

Louisiana Statewide Order 29-A⁷ was promulgated in 1942. Chevron’s operations in Ecuador were conducted in violation of nearly all of the Statewide Order 29-A standards, even though operations in Ecuador began almost twenty-five years *after* the Order became effective in Louisiana. In addition, it is important to note that Texaco was a major oil producer in Louisiana for many decades and thus was not only familiar with the restrictions of the Order, but had complied with them repeatedly in Louisiana, while at the exact same time ignoring them in Ecuador. The Order’s provisions regarding disposal of produced water, fire hazards, storage of drilling fluids, general pollution prevention, and procedures for abandoning wells, were all violated by Texaco in Ecuador.

1. *Production and Disposal of Produced Water*

Louisiana Statewide Order 29-A, in Section XV, clearly required that “no salty produced water is allowed to run into natural drainage channels,”⁸ effectively prohibiting the discharge of produced water in inland freshwater areas. In Ecuador, however, Texaco did exactly this: produced water was discharged directly into the environment. In contrast Texaco used reinjection technology in its extensive E&P operations in Louisiana. Reinjection technology involves reinserting produced water into a saline aquifer deep in the ground using a non-producing oil well or a well specifically drilled to reinject produced water, effectively storing this wastewater at a depth where it cannot contaminate potable groundwater. Texaco drilled produced water disposal wells in Louisiana as early as the 1930s and had drilled many produced water disposal wells at inland oilfields in Louisiana prior to initiating production operations in Ecuador. Six such produced water disposal wells are listed in Table 1 as examples. Texaco used reinjection technology in Louisiana because of the unambiguous prohibition contained in Order 29-A, which was premised on the knowledge that saline produced water has detrimental effects on the environment and human health. Moreover, the Louisiana regulation was particularly applicable in Ecuador because of the two locations’ similarities in climate and terrain. Despite Texaco’s clear knowledge of the prohibition in Louisiana and its apparent applicability in Ecuador, the company discharged saline produced water directly into surface waters and onto the ground surface.

⁷ Louisiana Department of Conservation (Minerals Division), State Wide Order Governing the Drilling for and Producing of Oil and Gas in the State of Louisiana, Order Number 29-A, May 20, 1942.

⁸ *Id.*

Table 1. Sample of Texaco pre-1970 Produced Water Injection Wells at Inland Louisiana Oilfields⁹

Louisiana DNR Well Identification Number	Well Completion Date	Production Field
972035	1937	Dog Lake
970127	1946	Paradis
971374	1952	Erath
970397	1959	Maurice
971743	1965	Caddo/Pine Island
970971	1965	Sorrento

2. *Pit Hazards: Overflow, Leaching & Horizontal Flaring*

The Order’s general requirement that operators avoid polluting streams and groundwater aquifers, found in Section VIII(E), effectively bans the use of unlined pits which can easily pollute surface and groundwater through overflow and leaching. Nonetheless, in Ecuador, Texaco used unlined pits, dug directly into the ground, with no mechanism to prevent the overflow of pit contents into surface water or to prevent leaching into the groundwater. Similarly, Section VIII(C.2) enacted special protections for swamp or marsh areas, such that operators had to use permanent tanks on impermeable platforms surrounded by metal gutters for drilling fluids storage in order to prevent fires and pollution. Texaco, although much of its concession is wet and marshy land, never used such tanks and instead used unlined pits, despite the likelihood that they would and did overflow and leach.

3. *Well Installation and Abandonment Procedures*

Lastly, the Louisiana Statewide Order Section XIX contains strict regulations regarding the abandonment of defunct wells: “All wells shall be abandoned with cement plugs placed in sufficient number and at proper locations to prevent the commingling of oil, gas, salt water, and fresh groundwater.”¹⁰ In addition, a well abandonment plan had to be submitted for approval prior to the actual abandonment operation. In Ecuador, Texaco never submitted a well abandonment plan to the Ecuadorian government. Moreover, when it did abandon wells, they were often not properly closed until the mid- to late- 1990s, despite having been abandoned years or decades earlier. This sub-standard abandonment operation created pollution pathways that easily could have contaminated groundwater aquifers.

⁹ Many of Texaco’s produced water disposal wells are listed on the Louisiana Department of Natural Resources website, along with the initial date of operation, at: http://sonris-www.dnr.state.la.us/www_root/sonris_portal_1.htm.

¹⁰Louisiana Statewide Order 29-A, *supra* note 8.

B. Texaco Knowingly Used Harmful Practices Which Were Prohibited in Texas in 1939

Texaco and its predecessor companies had major production operations in Texas, the state in which Texaco was founded, for decades prior to initiating operations in Ecuador.¹¹ As such, the company was well aware of the regulatory requirements and standards of practice that were required to conduct its operations in Texas. Texas Statewide Order No. 20-804,¹² originally promulgated in 1939, clearly prohibited the use of earthen pits to store oil, its by-products, and its wastes:

No person engaged in the production, transportation, storage, handling, refining, reclaiming, processing, treating, or marketing of crude petroleum oil or the products or by-products thereof shall store, either permanently or temporarily, crude petroleum oil or the products and by-products thereof in open pits or earthen storage.¹³

Nonetheless, Texaco's operations in its Ecuador concession were conducted using pits as storage, even though this practice had been outlawed in Texas more than twenty-five years earlier. The Texas Statewide Oil & Gas Rules¹⁴ require that operators take extensive steps toward protecting fresh water. Rule 8 of 1969 states unequivocally that "discharges of oil field brines and mineralized waters into a surface drainage water course, whether it be a dry creek, a flowing creek or a river, except where permitted by the Commission, is *not* an acceptable disposal operation and is prohibited."¹⁵ Rule 8 further requires that all wells must be maintained and closed such that "no pollution of any stream or water course... or any subsurface waters will occur as a result of the escape or release or injection of oil, gas, salt water or other mineralized water from any well."¹⁶ This Rule prohibits the discharge of produced water on the ground or into surface waters, yet Texaco discharged produced water directly into the rainforest as part of its standard practice in Ecuador. In addition, as discussed above, Texaco's failure to properly close several wells likely caused further contamination of subsurface waters.

Chevron has argued repeatedly that it did not use reinjection technology in Ecuador because the technology had not yet "evolved." However, Rule 9 makes clear that injection was the preferred disposal method for produced water in 1966, when the rule went into effect: "Salt water or other water containing minerals... may be disposed of... by injection into the following formations."¹⁷ Nonetheless, Texaco failed to *ever* inject produced water in Ecuador while the company operated the concession from 1964 to 1990.

¹¹ The first Texaco Company refinery started operations in November 1903 in Port Arthur Works, Texas, and processed 318,364 barrels of oil in its first year. About Texaco US: Facts & Figures, *available at* http://www.texaco.com/about/facts_figures.asp.

¹² Railroad Commission of Texas, Open Pit Storage Prohibited, Texas Statewide Order No. 20-804, July 31, 1939.

¹³ *Id.*

¹⁴ Railroad Commission of Texas, Texas Oil and Gas Statewide Rule Book, effective July 1, 1964, amended July 1, 1967.

¹⁵ *Id.* at Rule 8, Fresh Water to be Protected, Exploratory Wells (c).

¹⁶ *Id.* at Rule 8, Fresh Water to be Protected, Exploratory Wells

¹⁷ *Id.* at Rule 9, Salt Water Disposal Well Applications.

C. Texaco Used Practices Prohibited Under Its *Own* Permits in California

1. *Discharge of Produced Water*

At least ten years prior to Ecuadorian drilling operations, Texaco was required to meet stringent produced water discharge standards at its California operations where fresh groundwater or surface water could be negatively impacted by such discharges. Three 1960-era California oilfield discharge permits are provided below as examples of conditions for oilfields where fresh groundwater or surface water could be impacted. The oilfields (Mountain View, North Tejon, and Round Mountain) are all located in the primary oil-producing region of California - the Bakersfield area in the Central Valley. In 1960, Texaco had production operations in two of these three fields, Mountain View and North Tejon. A predecessor company, the Texas Company, operated in these fields prior to the transferring the oilfield leases to Texaco in 1959. The limitations in the produced water discharge permits for each of these three fields are summarized below.

(a) *Mountain View Oil Field (1960)*¹⁸

Groundwater in the area was used for irrigation and domestic water supply, exactly as it was, and continues to be, used in the Ecuadorian Oriente. Texaco had to meet these permit conditions:

1. Neither the waste discharge nor the method of disposal facility could create a public nuisance by odors or unsightliness.
2. The waste discharge could not result in pollution of adjacent surface waters or the underlying groundwater aquifer.
3. Wastewater discharges exceeding 25 barrels per day to the ground surface, to unlined drainage sumps (pits), or to drainage channels could not exceed 1,000 ppm total dissolved solids (TDS); chlorides could not exceed 175 ppm; and boron could not exceed 2 ppm.

(b) *North Tejon Oil Field (1960)*¹⁹

Groundwater in the area was used for irrigation and domestic water supply, exactly as it was, and continues to be, used in the Ecuadorian Oriente. Texaco had to meet these permit conditions:

1. Neither the waste discharge nor the method of disposal facility could create a public nuisance by odors or unsightliness.
2. The waste discharge could not result in pollution of adjacent surface waters or the underlying groundwater aquifer.

¹⁸ Regional Water Quality Control Board, California, Resolution: Waste Discharge Requirements: Mountain View Oil Field, Kern County (No. 60-201 – 60-238), June 23, 1960. Texaco was one of the operators in the Mountain View oilfield at the time.

¹⁹Regional Water Quality Control Board, California, Resolution: Waste Discharge Requirements: North Tejon Oil Field, Kern County (No. 60-79 – 60-82), April 21, 1960. Texaco was one of the operators in the North Tejon oilfield at the time.

3. Wastewater discharges to the ground, unlined drainage sumps (pits), or drainage channels could not exceed 1,000 ppm TDS; chlorides could not exceed 175 ppm; and boron could not exceed 1 ppm.

(c) *Round Mountain Oil Field (1958)*²⁰

Even though the land area was used predominantly for oil industry operations and to a lesser extent cattle grazing, the deeper groundwater was utilized in a variety of ways. The oil and gas operations were recognized as having the potential to contaminate water and therefore, certain permit restrictions were enforced to protect adjacent surface waters and the underlying groundwater. Texaco had to meet these permit conditions:

1. Neither the waste discharge nor the disposal facility could create a public nuisance by odors or unsightliness.
2. Neither the waste discharge nor the disposal facility could result in pollution of adjacent surface water or the underlying groundwater aquifer.
3. Wastewater discharges to the ground, unlined drainage sumps (pits), or drainage channels could not exceed 1,000 ppm TDS; chlorides could not exceed 200 ppm; and boron could not exceed 1 ppm.

These three permits contain restrictions because of the likelihood that oil and gas operations would contaminate water used by humans and animals. Although the water in Block 13 was also used by humans and animals, Texaco chose not to implement similar restrictions. The surface water in the concession area in Ecuador has very low natural salinity and, consequently, at the time of Texaco's arrival it was in use for drinking, swimming, and fishing by the local people that lived in the area. The groundwater was, and continues to be, used for drinking water and is shallow, making it particularly susceptible to contamination. Even at the Round Mountain Oil Field, where the groundwater was markedly deeper than the groundwater in Ecuador, there were extensive prohibitions governing the discharge of produced water. Yet Texaco ignored the standards its California E&P operations were subject to in similar situations, resulting in discharges that polluted surface waters and groundwater throughout the concession area and threatening the health of humans and animals.

The permits specify that produced water could only be discharged when the salinity of the water did not exceed 1,000 ppm TDS, chloride levels did not exceed 175 or 200 ppm, and boron concentrations did not exceed 1 to 2 ppm. In Ecuador, all of the produced water failed to meet these criteria, yet was discharged into the rainforest anyway. An audit²¹ performed in 1993 by HBT AGRA Limited under contract to Texaco included an analysis of the chemical composition of produced waters discharged from production stations in the concession area. As Table 2 demonstrates, using data from Texaco's own environmental audit, produced water discharged from all seventeen stations in Texaco's concession violated the TDS and chloride limits set by the 1960 California discharge permits.

²⁰ Regional Water Quality Control Board, California, Resolution: Waste Discharge Requirements Kern River Water-Shed/Round Mountain Oil Field (No. 58-389), September 18, 1958.

²¹ HBT AGRA Limited, *Environmental Assessment of the Petroecuador-Texaco Consortium Oil Fields*, October 1993.

Table 2. Comparison of 1960 California Oilfield Produced vs. Concession Area Produced Water - TDS and Chloride Concentrations

Concession Station	Extraction and Discharge Locations Active as of 1990	TDS (ppm)	Chloride (ppm)
1960 California oilfield limits		1,000	175
Shushufindi South	88 wells, 4 stations	39,100	20,000
Shushufindi North		20,200	11,200
Shushufindi SW		49,700	28,200
Aguarico Central	10 wells, 1 station	55,400	32,600
Sacha North #2	124 wells, 4 stations	3,130	1,580
Sacha North		4,540	2,400
Sacha Central		8,180	4,540
Sacha South		3,240	1,630
Yuca Central	11 wells, 1 station	52,700	30,400
Cononaco Central	11 wells, 1 station	1,510	670
Auca Central	34 wells, 1 station	5,790	3,270
Auca South	2 wells, 1 station	24,100	13,700
Lago Agrio Central	38 wells, 2 stations	1,020	418
Lago Agrio North		10,200	5,130
Atacapi Central	6 wells, 1 station	147,000	88,000
Parahuacu Central	5 wells, 1 station	10,300	6,020
Guanta Central	9 wells, 1 station	82,400	48,900
Average	338 wells 18 stations	30,500 ppm	17,568 ppm

The produced water discharged by Texaco in Ecuador was flagrantly in violation of the California permits – the average sample had TDS concentrations thirty times higher and chloride levels 100 times higher than that permitted in California. The California TDS limit was 1,000 ppm, yet the average TDS concentration of produced water discharged by Texaco in Ecuador was 30,500 ppm. Further, the permitted chloride level was 175 ppm, yet the produced water discharged by Texaco had an average chloride concentration of 17,568 ppm. Chevron’s decision to discharge saline produced water to surface waters in Ecuador was made at a time when these same discharges would have not have been allowed in U.S. oilfields in similar situations exactly because it was known that such discharges would have severely harmful impacts on the environment and human health.

2. *Burning Flares*

Texaco was a major oil producer in Southern California at the time that the Ecuador concession entered production. Therefore, the company clearly would have known that the accepted practice in 1973 for oilfield flares in California was to use “smokeless flares.”²² In contrast, in Ecuador, Chevron constructed horizontal flares that directed the burning gases directly onto the surface of the waste pits to remove the floating oil layer by direct combustion. This practice – in direct opposition to the smokeless flare -- resulted in the continuous generation of tremendous clouds of thick, toxic smoke in an otherwise pristine jungle environment. The “smokeless flare” practice was premised on modern U.S. air quality regulations developed in the 1950s and 1960s, which prohibited air quality nuisances caused by visual impact, smell, or health impact. The practice of directing a horizontal flare onto an oily surface to combust the oil would have been considered a gross nuisance in 1973 and in clear violation of the air quality regulations in force at the time.²³

IV. CONCLUSION

As this report demonstrates, Texaco operated several oilfields in Louisiana, Texas, and California during the same period in which it operated Block 13 in Ecuador. In its U.S. oilfields, Texaco was aware of -- and accustomed to complying with -- regulations, performance standards and permit conditions which were protective of human health and the environment. During the period that Texaco operated the concession, U.S. regulations and industry standards demonstrated a clear and unambiguous understanding that E&P operations are harmful to the environment and that certain protective measures must be implemented. However, Texaco’s operations in Ecuador were clearly sub-standard and their use of unlined pits, horizontal flares to combust oily waste, and the direct discharge of produced water would have been illegal under the prevailing laws in major oil-producing states. Consequently, based on Texaco’s awareness of U.S. laws and their compliance with them in their U.S. operations, we conclude that Texaco *knowingly* used sub-standard technology and *knowingly* endangered the environment and human health. Had Texaco implemented in Ecuador the practices it followed at its U.S. oilfields, the company would have largely – if not completely – avoided the human and environmental damage that is the basis of the current lawsuit.

²² John A. Danielson, ed., Air Pollution Control District County of Los Angeles, *Air Pollution Engineering Manual* (2d ed.), May 1973, at 582 (Table 153).

²³ California Health & Safety Code, § 41700 Prohibited Discharges (2006); originally promulgated as §24243 (1947); §24360 (1955); §39430 (1967); §39077 (1970). (“[N]o person shall discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, *nuisance*, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause, injury or damage to business or property”) (emphasis added).