

**Expert Report, Dr. Luis Villacreces Carvajal**

**Judicial Inspection of the Shushufindi - 18 Well Site**

**María Aguinda et. Al. Vs. ChevronTexaco Corporation**

**Trial No. 002-2003, Superior Justice Court, Nueva Loja, Ecuador**

## 1. EXECUTIVE SUMMARY

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- A. ACCORDING TO THE ANALYZED DOCUMENTS, **TEXACO** WAS THE SOLE OPERATOR OF WELL **SHUSHUFINDI-18**, UNDERTAKING IN OIL-EXTRACTION ACTIVITIES BETWEEN **1973** AND **1980**, WITH AN AVERAGE CRUDE PRODUCTION OF **1653** BARRELS PER DAY. BY THE TIME THESE FIRST FEW YEARS HAD PASSED, PRODUCTION OF WELL **SHUSHUFINDI 18** STARTED DECLINING. AFTER A PERIOD OF DISSAPPOINTINGLY LOW PRODUCTION, THE REACTIVATION OF THE WELL WAS ATTEMPTED BETWEEN **1983** AND **1985** WITHOUT ANY RESULTS, SO THE WELL WAS ULTIMATELY CLOSED. IN **1987**, WHILE **TEXACO** WAS STILL THE OPERATING COMPANY, THE WELL BECAME INJECTING WELL **WIW-09**, TAKING CARE OF PRODUCTION WATER INCOMING FROM THE **SHUSHUFINDI CENTRAL STATION**. CURRENTLY THE WELL IS "DEAD".
- B. ACCORDING TO THE **TEXACO'S RAP (ENVIRONMENTAL REPARATION PLAN)** AND OTHER DOCCUMENTS (SEE SECTIONS **3.5.2.7** TO **3.5.2.8**), REMEDIATION ACTIONS WERE IMPLEMENTED IN ONE OF **SHUSHUFINDI-18'S** PITS (**PIT No.1**); HOWEVER, BOTH FIELD AND LAB RESULTS SHOW THE EXISTENCE OF CONTAMINATION IN SAID PIT EVEN TODAY.
- C. THERE IS AT LEAST ONE ADITONAL PIT (**No.2**) IN WELL **SHUSHUFINDI-18** (SEE SECTIONS **3.5.1** AND **4.1**). THIS PIT WHICH WASN'T TAKEN CONSIDERED BY THE **RAP**, HAVING BEEN BURIED BY **TEXACO** IN LATE **1987** (SEE SECTION **3.5.2.2**). ACCORDING TO BOTH FIELD AND LAB RESULTS, THIS PIT IS CONTAMINATED.
- D. CURRENT LEVELS OF CANTAMINATION FOUND IN PITS **1** AND **2**, AND AREAS **1** THROUGH **3**, OF WELL **SHUSHUFINDI-18**, VIOLATE THE FOLLOWING **ECUADORIAN ENVIRONMENTAL LAWS** APPLICABLE TO SOILS:
- A. **REGLAMENTO AMBIENTAL PARA OPERACIONES HIDROCARBURÍFERAS, (RAOHE) DECRETO No. 1215, R.O. 265 DEL 13 DE FEBRERO DEL 2001, ANEXO 2, TABLA 6: LÍMITES PERMISIBLES PARA LA IDENTIFICACIÓN Y REMEDIACIÓN DE SUELOS CONTAMINADOS EN TODAS LAS FASES DE LA INDUSTRIA HIDROCARBURÍFERA, INCLUIDAS LAS ESTACIONES DE SERVICIO. (VALORES LÍMITES PERMISIBLES PARA LA PROTECCIÓN DE ECOSISTEMAS SENSIBLES TALES COMO PATRIMONIO NACIONAL DE ÁREA NATURALES Y OTROS IDENTIFICADOS EN EL CORRESPONDIENTE ESTUDIO AMBIENTAL).**
  - B. **TEXTO UNIFICADO DE LEGISLACIÓN SECUNDARIA DEL MINISTERIO DEL AMBIENTE, DECRETO EJECUTIVO No. 3516 (TULA), DEL 31 DE MARZO DEL 2003, LIBRO VI, ANEXO 2, TABLA 3: CRITERIOS DE REMEDIACIÓN O RESTAURACIÓN DE SUELOS (USO AGRÍCOLA).**

**AND WATER:**

- **TEXTO UNIFICADO DE LEGISLACIÓN SECUNDARIA DEL MINISTERIO DEL AMBIENTE, DECRETO EJECUTIVO No. 3516 (TULA), DEL 31 DE MARZO DEL 2003, LIBRO VI, ANEXO 1. TABLA 5: CRITERIOS REFERENCIALES DE CALIDAD PARA AGUAS SUBTERRÁNEAS, CONSIDERANDO UN SUELO CON CONTENIDO DE ARCILLA ENTRE (0-0.25) % DE MATERIA ORGÁNICA ENTRE (0-10.0) %. TABLA 1: LÍMITES MÁXIMOS PERMISIBLES PARA AGUAS DE CONSUMO HUMANO Y USO DOMÉSTICO, QUE ÚNICAMENTE REQUIEREN TRATAMIENTO CONVENCIONAL. TABLA 2: LÍMITES MÁXIMOS PERMISIBLES PARA AGUAS DE CONSUMO**

HUMANO Y USO DOMÉSTICO QUE ÚNICAMENTE REQUIERAN DESINFECCIÓN. TABLA 3: CRITERIOS DE CALIDAD ADMISIBLES PARA LA PRESERVACIÓN DE LA FLORA Y FAUNA EN AGUAS DULCES, FRÍAS O CÁLIDAS, Y EN AGUAS MARINAS Y DE ESTUARIO.

SEE ANNEX "K"

- E. IN SOME CASES, CONTAMINATION VALUES EXCEED EVEN THE OBJECTIVE STANDARD PROPOSED BY THE RAP GUIDELINES IN 1995 (SEE SECTION 3.3.1.2).
- F. THE CONCENTRATION OF TOTAL PETROLEUM HYDROCARBONS -TPH FOUND IN SHUSHUFINDI-18'S PITS EXCEEDS THE STANDARDS IMPOSED BY CURRENT ECUADORIAN LAWS (SEE "D") BY 43.97 TIMES; THE LEVELS FOUND FOR CHROMIUM (VI), EXCEEDS THE STANDARD 5.28 TIMES, WHILE POLYCYCLIC AROMATIC HYDROCARBONS – HAPs, SURPASS THE LIMIT BY 72.63 TIMES. IT IS SO CONCLUDED THAT TEXACO'S REPARATION PLAN WASN'T THE MOST APPROPRIATE.
- G. CURRENT LEVELS OF CONTAMINATION FOUND AT SHUSHUFINDI-18'S PITS DON'T EVEN COMPLY TO THE RAP'S STANDARDS: TOTAL PETROLEUM HYDROCARBONS -TPH, MEASURED USING THE SAME MODIFIED EPA 418.1 METHOD (SEE ANNEX C), WERE FOUND TO EXCEED THE OBJECTIVE REMEDIATION VALUE FOR SOIL (SEE "E") 1,1 TIMES IN PIT No. 1 AND 8 TIMES IN PIT No. 2. IT IS THUS CONFIRMED THAT NOT EVEN THE ENVIRONMENTAL REPARATION PLAN (RAP) WAS CORRECTLY APPLIED TO THE SITE.
- H. SOIL CONTAMINATION FOUND IN AREAS NEAR PITS 1 AND 2 (CONTAMINATED AREA 1) EXCEEDS THE STANDARD IMPOSED BY CURRENT ECUADORIAN LAWS FOR SOIL CONTAMINATION (SEE "D"): TOTAL PETROLEUM HYDROCARBONS -TPH ARE OVER THE ALLOWED STANDARD BY UP TO 300 TIMES, CHROMIUM (VI): 30 TIMES; ZINC: 1.44 TIMES; HAPs: 153.15 TIMES.
- I. THE WESTERN LOWER AREA OF THE PLATFORM (CONTAMINATED AREA 3) CURRENTLY SHOWS SOIL CONTAMINATION: TOTAL PETROLEUM HYDROCARBONS -TPH EXCEED THE ALLOWED STANDARD IN UO TO 38.31 TIMES; CADMIUM: 1.25 TIMES; CHROMIUM (VI): 1.75 TIMES; ZINC: 0.24 TIMES; HAPs: 15.08 TIMES.
- J. HAPs VALUES FOUND IN A SOIL SAMPLE TAKEN BY THE DEFENDANT'S EXPERT OUTSIDE THE PERIMETER OF PIT No. 1 (CONTAMINATED AREA 2), ANALYZED BY THE PLAINTIFF'S EXPERT AS WELL,) SURPASS THE ECUADORIAN LEGAL STANDARD 9.7 TIMES. THIS FACT PROVES MIGRATION (SEE SECTION 3.4)
- K. ACCORDING TO DOCUMENTS REGARDING THE WELL'S OPERATION, SUCH AS THE "SPILL LOG" (SEE SECTION 4.2, SECTION 3.5 AND "DOCUMENTS" ANNEX), AND THE "ACTUAL STANDING OF THE SITE" REPORT (SEE 3.1.2.), POLLUTION FOUND AT THE PITS ANS CONTAMINATED AREAS IS AN EXCLUSIVE CONSEQUENCE OF TEXACO'S OPERATION OF THE WELL.
- L. PITS 1 AND 2, AND CONTAMINATED AREAS 1 THROUGH 3, WERE USED AS STORAGE SITES FOR PRODUCTS, TOXIC RESIDUES, HYDROCARBONS FOR PRODUCTION TESTING , DRILLING MUDS, FORMATION WATER, ETC. CREATED BY THE

DRILLING, MAINTENANCE AND OPERATION OF WELL SHUSHUFINDI-18. (SEE SECTION 4.2). BECAUSE OF NEGLIGENCE AT DEALING WITH ENVIRONMENTAL DAMAGES (SEE 3.5.2), AND AN AWFUL JOB AT OVERSEEING THE REMEDIATION RESULTS (SEE 3.5.2), THE AFOREMENTIONED SITES (SEE SECTION 4.3) ARE CURRENTLY BEING CONSIDERED CONTAMINATION FOCAL POINTS (SEE ANNEXES J, O, T AND U).

**M. NEW ROADS OPENED BY TEXACO INCREASED DEFORESTATION AND COLONIZATION. (SEE SECTION 4.1 AND ANNEX D).**

**N. POLLUTION OF GROUNDWATER HAS ALSO BEEN VERIFIED. TOXIC LEVELS FOUND REACH LEVELS THAT GREATLY SURPASS THE STANDARDS SET BY CURRENT ECUADORIAN LAWS (SEE "D"), REACHING LEVELS THAT ARE: 3.65 TIMES HIGHER THAN THE TPH STANDARD; 1.01 TIMES HIGHER THAN THE BARIUM STANDARD; 2 TIMES HIGHER THAN THE CADMIUM STANDARD, AND 0.60 TIMES HIGHER THAN THE NICKEL STANDARD. HAPs STANDARDS ARE 0.81 TIMES LOWER THAN THE CONTAMINATION LEVELS FOUND.**

**O. QUALITATIVE GEOLOGICAL FIELD INVESTIGATION HAS DETERMINED AN IMMINENT MIGRATION OF TOXICS FROM THE CONTAMINATION FOCAL POINTS DESCRIBED BEFORE (SEE SECTION 3.4 Y ANNEXES F, L, M AND N).**

**P. THE TOTAL VOLUME CONTAMINATED BY TEXACO'S OPERATION IS 1644 m<sup>3</sup> (PIT 1), AND 236 m<sup>3</sup> (PIT 2). CONTAMINATED AREA 3 SHOWS 1218 m<sup>2</sup> OF POLLUTED MATERIAL AT VARIABLE DEPTHS, WHILE CONTAMINATED AREA 1 HAS 126 m<sup>2</sup> OF POLLUTION THAT HAS BEEN SUBJECT TO THE ELEMENTS. THIS DATA DOES NOT INCLUDE THE DAMAGES CAUSED BY THE SPILLAGE AND MOVEMENT OF CONTAMINANTS AND OTHER ISSUES TYPICAL OF THE OIL PRODUCTION INDUSTRY RELATED TO TEXACO'S OPERATION OF THE WELL (SEE 4.1, 4.3.1, ANNEX D, ANNEXES G, H, O, T, U)**

**Q. SEVERAL GUIDELINES RELATED TO TPH SOIL REMEDIATION WERE MADE AVAILABLE BY US REGULATIONS AS EARLY AS 1990 (SEE ANNEX P); HOWEVER, THESE GUIDELINES WERE IGNORED BY TEXACO.**

**R. ACCORDING TO THE PIT CLOSURE DOCUMENTS (WORK SHEETS, RAT, DELIVERY PAPERS, LAB ANALYSIS) (SEE 3.5.2.9), NONE OF THE SAMPLES WERE TAKEN AT THE APPROPRIATE DEPTH, NOR WERE THE PROPER PARAMETERS ANALYZED. AN EMISSION ANALYSIS OF THE INCINERATION IS NOWHERE TO BE FOUND**

**S. LATER INSPECTIONS (SEE 3.5.4, ANNEX R) SHOW AN INAPPROPRIATE IMPLEMENTATION OF THE REMEDIATION SYSTEM EMPLOYED.**

**T. THE TCLP (EPA 1311) TEST USED FOR THE PITS' CLOSURE (SEE RAP, SECTION 2.0 CRITERIA AND GUIDELINES FOR REMEDIATION ACTIVITIES) IS NOT, AND WAS NOT AT THE TIME, APPROPRIATE FOR MEASURING HYDROCARBONS IN STABILIZED MUDS (SEE ANNEXES N AND Q).**

**U. PRESENTED ANNEXES:**

- **D: PHYSICAL AND ENVIRONMENTAL ASPECTS OF THE SHUSHUFINDI AREA AT THE BEGINNING OF THE 1990s**

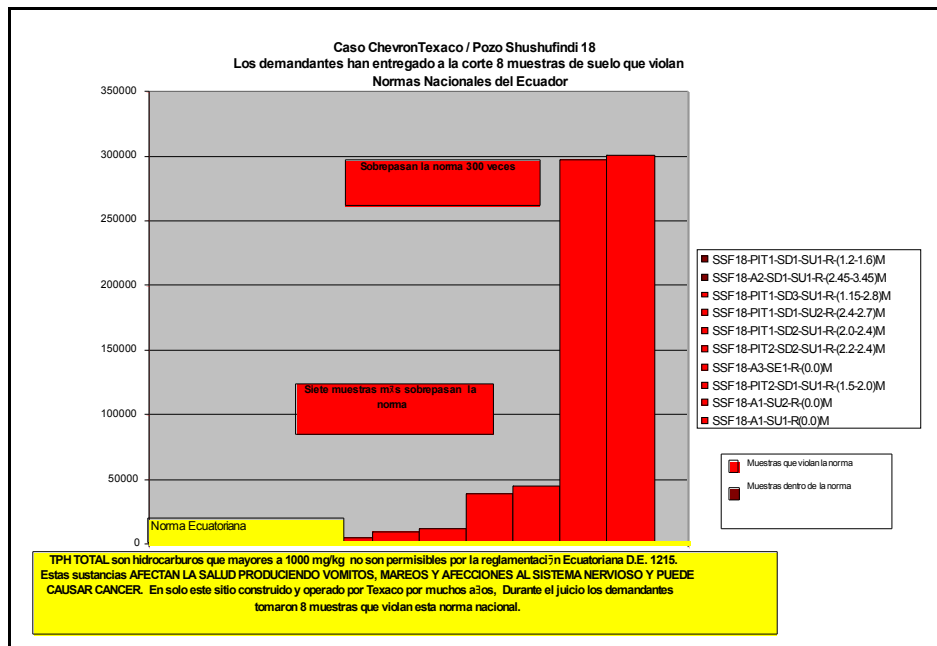
- **H: TOXICOLOGY RELATIONS BETWEEN THE PARAMETERS ANALYZED IN THE LAB**
- **J: TOXIC PRODUCTS EMPLOYED AT THE TEXACO OPERATION OF THE WELL; ENVIRONMENTAL AND TOXICOLOGICAL IMPLICATIONS**
- **L: BRIEF DISCUSSION OF UNDERGROUND OIL TRANSPORT AND DESTINATION**
- **M: NATURAL ATTENUATION OF OIL IN THE TROPICAL FOREST**
- **N: OIL-CONTAMINATED SOILS STABILIZATION**
- **O: EFFECTS OF CRUDE OIL ON PLANTS AND LIVESTOCK**
- **P: 1990 US GUIDELINES AND LIMITS FOR TPH IN SOIL REMEDIATION**
- **Q: INACCURACY OF TCLP TEST**
- **T: TOXICITY OF PRODUCED OR FORMATION WATER**
- **U: TOXICITY OF PERFORATION MUDS AND FLUIDS**

, THIS BIBLIOGRAPHIC INVESTIGATION CONSTITUTES IMPORTANT EVIDENCE THAT DEMONSTRATES CERTAIN ASSERTIONS MADE IN THIS REPORT, AND BACK ITS CONCLUSIONS.

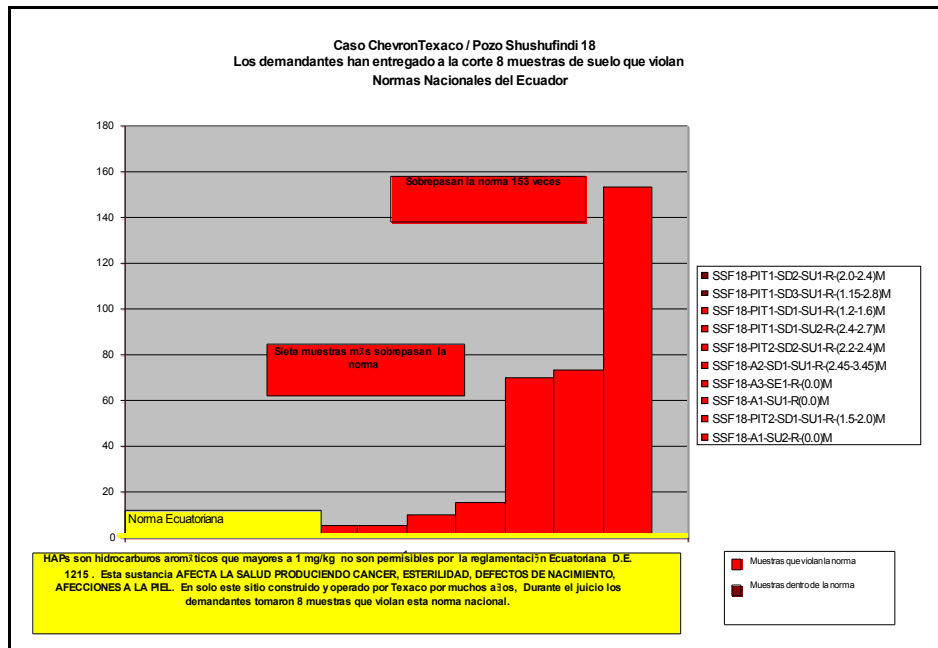
V. THE GRAPHS AND MAPS SHOWN BELOW HELP VISUALIZE ACTUAL CONTAMINATION, THE WAY IT EXCEEDS CURRENT ECUADORIAN LAWS, ITS LOCATION WITHIN THE PLATFORM, AND ITS AREA OF INFLUENCE:

## 1.1. GRAPHIC RESULTS OF LAB SAMPLES: SOIL

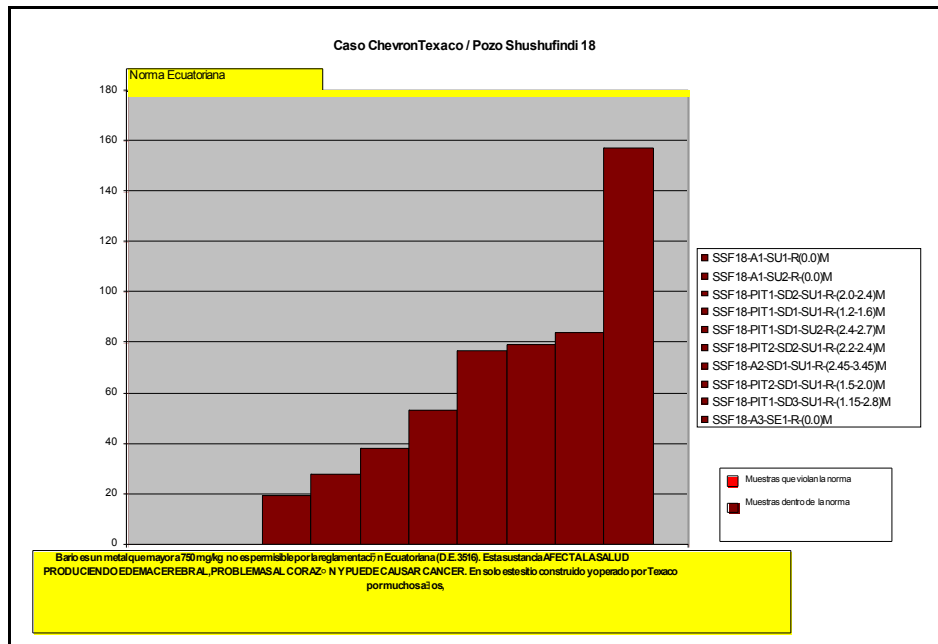
### 1.1.1. TOTAL HYDROCARBON CONCENTRATION



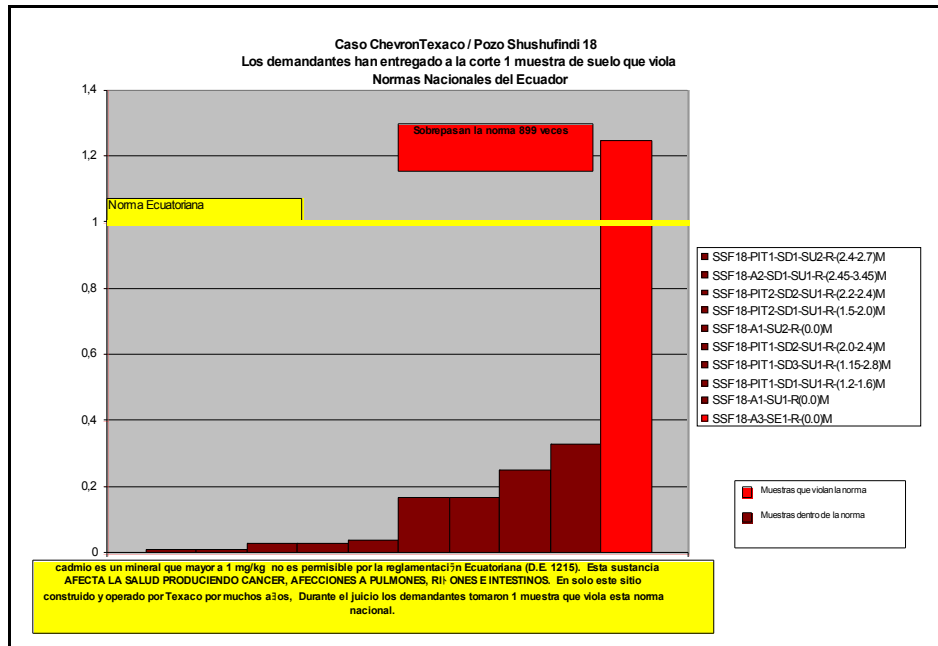
### 1.1.1. HAPs CONCENTRATION



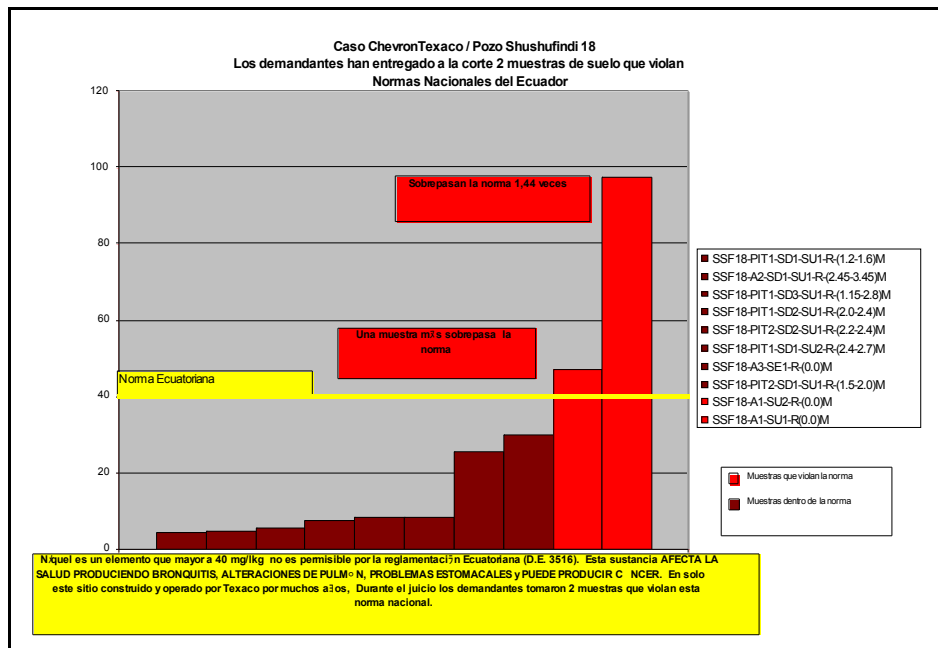
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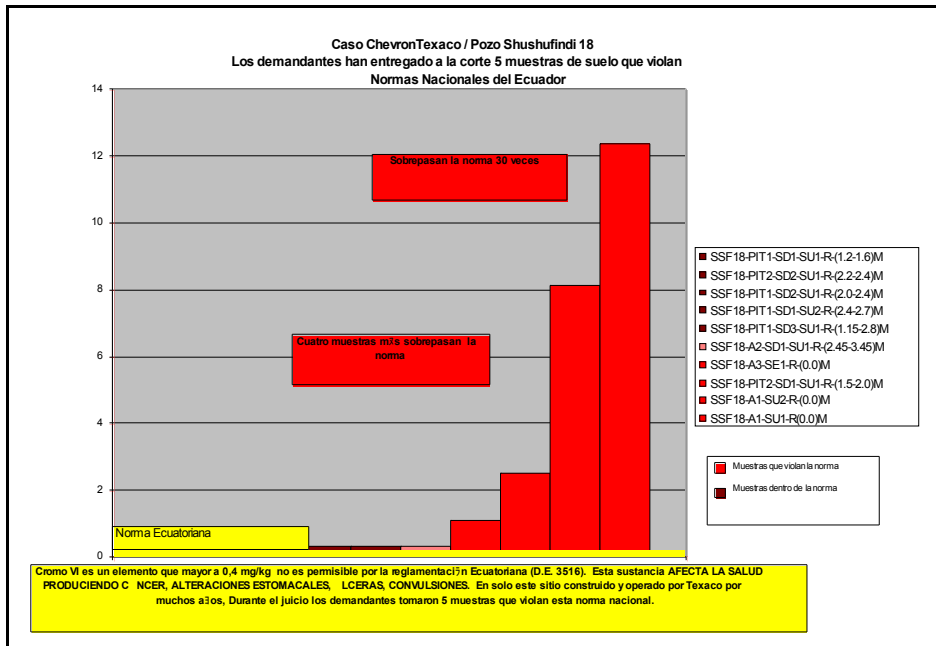
### 1.1.3. CADMIUM CONCENTRATION



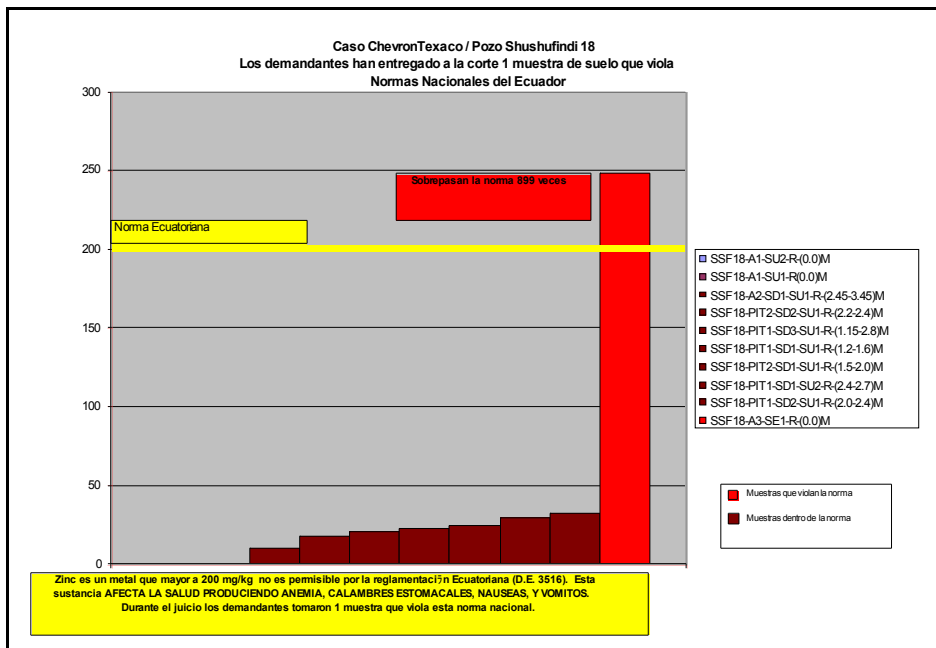
### 1.1.4. NICKEL CONCENTRATION



### 1.1.5. CHROMIUM (VI) CONCENTRATION

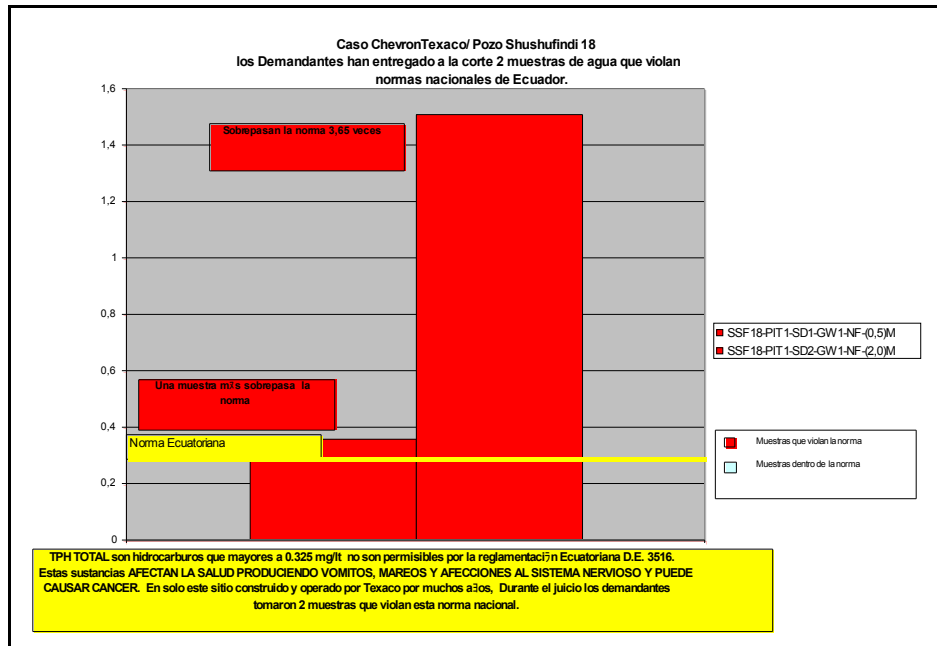


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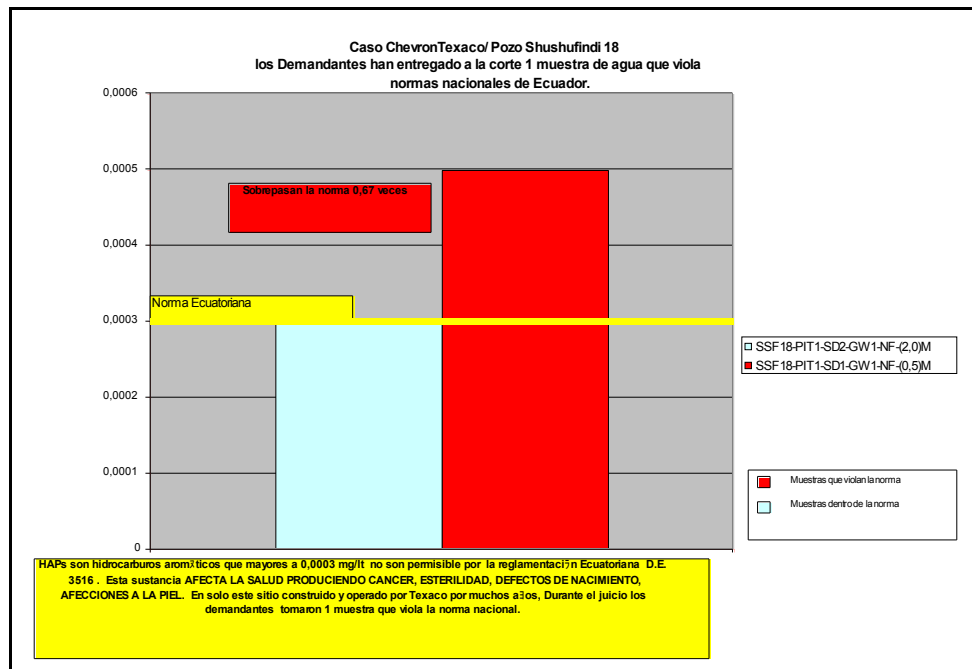


## 1.2. GRAPHIC RESULTS OF LAB SAMPLES: WATER

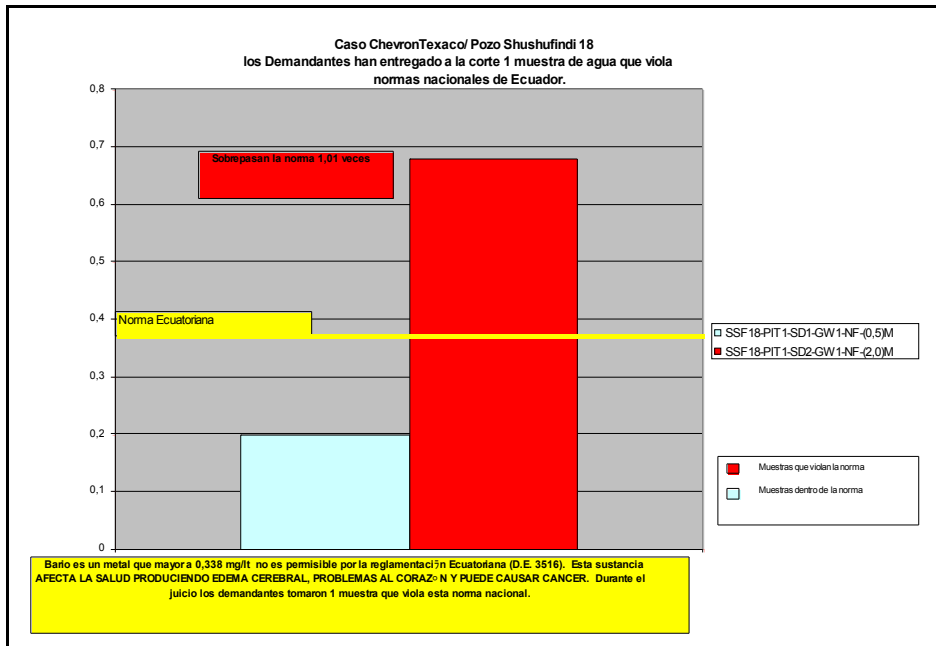
### 1.2.1. TOTAL HYDROCARBON CONCENTRATION



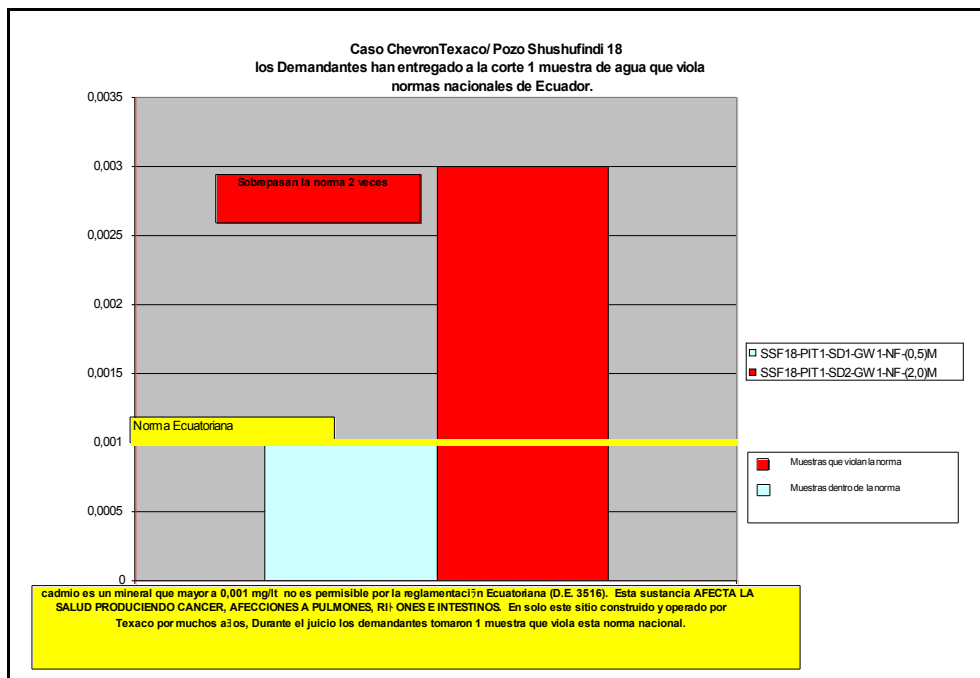
### 1.2.2. HAPs CONCENTRATION



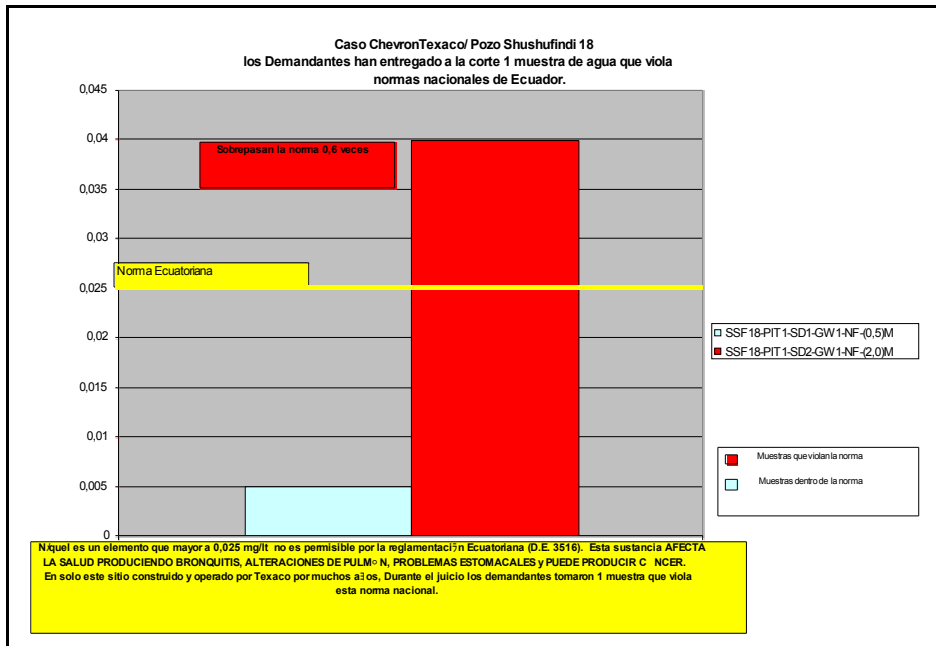
### 1.2.3. BARIUM CONCENTRATION



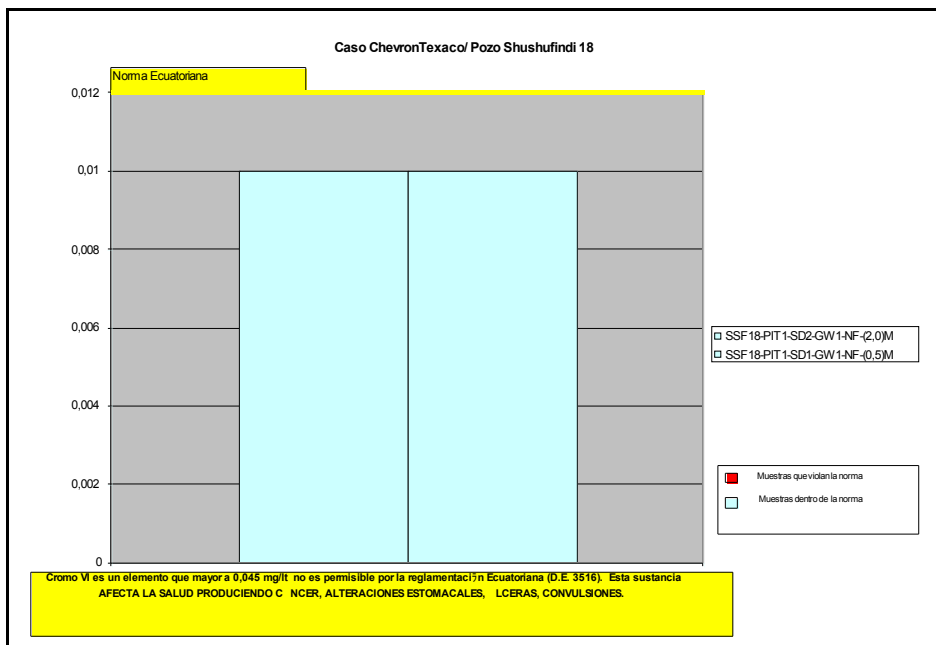
### 1.2.4. CADMIUM CONCENTRATION



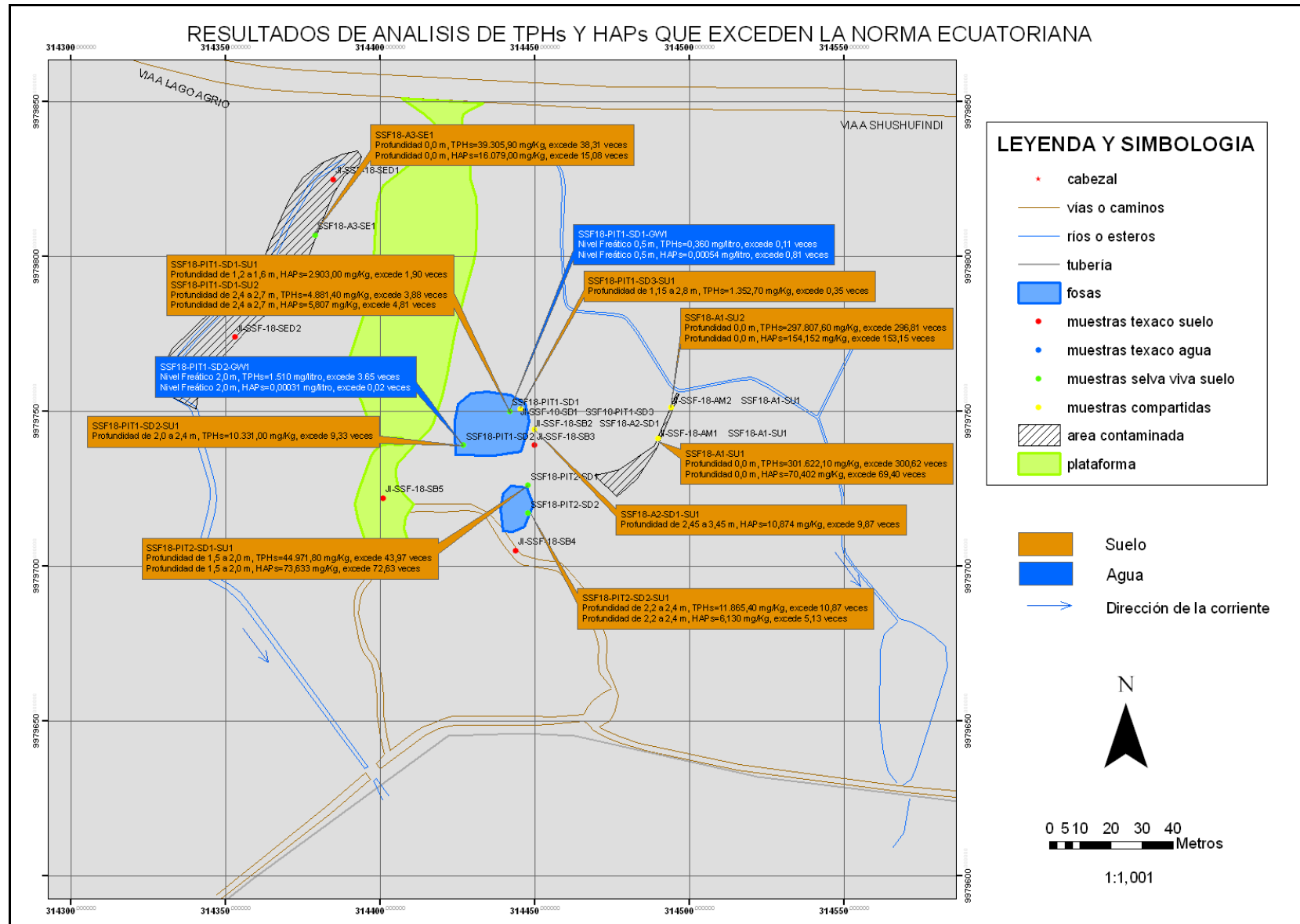
### 1.2.5. NICKEL CONCENTRATION



### 1.2.6. CHROMIUM (VI) CONCENTRATION



### 1.3. SOIL AND WATER TPH CONCENTRATION MAP



### 1.4. SOIL AND WATER HEAVY METAL CONCENTRATION MAP

