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Water Quality Survey

Analytical Report
Water Quality Survey
Cerro Patacon's Landfill
Panama District

Laboratorio de Evaluaciones Ambientales

Instituto Especializado de Análisis

For ,

EARTHEON

KOKUSAI KOGYO CO., LTD.

VD.'02

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1903 2003

Generación del Centenario, Nueva Universidad, Nuevo Liderazgo, Desarrollo Humano Sostenible

FINAL REPORT

ANALYSIS OF LEACHEATES, RIVERINE AND GROUNDWATERS AT CERRO PATACON's LANDFILL SITE

PURPOSE:

The collection and physical-chemical and bacteriological analysis of water samples collected around Cerro Patacon's landfill site. .

DESCRIPTION:

Together with the contractor's representative and the representatives from Panama City's Municipal authorities, the sites for boring the two monitoring wells and the sites for collecting leacheates and superficial riverine water samples, where chosen in accordance to the contractor's decision.

The designated sites are described as follows:

1. Natural River close to Cerro Patacon's landfill site that flows from the Metropolitan Natural Park.
   Geographical position: 09º 02.99 North / 0.79º 34.29 West

2. Monitoring Well, before the landfill.
   Geographical position: 09º 03.53 North / 0.79º 34.02 West

3. Leacheate from the old dumping site.
   Geographical position: 09º 03.06 North / 0.79º 33.99 West

4. River in which the Leacheate is discharged (after the discharge)
   Geographical position: 09º 03.07 North / 0.79º 34.04 West

5. River in which the Leacheate is discharged (before discharge).
   Geographical position: 09º 03.17 North / 0.79º 34.04 West

6. Discharge from the oxidation pond.
   Geographical position: 09º 03.19 North / 0.79º 34.02 West

7. Monitoring Well, after the landfill.
   Geographical position: 09º 03.53 North / 0.79º 34.02 West

8. Leacheate discharge (actual).
   Geographical position: 09º 023.29 North / 0.79º 33.87 West

9. Car washing well.
   Geographical position: 09º 02.74 North / 0.79º 33.81 West

The samples were taken in two separate dates in order to allow for the boring of the wells, the priming by pumping the water out (three times), and a 24 hour settling of same. On the first day samples 1, 3, 4, 5, 6, y 8 where collected, and on the fourth day samples from the recently bored wells and the car washing well, were collected. (According to water sampling protocol EPA # 600/4-82-029)

- Samples where taken according to the description that follows (See photos in Annex, pages. 1, 2), They follow the EPA # 600/4-82-029 directives; and **Technical Rules from DGNTI-COPANIT 35-2000** (legally binding) published by the Ministry of Commerce and Industry and its "Dirección de Normas y Tecnología Industrial según Resolución Nº 351 dado en Panamá el 26 de julio de 2000" (see annex page 67 - 73).

  In accordance with the above, the samples where collected in the following order and in the following containers:① Three (3) 200 ml sterilized containers, ② Poliethylene yellow gallon, ③ Poliethylene Gallon acidified with H_2SO_4 to a pH of <2.00, ④ Poliethylene Liter acidified with HNO_3 to a pH of <2.0, ⑤ Amber glass gallon (prewashed with Hexane), ⑥ Poliethylene Liter made alkaline with NaOH to a pH of >12.0. All samples where labelled twice, identified with permanet ink pens and refrigerated inmediately.

SITE DESCRIPTION AND ANALYTICAL RESULTS:

SITE # 1

- *El Guanabano river, located next to a road that comes out of Cerro Patacon towards the area known as "Los Lagos", the road limits the Natural Metropolitan Park (a national forest reserve) (see photos annex pages. 8,9,10) this would lead you to believe that the stream is free of pollutants, as evidenced by the abundant aquatic life that is seen inside the stream (several species of fish, Characidae, Poeciliade, Cichilidae, inclusive Piabusina panamensi), the clear waters allow for the observation of this diversity (see annex page 10). For this time of year (two weeks after the onset of the dry season) the water volume is very small (see photos on measuring, annex page 10), this volume will decrease much more around march, towards the middle / end of the dry season and this will obviously influence the already atypical values of the stream. The great amount of organic matter (leaves, wood) in decomposition (see annex page 10) plus the scarce water flow will increase significantly the biological oxygen demand as well as many other values that seems unusual for a river's water quality, nonetheless, the abundant aquatic life and its diversity lets you conclude that this is a moderate polluted stream.*

- *Geographical position:* 09º 02.99 North / 0.79º 34.29 West
- *Date / time of sampling:* 28th January, 2002 / 8:40 am
- *Codes of collected samples:*

CODES	DESCRIPTION	VOLUME
1	Yellow plastic (PE) container. Refrigerated sample without preservatives	3.785 L
1B	Sterilized plastics containers, refrigerated.	(3) x 200 mL
1N	Semitransparent Plastic container with the addition of HNO_3 a pH<2,0	1,0 L
1S	Semitransparent Plastic container with the addition of H_2SO_4 a pH<2,0	3.785 L
1O	Semitransparent Plastic container with the addition of NaOH a pH >12,0	1,0 L
1P	Amber glass container prewashed with Hexane	3.785 L

RESULTS SHEET

WATER QUALITY AT CERRO PATACON's LANDFILL SITE.

Laboratorio de Evaluaciones Ambientales

SAMPLE CODES =
1 / 1B / 1S / 1N / 1O / 1P

SAMPLE TYPE=
El Guanabano River

SAMPLE DATE =28 – 01 – 02 TIME=8:05 AM

DESCRIPTION =
Superficial clear water

ANALYTICAL PARAMETERS		---MDL---	RESULTS	METHOD
Flow Volume	L/seg		0.8	Vol
Groundwater level	m		-	
pH			7.0	EPA9040B
Temperature	°C		25.0	SM2550B
Conductivity	µS/cm		287	EPA9050A
Suspended Solids	mg/L		0.8	SM2540D
Turbidity	NTU	0.02	1.1	SM2130B
Color	PtCo	0	6	SM2120C
Alkalinity	mg/L		140	SM2320B
Oil Content (HEM)	mg/L		14.0	EPA1664
Fecal Coliforms	cfu/100 mL	1.0	520	EPA9132
Total Coliforms	cfu/100 mL	1.0	755	EPA9132
BOD_5	mg/L	-	20.5	SM5210B
COD	mg/L	-	25	SM5220D
Ammonia Nitrogen	mg/L	5.0	<5.0	SM4500-NH_3
Total Nitrogen	mg/L	5.0	<5.0	SM4500/N
Na^+	mg/L	0.002	16.4	EPA7000A
Ca^{2+}	mg/L	0.01	13.7	EPA7000A
HCO_3^-	mg/L		170.8	SM2320
SiO_2	mg/L	0.02	50.5	SM4500-Si
Cl^-	mg/L	5.0	53.2	EPA9253
P	mg/L	0.01	79.0	SM4500-P
Cd^{2+}	mg/L	0.005	0.005	EPA7000A
CN^-	mg/L	0.2	<0.2	EPA9010B/9014
Pb	mg/L	0.1	0.21	EPA7000A
Cr	mg/L	0.001	0.0027	EPA7190
Cr^{6+}	mg/L	0.5	<0.5	EPA7196A
As	mg/L	0.002	0.0024	EPA7000A
Hg	mg/L	0.0002	<0.0002	EPA7000A
Cu	mg/L	0.02	0.022	EPA7000A
Zn	mg/L	0.005	0.032	EPA7000A
Fe	mg/L	0.03	0.115	EPA7000A
Mn	mg/L	0.01	0.062	EPA7000A
PCB's	mg/L	See results in page 24		EPA8082

Chemist = Signature =

SITE # 2

- *Monitoring well before the new dumping site, bored according to the submitted design (see annex page 22 - 23) on the 26ih of January 2002, the flow volume measured according to our subcontractor is <1.0 m/sec calculated with the formula of volume versus time at constant flow.*

  The results show this to be a lightly polluted site (see photos in annex page 4) It is noteworthy to mention that according to our subcontractor (see annex page 24) The low flow volume measured is due to the fact that they never perforated the freatic level and that the measured water is the result of the "dry season", our summer. The groundwater level measured by us is 5.2 m.

- *Geographical position:* 09º 03.53 North y 0.79º 34.02 West

- *Date / time of sampling:* 30th. January, 2002 / 9:00 am

- *Codes of collected samples:*

CODES	DESCRIPTION	VOLUME
2	Yellow plastic (PE) container. Refrigerated sample without preservatives	3.785 L
2B	Sterilized plastics containers, refrigerated .	(3) x 200 mL
2N	Semitransparent Plastic container with the addition of HNO_3 a pH<2,0	1,0 L
2S	Semitransparent Plastic container with the addition of H_2SO_4 a pH<2,0	3.785 L
2O	Semitransparent Plastic container with the addition of NaOH a pH >12,0	1,0 L
2P	Amber glass container prewashed with Hexane	3.785 L

RESULTS SHEET

WATER QUALITY AT CERRO PATACON's LANDFILL SITE.

Laboratorio de Evaluaciones Ambientales

SAMPLE CODES =
2 / 2B / 2S / 2N / 2O / 2P

SAMPLE TYPE= Underground Water

SAMPLE DATE = 30-01-02 TIME=9:45 AM

DESCRIPTION =
Monitoring Well (Before landfill)

ANALYTICAL PARAMETERS		---MDL---	RESULTS	METHOD
Flow Volume	L/seg		<0.1	
Groundwater level	m		0.52	
pH			7.1	EPA9040B
Temperature	ºC		28.9	SM2550B
Conductivity	µS/cm		1070	EPA9050A
Suspended Solids	mg/L		30.8	SM2540D
Turbidity	NTU	0.02	20.4	SM2130B
Color	PtCo	0	1	SM2120C
Alkalinity	mg/L		302	SM2320B
Oil Content (HEM)	mg/L		2.0	EPA1664
Fecal Coliforms	cfu/100 mL	1.0	95	EPA9132
Total Coliforms	cfu/100 mL	1.0	285	EPA9132
BOD_5	mg/L	-	6.8	SM5210B
COD	mg/L	-	0	SM5220D
Ammonia Nitrogen	mg/L	5.0	<5.0	SM4500-NH_3
Total Nitrogen	mg/L	5.0	<5.0	SM4500/N
Na^+	mg/L	0.002	68.0	EPA7000A
Ca^{2+}	mg/L	0.01	69	EPA7000A
HCO_3^-	mg/L		346.5	SM2320
SiO_2	mg/L	0.02	31.3	SM4500-Si
Cl^-	mg/L	5.0	100.4	EPA9253
P	mg/L	0.01	37.0	SM4500-P
Cd^{2+}	mg/L	0.005	0.008	EPA7000A
CN^-	mg/L	0.2	<0.2	EPA9010B/9014
Pb	mg/L	0.1	0.33	EPA7000A
Cr	mg/L	0.001	0.0021	EPA7190
Cr^{6+}	mg/L	0.5	<0.5	EPA7196A
As	mg/L	0.002	0.0048	EPA7000A
Hg	mg/L	0.0002	<0.0002	EPA7000A
Cu	mg/L	0.02	0.020	EPA7000A
Zn	mg/L	0.005	0.033	EPA7000A
Fe	mg/L	0.03	0.552	EPA7000A
Mn	mg/L	0.01	0.405	EPA7000A
PCB's	mg/L	See results in page 24		EPA8082

Chemist = Signature =

SITE # 3

- *In view that the Leacheate collector from the old dump site was almost dry, the contractor (Kokusai Koygo) decided to bore a small well in order for the Leacheate to sum up in sufficient quantities to be sampled (see annex page 12). The flow was measure by displacing a certain volume in time according to the wells dimensions (see annex page 13) A flow of 8 x 10^{-7}L/sec was calculated according to our subcontractor (see report in annex pages 25 - 26)*

- *Geographical position:* 09º 03.06 North y 0.79º 33.99 West

- *Date / time of sampling:* 28th. January, 2002 / 9:00 AM

- *Codes of collected samples:*

CODES	DESCRIPTION	VOLUME
3	Yellow plastic (PE) container. Refrigerated sample without preservatives	3.785 L
3B	Sterilized plastics containers, refrigerated .	(3) x 200 mL
3N	Semitransparent Plastic container with the addition of HNO_3 a pH<2,0	1,0 L
3S	Semitransparent Plastic container with the addition of H_2SO_4 a pH<2,0	3.785 L
3O	Semitransparent Plastic container with the addition of NaOH a pH >12,0	1,0 L
3P	Amber glass container prewashed with Hexane	3.785 L

RESULTS SHEET

WATER QUALITY AT CERRO PATACON's LANDFILL SITE.

Laboratorio de Evaluaciones Ambientales

SAMPLE CODES =
3 / 3B / 3S / 3N / 3O / 3P

SAMPLE TYPE=
Brownish water

SAMPLE DATE =28 - 01- 02 TIME=11:00 AM

DESCRIPTION =
Leacheate from old dump site

ANALYTICAL PARAMETERS		---MDL---	RESULTS	METHOD
Flow Volume	L/seg		0.00003	
Groundwater level	m		-	
pH			6.9	EPA9040B
Temperature	ºC		27.5	SM2550B
Conductivity	µS/cm		4130	EPA9050A
Suspended Solids	mg/L		227.2	SM2540D
Turbidity	NTU	0.02	321	SM2130B
Color	PtCo	0	1638	SM2120C
Alkalinity	mg/L		453	SM2320B
Oil Content (HEM)	mg/L		1181.0	EPA1664
Fecal Coliforms	cfu/100mL	1.0	12500	EPA9132
Total Coliforms	cfu/100mL	1.0	19500	EPA9132
BOD_5	mg/L	-	32.0	SM5210B
COD	mg/L	-	35.4	SM5220D
Ammonia Nitrogen	mg/L	5.0	33.0	SM4500-NH_3
Total Nitrogen	mg/L	5.0	35.4	SM4500/N
Na^+	mg/L	0.002	445.0	EPA7000A
Ca^{2+}	mg/L	0.01	78.9	EPA7000A
HCO_3^-	mg/L		553.8	SM2320
SiO_2	mg/L	0.02	31.8	SM4500-Si
Cl^-	mg/L	5.0	691.3	EPA9253
P	mg/L	0.01	620.0	SM4500-P
Cd^{2+}	mg/L	0.005	0.018	EPA7000A
CN^-	mg/L	0.2	<0.2	EPA9010B/9014
Pb	mg/L	0.1	0.35	EPA7000A
Cr	mg/L	0.001	0.0021	EPA7190
Cr^{6+}	mg/L	0.5	<0.5	EPA7196A
As	mg/L	0.002	0.0046	EPA7000A
Hg	mg/L	0.0002	0.0010	EPA7000A
Cu	mg/L	0.02	0.262	EPA7000A
Zn	mg/L	0.005	0.117	EPA7000A
Fe	mg/L	0.03	15.720	EPA7000A
Mn	mg/L	0.01	6.272	EPA7000A
PCB's	mg/L	See results in page 24		EPA8082

Chemist = Signature =

SITE # 4

- *Small stream where the Leacheate coming out of the oxidation pond from the old dump site is discharged, on the sampling day, the original site was changed for another point further down the stream after another little stream joins it, presumably untreated Leacheate from the old dump site that filters from the first of the oxidizing ponds (see photo annex page 14). The sample was taken around 7 m from where the two little streams join (see photo annex page 15)*

  *Is self evident that the Leacheate percolating from the old dump site (**B**) significantly contributes to the deterioration and pollution of the stream, is readily observed how before the Leacheate joins the stream the aquatic life, fish, amphibians and crustaceans are plentiful but right after it joins the stream this life disappears.*

  The flow volume is very small (see photo annex page 15) and with all probability once the dry season takes hold, the stream will dry out.

- *Geographical position:* 09º 03.07 North y 0.79º 34.04 west

- *Date / time of sampling:* 28th. January, 2002 / 9:00 AM

- *Codes of collected samples:*

CODES	DESCRIPTION	VOLUME
4	Yellow plastic (PE) container. Refrigerated sample without preservatives	3.785 L
4B	Sterilized plastics containers, refrigerated .	(3) x 200 mL
4N	Semitransparent Plastic container with the addition of HNO_3 a pH<2,0	1,0 L
4S	Semitransparent Plastic container with the addition of H_2SO_4 a pH<2,0	3.785 L
4O	Semitransparent Plastic container with the addition of NaOH a pH >12,0	1,0 L
4P	Amber glass container prewashed with Hexane	3.785 L

RESULTS SHEET

WATER QUALITY AT CERRO PATACON's LANDFILL SITE.

Laboratorio de Evaluaciones Ambientales

SAMPLE CODES =
4 / 4B / 4S / 4N / 4O / 4P

SAMPLE TYPE=
Water

SAMPLE DATE =28-01-02 TIME=11:50 AM

DESCRIPTION =
Brackish, smelly, light brown water

ANALYTICAL PARAMETERS		---MDL---	RESULTS	METHOD
Flow Volume	L/seg		0.4	
Groundwater level	m		-	
pH			6.7	EPA9040B
Temperature	ºC		28.3	SM2550B
Conductivity	µS/cm		2140	EPA9050A
Suspended Solids	mg/L		38.8	SM2540D
Turbidity	NTU	0.02	46.9	SM2130B
Color	PtCo	0	76	SM2120C
Alkalinity	mg/L		440	SM2320B
Oil Content (HEM)	mg/L		13.0	EPA1664
Fecal Coliforms	cfu/100mL	1.0	2400	EPA9132
Total Coliforms	cfu/100mL	1.0	5650	EPA9132
BOD_5	mg/L	-	36.3	SM5210B
COD	mg/L	-	54	SM5220D
Ammonia Nitrogen	mg/L	5.0	7.8	SM4500-NH_3
Total Nitrogen	mg/L	5.0	8.2	SM4500/N
Na^+	mg/L	0.002	99.0	EPA7000A
Ca^{2+}	mg/L	0.01	69.5	EPA7000A
HCO_3^-	mg/L		536.6	SM2320
SiO_2	mg/L	0.02	55.7	SM4500-Si
Cl^-	mg/L	5.0	336.8	EPA9253
P	mg/L	0.01	194.0	SM4500-P
Cd^{2+}	mg/L	0.005	0.017	EPA7000A
CN^-	mg/L	0.2	<0.2	EPA9010B/9014
Pb	mg/L	0.1	0.35	EPA7000A
Cr	mg/L	0.001	0.0018	EPA7190
Cr^{6+}	mg/L	0.5	<0.5	EPA7196A
As	mg/L	0.002	0.0026	EPA7000A
Hg	mg/L	0.0002	<0.0002	EPA7000A
Cu	mg/L	0.02	0.025	EPA7000A
Zn	mg/L	0.005	0.040	EPA7000A
Fe	mg/L	0.03	7.890	EPA7000A
Mn	mg/L	0.01	1.643	EPA7000A
PCB's	mg/L	See results in page 24		EPA8082

Chemist =

Signature =

SITE # 5

Small stream where the Leacheate coming out of the oxidation pond from the old dump site is discharged, the site was chosen (see annex page 16) because it represents the part of the river where the leacheate has not yet discharged, we observed some small oil spots on the surface, even though the clarity of the water and the abundant aquatic life allows you to conclude this part of the stream is in better condition, it has to be remembered that with the onset of the dry season (see annex page 17) the stream most probably will dry out.

- *Geographical position:* 09º 03.17 North y 0.79º 34.04 West

- *Date / time of sampling:* 28th. January, 2002 / 9:00 AM

- *Codes of collected samples:*

CODES	DESCRIPTION	VOLUME
5	Yellow plastic (PE) container. Refrigerated sample without preservatives	3.785 L
5B	Sterilized plastics containers, refrigerated .	(3) x 200 mL
5N	Semitransparent Plastic container with the addition of HNO_3 a pH<2,0	1,0 L
5S	Semitransparent Plastic container with the addition of H_2SO_4 a pH<2,0	3.785 L
5O	Semitransparent Plastic container with the addition of NaOH a pH >12,0	1,0 L
5P	Amber glass container prewashed with Hexane	3.785 L

RESULTS SHEET

WATER QUALITY AT CERRO PATACON's LANDFILL SITE.

Laboratorio de Evaluaciones Ambientales

SAMPLE CODES =
5 / 5B / 5S / 5N / 5O / 5P

SAMPLE TYPE=
Water

SAMPLE DATE =28-01-02 TIME=9:30 AM

DESCRIPTION =
Clear water

ANALYTICAL PARAMETERS		---MDL---	RESULTS	METHOD
Flow Volume	L/seg		0.4	
Groundwater level	m		-	
pH			6.8	EPA9040B
Temperature	ºC		25.3	SM2550B
Conductivity	µS/cm		1172	EPA9050A
Suspended Solids	mg/L		3.6	SM2540D
Turbidity	NTU	0.02	4.06	SM2130B
Color	PtCo	0	35	SM2120C
Alkalinity	mg/L		434	SM2320B
Oil Content (HEM)	mg/L		36.0	EPA1664
Fecal Coliforms	cfu/100mL	1.0	20500	EPA9132
Total Coliforms	cfu/100mL	1.0	54000	EPA9132
BOD_5	mg/L	-	6.1	SM5210B
COD	mg/L	-	4	SM5220D
Ammonia Nitrogen	mg/L	5.0	8.1	SM4500-NH_3
Total Nitrogen	mg/L	5.0	9.0	SM4500/N
Na^+	mg/L	0.002	82.5	EPA7000A
Ca^{2+}	mg/L	0.01	49.4	EPA7000A
HCO_3^-	mg/L		529.7	SM2320
SiO_2	mg/L	0.02	29.5	SM4500-Si
Cl^-	mg/L	5.0	141.8	EPA9253
P	mg/L	0.01	35.0	SM4500-P
Cd^{2+}	mg/L	0.005	0.010	EPA7000A
CN^-	mg/L	0.2	<0.2	EPA9010B/9014
Pb	mg/L	0.1	0.24	EPA7000A
Cr	mg/L	0.001	0.0036	EPA7190
Cr^{6+}	mg/L	0.5	<0.5	EPA7196A
As	mg/L	0.002	0.0033	EPA7000A
Hg	mg/L	0.0002	<0.0002	EPA7000A
Cu	mg/L	0.02	0.015	EPA7000A
Zn	mg/L	0.005	0.042	EPA7000A
Fe	mg/L	0.03	0.420	EPA7000A
Mn	mg/L	0.01	2.987	EPA7000A
PCB's	mg/L	See results in page 24		EPA8082

Chemist = Signature =

SITE # 6

This site was supposed to represent the discharged from the oxidation pond, nonetheless due to the onset of the dry season there was not a discharge (see annex pages 17,18) in view of this the representative from the contractor (Kokusai) determined to take the sample at the oxidation pond right at the intake of the discharge pipe (see annex page 18).

- *Geographical position:* 09º 03.17 North y 0.79º 34.04 West

- *Date / time of sampling:* 28th. January, 2002 / 9:00 AM

- *Codes of collected samples:*

CODES	DESCRIPTION	VOLUME
6	Yellow plastic (PE) container. Refrigerated sample without preservatives	3.785 L
6B	Sterilized plastics containers, refrigerated .	(3) x 200 mL
6N	Semitransparent Plastic container with the addition of HNO_3 a pH<2,0	1,0 L
6S	Semitransparent Plastic container with the addition of H_2SO_4 a pH<2,0	3.785 L
6O	Semitransparent Plastic container with the addition of NaOH a pH >12,0	1,0 L
6P	Amber glass container prewashed with Hexane	3.785 L

RESULTS SHEET

WATER QUALITY AT CERRO PATACON's LANDFILL SITE.

Laboratorio de Evaluaciones Ambientales

SAMPLE CODES =
6 / 6B / 6S / 6N / 6O / 6P

SAMPLE TYPE=
Water

SAMPLE DATE =28-01-02 TIME=10:15 AM

DESCRIPTION =
Green to yellowish colored water

ANALYTICAL PARAMETERS		---MDL---	RESULTS	METHOD
Flow Volume	L/seg		-	
Groundwater level	m		-	
pH			9.6	EPA9040B
Temperature	ºC		28.9	SM2550B
Conductivity	µS/cm		1255	EPA9050A
Suspended Solids	mg/L		84.4	SM2540D
Turbidity	NTU	0.02	164	SM2130B
Color	PtCo	0	108	SM2120C
Alkalinity	mg/L		199	SM2320B
Oil Content (HEM)	mg/L		434.0	EPA1664
Fecal Coliforms	cfu/100mL	1.0	6	EPA9132
Total Coliforms	cfu/100mL	1.0	22	EPA9132
BOD_5	mg/L	-	15.7	SM5210B
COD	mg/L	-	20.9	SM5220D
Ammonia Nitrogen	mg/L	5.0	<5.0	SM4500-NH_3
Total Nitrogen	mg/L	5.0	<5.0	SM4500/N
Na^+	mg/L	0.002	191.2	EPA7000A
Ca^{2+}	mg/L	0.01	10.8	EPA7000A
HCO_3^-	mg/L		181.8	SM2320
SiO_2	mg/L	0.02	17.7	SM4500-Si
Cl^-	mg/L	5.0	254.1	EPA9253
P	mg/L	0.01	365.0	SM4500-P
Cd^{2+}	mg/L	0.005	0.008	EPA7000A
CN^-	mg/L	0.2	<0.2	EPA9010B/9014
Pb	mg/L	0.1	0.26	EPA7000A
Cr	mg/L	0.001	0.0030	EPA7190
Cr^{6+}	mg/L	0.5	<0.5	EPA7196A
As	mg/L	0.002	0.0022	EPA7000A
Hg	mg/L	0.0002	0.0005	EPA7000A
Cu	mg/L	0.02	0.013	EPA7000A
Zn	mg/L	0.005	0.030	EPA7000A
Fe	mg/L	0.03	0.113	EPA7000A
Mn	mg/L	0.01	0.220	EPA7000A
PCB's	mg/L	See results in page 24		EPA8082

Chemist = Signature =

SITE # 7

- *Monitoring well located right next to the main road at Cerro Patacon and close to the new dumping site (see annex page 19), with a depth of 10 m., sources of water from the aquifer where encountered at a depth of 1.8m and 6.1m, this allows for a higher flow than at Site # 2, the other monitoring well where the flow is much less. The analytical results obtained for this site demonstrate that the leacheate from the new dumping site is percolating and affecting the groundwater at this site.*

  At this site samples were analyzed in duplicate for certain items.

- *Geographical position:* 09º 03.53 North y 0.79º 34.02 West

- *Date / time of sampling:* 30th. January, 2002 / 9:00 AM

- *Codes of collected samples:*

CODES	DESCRIPTION	VOLUME
7	Yellow plastic (PE) container. Refrigerated sample without preservatives	3.785 L
7B	Sterilized plastics containers, refrigerated .	(3) x 200 mL
7N	Semitransparent Plastic container with the addition of HNO_3 a pH<2,0	1,0 L
7S	Semitransparent Plastic container with the addition of H_2SO_4 a pH<2,0	3.785 L
7O	Semitransparent Plastic container with the addition of NaOH a pH >12,0	1,0 L
7P	Amber glass container prewashed with Hexane	3.785 L

RESULTS SHEET

WATER QUALITY AT CERRO PATACON's LANDFILL SITE.

Laboratorio de Evaluaciones Ambientales

SAMPLE CODES =
7 / 7B / 7S / 7N / 7O / 7P

SAMPLE TYPE=
Groundwater

SAMPLE DATE =30-01-02 TIME=10:45 AM

DESCRIPTION =
Yellowish Color and Smell

ANALYTICAL PARAMETERS		---MDL---	RESULTS	METHOD
Flow Volume	L/seg		0.95	
Groundwater level	m		3.0	
pH			6.9	EPA9040B
Temperature	°C		29.9	SM2550B
Conductivity	µS/cm		4590	EPA9050A
Suspended Solids	mg/L		31.6	SM2540D
Turbidity	NTU	0.02	13.5	SM2130B
Color	PtCo	0	98	SM2120C
Alkalinity	mg/L		735	SM2320B
Oil Content (HEM)	mg/L		35.0	EPA1664
Fecal Coliforms	cfu/100mL	1.0	30500	EPA9132
Total Coliforms	cfu/100mL	1.0	250000	EPA9132
BOD_5	mg/L	-	22.9	SM5210B
COD	mg/L	-	37.5	SM5220D
Ammonia Nitrogen	mg/L	5.0	7.1	SM4500-NH_3
Total Nitrogen	mg/L	5.0	8.5	SM4500/N
Na^+	mg/L	0.002	109.4	EPA7000A
Ca^{2+}	mg/L	0.01	362.5	EPA7000A
HCO_3^-	mg/L		896.9	SM2320
SiO_2	mg/L	0.02	83.6	SM4500-Si
Cl^-	mg/L	5.0	756.3	EPA9253
P	mg/L	0.01	92.0	SM4500-P
Cd^{2+}	mg/L	0.005	0.035	EPA7000A
CN^-	mg/L	0.2	<0.2	EPA9010B/9014
Pb	mg/L	0.1	0.23	EPA7000A
Cr	mg/L	0.001	0.0017	EPA7190
Cr^{6+}	mg/L	0.5	<0.5	EPA7196A
As	mg/L	0.002	0.0177	EPA7000A
Hg	mg/L	0.0002	0.0010	EPA7000A
Cu	mg/L	0.02	0.047	EPA7000A
Zn	mg/L	0.005	0.065	EPA7000A
Fe	mg/L	0.03	0.595	EPA7000A
Mn	mg/L	0.01	3.930	EPA7000A
PCB's	mg/L	See results in page 24		EPA8082

Chemist =

Signature =

SITE # 8

- *Leacheate discharged from the new trash-dumping site (see annex page 19,20), its high "on site" temperature as well as all analytical results demonstrate the nature of the sample.*

  The site is characteristic for its strong smell and abundant flies.

- *Geographical position:* 09º 023.29 North y 0.79º 33.87 West

- *Date / time of sampling:* 28th. January, 2002 / 9:00 am

- *Codes of collected samples:*

CODES	DESCRIPTION	VOLUME
8	Yellow plastic (PE) container. Refrigerated sample without preservatives	3.785 L
8B	Sterilized plastics containers, refrigerated .	(3) x 200 mL
8N	Semitransparent Plastic container with the addition of HNO_3 a pH<2,0	1,0 L
8S	Semitransparent Plastic container with the addition of H_2SO_4 a pH<2,0	3.785 L
8O	Semitransparent Plastic container with the addition of NaOH a pH >12,0	1,0 L
8P	Amber glass container prewashed with Hexane	3.785 L

RESULTS SHEET

WATER QUALITY AT CERRO PATACON's LANDFILL SITE.

Laboratorio de Evaluaciones Ambientales

SAMPLE CODES=
8 / 8B / 8S / 8N / 8O / 8P

SAMPLE TYPE=
LEACHÉATE "NEW DUMPING SITE"

SAMPLE DATE =28-01-02 TIME=12:45 PM

DESCRIPTION =
VERY DARK LECHEATE, WITH FETID SMELL

ANALYTICAL PARAMETERS		---MDL---	RESULTS	METHOD
Flow Volume	L/seg		0.32	
Groundwater level	m		-	
pH			6.9	EPA9040B
Temperature	°C		34.4	SM2550B
Conductivity	µS/cm		9120	EPA9050A
Suspended Solids	mg/L		42	SM2540D
Turbidity	NTU	0.02	89.2	SM2130B
Color	PtCo	0	1858	SM2120C
Alkalinity	mg/L		3192	SM2320B
Oil Content (HEM)	mg/L		28.0	EPA1664
Fecal Coliforms	cfu/100mL	1.0	4750	EPA9132
Total Coliforms	cfu/100mL	1.0	51000	EPA9132
BOD_5	mg/L	-	762.1	SM5210B
COD	mg/L	-	1009	SM5220D
Ammonia Nitrogen	mg/L	5.0	491.4	SM4500-NH_3
Total Nitrogen	mg/L	5.0	495.0	SM4500/N
Na^+	mg/L	0.002	490	EPA7000A
Ca^{2+}	mg/L	0.01	245.0	EPA7000A
HCO_3^-	mg/L		3895.3	SM2320
SiO_2	mg/L	0.02	40.9	SM4500-Si
Cl^-	mg/L	5.0	1181.7	EPA9253
P	mg/L	0.01	5616.0	SM4500-P
Cd^{2+}	mg/L	0.005	0.035	EPA7000A
CN^-	mg/L	0.2	<0.2	EPA9010B/9014
Pb	mg/L	0.1	0.30	EPA7000A
Cr	mg/L	0.001	0.0054	EPA7190
Cr^{6+}	mg/L	0.5	<0.5	EPA7196A
As	mg/L	0.002	0.0021	EPA7000A
Hg	mg/L	0.0002	0.0011	EPA7000A
Cu	mg/L	0.02	0.038	EPA7000A
Zn	mg/L	0.005	0.587	EPA7000A
Fe	mg/L	0.03	8.195	EPA7000A
Mn	mg/L	0.01	4.830	EPA7000A
PCB's	mg/L	See results in page 24		EPA8082

Chemist =

Signature =

SITE # 9

- *Well used for washing the garbage collector trucks and equipment (see annex page 21), it is a closed well with an electric turbine that works every two minutes, according to information gathered at the site, the flow could not be measured and must be minimal since it can not hold a constant flow due to the fact that it runs dry in just about a minute.*

- *Geographical position:* 09º 023.29 North y 0.79º 33.87 West

- *Date / time of sampling:* 30th. January, 2002 / 9:00 am

- *Codes of collected samples:*

CODES	DESCRIPTION	VOLUME
9	Yellow plastic (PE) container. Refrigerated sample without preservatives	3.785 L
9B	Sterilized plastics containers, refrigerated .	(3) x 200 mL
9N	Semitransparent Plastic container with the addition of HNO_3 a pH<2,0	1,0 L
9S	Semitransparent Plastic container with the addition of H_2SO_4 a pH<2,0	3.785 L
9O	Semitransparent Plastic container with the addition of NaOH a pH >12,0	1,0 L
9P	Amber glass container prewashed with Hexane	3.785 L

RESULTS SHEET

WATER QUALITY AT CERRO PATACON's LANDFILL SITE.

Laboratorio de Evaluaciones Ambientales

SAMPLE CODES=
9 / 9B / 9S / 9N / 9O / 9P

SAMPLE TYPE=
groundwater

SAMPLE DATE =30 – 01- 02 TIME=12:10 PM

DESCRIPTION =
Slightly red water

ANALYTICAL PARAMETERS		---MDL---	RESULTS	METHOD
Flow Volume	L/seg		-	
Groundwater level	m		-	
pH			7.7	EPA9040B
Temperature	ºC		28.3	SM2550B
Conductivity	µS/cm		696	EPA9050A
Suspended Solids	mg/L		5.2	SM2540D
Turbidity	NTU	0.02	6.0	SM2130B
Color	PtCo	0	0	SM2120C
Alkalinity	mg/L		313	SM2320B
Oil Content (HEM)	mg/L		17.0	EPA1664
Fecal Coliforms	cfu/100mL	1.0	0	EPA9132
Total Coliforms	cfu/100mL	1.0	0	EPA9132
BOD_5	mg/L		0	SM5210B
COD	mg/L		0	SM5220D
Ammonia Nitrogen	mg/L	5.0	<5.0	SM4500-NH_3
Total Nitrogen	mg/L	5.0	<5.0	SM4500/N
Na^+	mg/L	0.002	111.9	EPA7000A
Ca^{2+}	mg/L	0.01	20.7	EPA7000A
HCO_3^-	mg/L		330.9	SM2320
SiO_2	mg/L	0.02	50.6	SM4500-Si
Cl^-	mg/L	5.0	59.1	EPA9253
P	mg/L	0.01	25.0	SM4500-P
Cd^{2+}	mg/L	0.005	0.012	EPA7000A
CN^-	mg/L	0.2	<0.2	EPA9010B/9014
Pb	mg/L	0.1	0.22	EPA7000A
Cr	mg/L	0.001	0.0024	EPA7190
Cr^{6+}	mg/L	0.5	<0.5	EPA7196A
As	mg/L	0.002	0.0030	EPA7000A
Hg	mg/L	0.0002	0.0010	EPA7000A
Cu	mg/L	0.02	0.025	EPA7000A
Zn	mg/L	0.005	0.443	EPA7000A
Fe	mg/L	0.03	0.063	EPA7000A
Mn	mg/L	0.01	1.272	EPA7000A
PCB's	mg/L	See results in page 24		EPA8082
Chemist =		Signature =		

ANALYTICAL RESULTS, BY SAMPLES AND ANALYTES

RESULTS SHEET

WATER QUALITY AT CERRO PATACON's LANDFILL SITE

Laboratorio de Evaluaciones Ambientales

ANALYTICAL PARAMETERS		SITES									
		1	2	3	4	5	6	7	7ª	8	9
Flow Volume	L/seg	0.8	<0.1	0.00003	0.4	0.4	-	0.95		0.32	-
Groundwater level	m	-	0.52	-	-	-	-	3.0		-	-
pH		7.0	7.1	6.9	6.7	6.8	9.6	6.9		6.9	7.7
Temperature	ºC	25.0	28.9	27.5	28.3	25.3	28.9	29.9		34.4	28.3
Conductivity	µS/cm	287	1070	4130	2140	1172	1255	4590		9120	696
Suspended Solids	mg/L	0.8	30.8	227.2	38.8	3.6	84.4	31.6		42	5.2
Turbidity	NTU	1.1	20.4	321	46.9	4.06	164	13.5	13.3	89.2	6.0
Color	PtCo	6	1	1638	76	35	108	98		1858	0
Alkalinity	mg/L	140	302	453	440	434	199	735	732	3192	313
Oil Content	mg/L	14.0	2.0	1181.0	13.0	36.0	434.0	35.0		28.0	17.0
Fecal Coliforms	cfu/100ml	520	95	12500	2400	20500	6	30500	28500	4750	0
Total Coliforms	cfu/100ml	755	285	19500	5650	54000	22	250000	330000	51000	0
BOD_5	mg/L	20.5	6.8	32.0	36.3	6.1	15.7	22.9		762.1	0
COD	mg/L	25	0	35.4	54	4	20.9	37.5		1009	0
Ammonia Nitrogen	mg/L	<5.0	<5.0	33.0	7.8	8.1	<5.0	7.1	7.3	491.4	<5.0
Total Nitrogen	mg/L	<5.0	<5.0	35.4	8.2	9.0	<5.0	8.5	8.4	495.0	<5.0
Na^+	mg/L	16.4	68.0	445.0	99.0	82.5	191.2	109.4		490	111.9
Ca^{2+}	mg/L	13.7	69	78.9	69.5	49.4	10.8	362.5		245.0	20.7
HCO_3^-	mg/L	170.8	346.5	553.8	536.6	529.7	181.8	896.9	880.8	3895.3	330.9
SiO_2	mg/L	50.5	31.3	31.8	55.7	29.5	17.7	83.6		40.9	50.6
Cl^-	mg/L	53.2	100.4	691.3	336.8	141.8	254.1	756.3	779.9	1181.7	59.1
P	mg/L	79.0	37.0	620.0	194.0	35.0	365.0	92.0		5616.0	25.0
Cd^{2+}	mg/L	0.005	0.008	0.018	0.017	0.010	0.008	0.035		0.035	0.012
CN^-	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Pb	mg/L	0.21	0.33	0.35	0.35	0.24	0.26	0.23		0.30	0.22
Cr	mg/L	0.0027	0.0021	0.0021	0.0018	0.0036	0.0030	0.0017		0.0054	0.0024
Cr^{6+}	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
As	mg/L	0.0024	0.0048	0.0046	0.0026	0.0033	0.0022	0.0177		0.0021	0.0030
Hg	mg/L	<0.0002	<0.0002	0.0010	<0.0002	<0.0002	0.0005	0.0010		0.0011	0.0010
Cu	mg/L	0.022	0.020	0.262	0.025	0.015	0.013	0.047		0.038	0.025
Zn	mg/L	0.032	0.033	0.117	0.040	0.042	0.030	0.065		0.587	0.443
Fe	mg/L	0.115	0.552	15.720	7.890	0.420	0.113	0.595		8.195	0.063
Mn	mg/L	0.062	0.405	6.272	1.643	2.987	0.220	3.930		4.830	1.272
PCB's	mg/L	See results in page 24									
Químico =	Firma=										

HOJA DE RESULTADOS

CALIDAD DE AGUAS - VERTEDERO EN CERRO PATACON

Laboratorio de Evaluaciones Ambientales

SAMPLES CODES = **QCI - 046 / QCI – 049 - 1**

SAMPLE TYPES = **CERTIFIED REFERENCE MATERIAL**

PREPARATION DATE = 02 – 02 - 02 HORA = 10:00 am

DESCRIPTION =Glass ampoules to be diluted to volume according to instructions (see Annex pp. 31-32)

ANALYTICAL PARAMETERS		Certified Value	Acceptance Limits	RESULTS	METHOD
Volumen de Flujo	m/seg		-		
Nivel de agua subterránea	m		-		
pH					EPA9040B
Temperatura	ºC				SM2550B
Conductividad	µS/cm	460	423 – 497	**428.3**	EPA9050A
Sólidos Suspendidos	mg/L				SM2540D
Turbiedad	NTU				SM2130B
Color	PtCo				SM2120C
Alcalinidad	mg/L	40.3	34.6 - 45.4	**42.0**	SM2320B
Contenido de Aceite	mg/L				EPA1664
Coliformes Fecales	ufc/100 mL				EPA9132
Coliformes Totales	ufc/100 mL				EPA9132
BOD_5	mg/L				SM5210B
COD	mg/L				SM5220D
Nitrógeno Amoniacal	mg/L				SM4500-NH_3
Nitrógeno Total	mg/L				SM4500/N
Na^+	mg/L	40.2	36.4 – 44.0	**36.0**	EPA7000A
Ca^{2+}	mg/L	25.3	22.0 – 28.6	**23.3**	EPA7000A
HCO_3^-	mg/L				SM2320
SiO_2	mg/L				SM4500-Si
Cl^-	mg/L	84.9	77.4 – 95.5	**83.3**	EPA9253
P	mg/L				SM4500-P
Cd^{2+}	µg/L	41.0	34.1 – 47.9	**37.0**	EPA7000A
CN^-	mg/L				EPA9010B/9014
Pb	µg/L	51.2	37.8 – 64.6	**63.3**	EPA7000A
Cr	µg/L	71.5	60.1 – 82.9	**81.1**	EPA7190
Cr^{6+}	mg/L				EPA7196A
As	µg/L	30.2	21.1 – 39.3	**21.1**	EPA7000A
Hg	µg/L	40.8	30.9 – 50.7	**41.7**	EPA7000A
Cu	µg/L	61.6	52.4 – 70.8	**66.0**	EPA7000A
Zn	mg/L				EPA7000A
Fe	mg/L				EPA7000A
Mn	mg/L				EPA7000A
PCB's	mg/L				EPA8082

Químico = Firma=

PCB's RESULTS

	SAMPLES ANALYZED (HEWLETT-PACKARD 6890 GC /MECD)													
	BLANK	STANDARD CALIBRATE	RECOVERY STANDARD	1P	2P	3P	4P	5P	6P	7P	8P	9P	AROCLOR 1016	AROCLOR 1260
Area (average) 1016		38.08	36.20	NEG	NEG		NEG[a]	NEG	NEG	NEG	156.49	NEG		
Area (average) 1260		31.94	32.39	NEG	NEG		NEG[b]	NEG	NEG	NEG	160.40	NEG		
Area (average) Surrogate 25 µg	135.32	135.54	218.36	246.08	164.14	38.61	211.17	221.20	161.56	202.61	24.35	148.29		
Recovery (%) Aroclor 1016													95.1 %	
Recovery (%) Aroclor 1260														101.4 %
Injection Volume (µL)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
Extracted Volume (mL)	1000		1000	1000	1000	1000	1000	345	1000	500	1000	500		
Concentration Aroclor 1016 (µg/L)						19.9					21.6			
Concentration Aroclor 1260 (µg/L)						41.5					24.8			

- [a], [b] This are "Weatherized" samples (degenerated by time).
- All samples analized show a presence of unkown chromatographic peaks, it is probable chlorinated pesticide residues and / or other types of chlorinated compounds.
- See chormatographic peaks in annex, pages 56 – 62.

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