

EXHIBIT 10

FUGRO-McCLELLAND (WEST), INC.



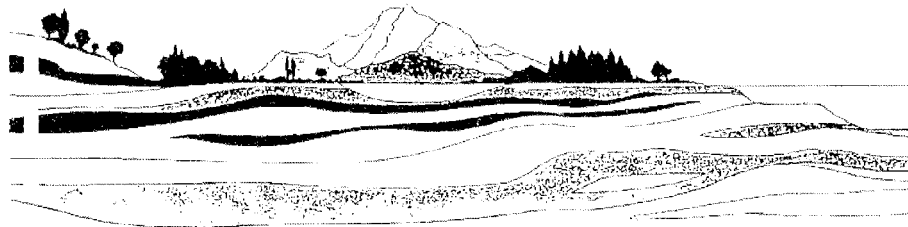
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FINAL
ENVIRONMENTAL FIELD AUDIT FOR PRACTICES 1964-1990
PETROECUADOR-TEXACO CONSORTIUM
ORIENTE, ECUADOR

Prepared for:

Texaco Petroleum Company
150 Alhambra Circle
P. O. Box 343300
Coral Gables, Florida 33134

October 1992



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Prepared by:

Fugro-McClelland (West), Inc.
5855 Olivas Park Drive / Ventura, California 93003

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EXECUTIVE SUMMARY

In 1964, Texaco Petroleum Company (TEXPET) began petroleum exploration and production operations in Ecuador. From 1967 through 1990 TEXPET, as the consortium operator, conducted exploration and development production operation in the Oriente. Operations ultimately included 15 fields, 18 production facilities, 6 camps, 316 wells and transmission pipelines. According to the concession agreement operation of the Oriente fields was turned over to PETROAMAZONAS in June, 1990. Ownership was then transferred to PETROAMAZONAS in June, 1992. As part of a transfer agreement between TEXPET and its partner PETROAMAZONAS, a joint environmental audit of the consortium facilities was to be performed. Fugro-McClelland was contracted independently by TEXPET to perform a parallel audit. This report provides the summary of the findings of that parallel audit. The audit was based on applicable Ecuadorian laws and regulations and oil industry environmental practices for rainforest areas in effect from 1964 through 1990. A report titled *International Oilfield Practices (1964-1990) in Tropical Rain Forest Areas and Summary of Ecuadorian Laws and Regulations* was prepared under separate cover as part of the audit contract. This initial report provides the basis for the regulatory and practice evaluation contained herein.

A field audit of all the production facilities and camps, 50 percent of the wells and 28 miles of pipeline was conducted in April and May, 1992. The audit included; site condition documentation, produced water, stream and groundwater sampling, and analysis, crude oil and spill sampling and analysis, soil permeability and percolation testing, and noise measurement. A review of historical documents was also performed. Field observations described herein have been summarized in an effort to consolidate the large amount of data collected. A decision flow chart was used to evaluate TEXPET practices against Ecuadorian laws and regulations and industry practices for the time frame of 1964 through 1990. Practices which did not comply with the criteria and caused environmental impacts were identified for remediation measures or operational modification.

TEXPET's operation from 1964 through 1990 were in compliance with Ecuadorian laws and regulations and industry practices for seismic, exploratory drilling and many areas of development drilling/production operations. The average well site gravel pad area was 60,000 square feet (~ 1/2 hectare). Secondary growth existed around the perimeter of many drill sites, indicating natural revegetation was occurring. The audit identified hydrocarbon contamination requiring remediation at all production facilities and a majority of the drill sites. Seventy percent of the 158 drill sites audited had drilling or production pits. Approximately 50 percent of those pits contained

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crude oil in them. Various degrees of crude oil contamination existed on many of the well sites audited. Hydrocarbon contamination was also observed at the production facilities. The contamination was usually associated with equipment leaks or spills. Based on the field observations and the assumptions herein, approximately 50 percent of the drill pad and pit contamination and thirty percent of the hydrocarbon contamination at production facilities was attributed to TEXPET's operations from 1964 through 1990. The total volume of soil requiring remediation was estimated at 32,225 cubic yards (24,640 cubic meters). All produced water from the production facilities eventually discharged to creeks and streams except for one facility which used a percolation pit. None of the discharges were registered with the Ecuadorian Institute of Sanitary Works (IEOS) as required by the Regulations for the Prevention and Control of Environmental Pollution related to Water Resources (1989). Since the discharges were not registered, the IEOS did not establish sampling points and water quality standards to determine regulatory compliance. Facility modifications will be required at those facilities to bring the discharges into compliance with the current regulatory standards. Groundwater samples were collected from springs and water wells at nine locations. Analytical test showed no indication of contamination from production operations. Soil samples were collected for classification at each drill site, camp and production facility. The data indicated that a majority of the surficial soils in the concession area were clays and silty clays. Both laboratory permeability and field percolations tests confirmed that the soils have low infiltration rates. Pipeline installation and operation was consistent with industry practices. Only pipelines adjacent to the road were audited. A majority of those pipelines are located above ground. The average area cleared beyond the road was 20 feet, but the pipelines only occupies a portion of that space.

A preliminary remedial action plan was developed to remediate hydrocarbon contaminated soils, close out production pits and properly dispose of produced water. Since water quality standards were not established in 1989 for produced water discharges, it is impossible to determine if modification would have been required at that time. Therefore, the cost to modify the produced water discharges to current standards have been included in this report and the Environmental Management Plan. The estimated cost to perform the required modifications and remediation activities was approximately U.S. \$8.5 million. The estimated cost for remediation, not including the produced water modifications was U.S. 5.5 million. These estimates include U.S. \$2 million to conduct a comprehensive environmental assessment of all the consortium facilities and prepare a Remedial Action Plan. The Remedial Action Plan is necessary to develop a remedial approach and prepare an accurate cost estimate. Remedial action should be conducted following implementation of the Environmental Management Plan.

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The outfall sample was collected at the point of discharge prior to mixing with surface water. If the discharge pipe could not be accessed, the outfall sample was collected within the surface drainage as near to the discharge point as was reasonably accessible. The mixing zone sample was collected downstream of the outfall/surface drainage prior to the point where fluids converged with a natural body of water. The discharge in several cases traveled up to one kilometer prior to entering a stream. Upstream and downstream samples were generally collected at various distances from the mixing zone. To allow for the relocation of sampling points, locations with distinguishable landmarks, such as at bridge crossings were utilized. Field testing of the samples included pH, temperature, dissolved oxygen, and turbidity. A sufficient volume of sample was retained for analysis of 15 other parameters including chlorides and hydrocarbon content (Appendix B).

Ground water samples were also collected for analysis from natural springs and wells around Sacha Central, Sacha Sur, Shushufindi Central, Shushufindi Sur (Appendix B). The depth to ground water ranged from 6.5 to 10.5 feet around the Sacha Central, 6.5 feet to 7.0 feet around Shushufindi Central and 20 to 27 feet at Shushufindi Sur. Based on the field observations, ground water in the Sacha area appear to be associated with a sand strata which occurs below the surface soils. A sandstone bedrock outcrop is present at the Sacha Central production facility below the production tank berm wall. Bedrock was observed at several other locations around Sacha Central including at the bottom of two of the Sacha Central produced water pits. The direction of groundwater flow could not be determined since the surface elevation were unknown. Ground water seeps were also sampled near Lago Agrio and Sacha Sur. There was no evidence of contamination observed in any of the ground water samples collected.

Since ground water was present at three of the fields, an evaluation of soil permeability was conducted. The evaluation included four field percolation tests and laboratory permeability analysis of four pit berm soil samples. The field percolation tests were performed at the following locations:

- eastern edge of Sacha Central facility near the drainage ditch;
- southern edge of Sacha Sur facility near the drainage ditch;
- near the northwestern entrance to Shushufindi Central;
- adjacent to the percolation pit at Shushufindi Sur.

The percolation test procedure and results are contained in Appendix C. Soil infiltration rates ranged from 0.2 to 1 inch per hour. Laboratory permeability tests were conducted on samples from the produced water pit berms at Sacha Central, Sacha Sur, Shushufindi Central and Shushufindi Sur. Permeabilities ranged from

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Abandonment and Restoration

Only a few instances of pipeline abandonment were observed during the audit. Transect No. 18 contained a section of pipeline that appeared to have been removed as evidenced by the concrete block which still remained. Pipelines which had been cut or capped were also observed along two other pipeline sections. The operational status of each pipeline was not evaluated, therefore pipelines which may have been out of service, but not removed could not be determined.

6.4 CONCLUSIONS

6.4.1 Access

Since there were no specific industry practices or Ecuadorian laws and regulations for drilling and production operation access site selection, preparation, waste handling and site abandonment and restoration, TEXPET's practices from 1964 through 1990 were considered acceptable. The environmental audit was unable to identify any impacts from TEXPET's practices beyond those associated with normal industrial development.

The 1976 Ecuadorian law and regulation requires the preparation of an EIS and control measures. But, the document review and environmental audit were unable to identify any such studies prepared from 1976 through 1990, except for one for a project in the national park. An EIS, if required, would probably have been conducted at the beginning of a large development project. It is important to emphasize that a majority of TEXPET's development in the Oriente (consortium roadways, well access roads, production facilities and camps) were constructed prior to adoption and implementation of this law (Table 6-1).

TEXPET's practices for site preparation and waste handling were identified through historical document review. A Task Force Review dated February 4, 1975, evaluated road construction practices against the specification in Contract MC-E-352. The report recommended more direct supervision for highway and well access roads construction in Auca and Sacha. Contract MC-E-907 dated April 6, 1984 provides the specifications for highway construction and included a note which stated, "Crude contamination should be avoided in areas adjacent to the road, especially in sections near estuaries, rivers, etc." This information acknowledges TEXPET's intent to comply with the 1971-1989 regulation to protect flora, fauna and natural resources and prevent pollution.

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Site Abandonment and Restoration

There are no industry practices that apply to site abandonment and restoration for development drilling and production base camps. Therefore, TEXPET's practices, for base camp abandonment and restoration were considered in compliance.

6.4.3 Drilling

Site Selection

With the exception of the 1976 requirement for an EIS and control measure, there were no industry practices or Ecuadorian laws or regulations for base camp site selection. It is not possible to determine the environmental impacts, if any, which were a direct result of not preparing an EIS for work conducted after 1976. Other than the requirement for preparation of an EIS, TEXPET's drill site selection practices were considered in compliance.

Site Preparation

Since there were no industry practices or Ecuadorian laws or regulations for development drilling, TEXPET's operations from 1964 through 1990 were considered in compliance. In fact, TEXPET's operation generally used less than 1/2 of the area allowed for drill sites under current regulations (2 hectares). Contract MC-E-907 dated April 6, 1984 contains a specification for well site construction. The total area occupied by well site based on that document is approximately 90,000 square feet or slightly less than 1 ha. This concurs with the field observations.

Waste Handling

TEXPET's practice of disposing of drill muds and cuttings in reserve pits is in accordance with standard industry practice from 1964 through 1990. In many cases the reserve pits were closed at the well sites audited. The 1974 through 1989 regulation prohibited the discharge of pollutants that are dangerous to the environment and human health. Historical documentation indicated that TEXPET's operations had been conscious of waste reduction since 1971 and proper handling of waste as early as 1972. A letter to Mr. J. H. Morre, dated January 14, 1971, discusses the transfer of drilling muds from location to location to reduce cost and mud pit construction. An internal memorandum dated, May 16, 1972, contains suggestions which indicate that reserve pits should not be used for well test, that small deep slush pit would be dug for well test, and that the slush pit should be filled in and the location graded once well testing was completed. In addition, numerous other documents were found which

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