



**ANALYSIS OF WATER  
SAMPLES TAKEN  
FROM THE URUGUAY RIVER  
IN THE  
NEIGHBOURHOOD  
OF THE BOTNIA PLANT**

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Chemical Sciences

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**Report N°1**

On March 20<sup>th</sup> Green Cross dispatched a boat in order to take water samples on both shores of the Uruguay River in the neighbourhood of the Botnia Plant . Besides the crew persons on board were Ms. Marisa Arienza, Mr. Guillermo Jorge and Dr. Carlos Marschoff from Green Cross; Mr. Julio Garzón, M.D.; Ms. Laura Marino, Schoolmaster; Mr. Jorge Sánchez Arana, Director of the magazine Foro Ambiental; Ms. Lucila Carmona, from the TV program “Recurso Natural” in the public TV channel; Mr. Pablo Gutiérrez, cameraman from the same program and Mr. Hernán Reyes Alcaide journalist for the newspapers “Clarín” from Buenos Aires and “El Observador” from Montevideo.

The plan was to take water samples from both coasts at about 1 km upriver from the plant, at the plant latitude and at 2-3 km downriver from the plant. The sites were identified with a code and before arriving to the zone, Ms. Marino and Mr. Sánchez Arana were asked to select the bottles for sampling assigning a random number to each of them. These numbers were matched with the site code on individual sheets which were signed by both witnesses. The tags on the bottles were also signed by them and finally, when samples were taken and sealed, the sealing tags were also signed by them.

On March 21 samples were taken at the following sites:

Uruguayan coast:

Sample III 33°06'32.5" S  
Sample II 33°06'70.0" S  
Sample I 33°08'24.9" S

Argentinian coast:

Sample 3 33°05'39.2" S  
Sample 2 33°05'96.4" S  
Sample 1 33°07'24.3" S

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In order to assess about water quality it was decided to measure the parameters that are listed in Table 1, together with the maximum prescribed values as determined by the Environmental Protection Agency (EPA) for drinking water

<i>Parameter</i>	<i>EPA prescribed limits</i>
<i>pH</i>	<i>6.5 – 8.5</i>
<i>SO<sub>4</sub><sup>=</sup></i>	<i>250 mg/L</i>
<i>NO<sub>3</sub><sup>-</sup></i>	<i>10 mg/L</i>
<i>Cl<sup>-</sup></i>	<i>250 mg/L</i>
<i>Pb</i>	<i>0.015 mg/L</i>
<i>Cd</i>	<i>0.005 mg/L</i>
<i>Hg</i>	<i>0.002 mg/L</i>
<i>Cr</i>	<i>0.1 mg/L</i>
<i>As</i>	<i>0.01 mg/L</i>
<i>Zn</i>	<i>5 mg/L</i>
<i>Cu</i>	<i>1.3 mg/L</i>
<i>Furans (as carbofuran)</i>	<i>0.04 mg/L</i>
<i>Dioxins</i>	<i>3 10<sup>-7</sup> mg/L</i>

Table 1: Measured parameters and EPA limits for drinking water

Three types of samples were taken: mud, water for heavy metal analysis and water for dioxin and furans analysis.

The mud and water samples for heavy metal analysis were sent to the Trace Analysis Service of the University of Buenos Aires, where the bottles numbered with no information about the place where the samples were taken were received.

General water characteristics on the different samples were measured with the results shown in table 2.

<b>Analysis</b>	<b>Sample III</b>	<b>Sample 3</b>	<b>Sample II</b>	<b>Sample 2</b>	<b>Sample I</b>	<b>Sample 1</b>
pH	7.46	7.36	7.60	7.55	7.66	7.54
Conductivity	86	84	82	89	95	84
Inorganic P	0.03	0.04	0.04	0.03	0.06	0.03
SO <sub>4</sub> <sup>=</sup>	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
NO <sub>3</sub> <sup>-</sup>	0.32	0.55	0.23	0.41	0.30	0.41
Cl <sup>-</sup>	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

Table 2: General parameters of water quality in mg/L. Conductivity is measured in µS/cm;

The obtained results for heavy metals in mud and water are shown in Tables 3 and 4. All data are given in mg/L in the case of water and mg/Kg for muds.

Metal	Sample III	Sample 3	Sample II	Sample 2	Sample I	Sample 1
Pb	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Cd	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Hg	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Cr	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
As	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Zn	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Cu	0.003	0.002	0.003	0.003	0.002	0.002

Table 3: Metal content in water samples (n.d. = non detectable)

Metal	Sample III	Sample 3	Sample II	Sample 2	Sample I	Sample 1
Pb	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Cd	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Hg	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Cr	14±1.3	19±1.9	17±1.7	8.9±1.0	9.7±1.0	9.5±1.0
As	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Zn	41±4.1	60±6.0	14±1.4	23±2.3	32±3.3	22±2.2
Cu	20±1.9	68±6.8	39±3.9	18±2.1	14±1.5	23±2.0

Table 4: Metal content in mud samples (n.d. = non detectable)

Detection limits in the Trace Analysis Lab are as follows:

Metal	Muds mg/Kg	Water mg/L
Pb	10	0.001
Cd	1.0	0.0001
Hg	0.5	0.0002
Cr	0.5	0.002
As	10	0.010
Zn	1.0	0.010
Cu	1.0	0.001

According to these results it is concluded that the Uruguay River water, on both coasts is chemically equivalent with regard to metal concentration *in water* and there are no grounds to assume that the Uruguay River is being polluted nor by the activities from Botnia Plant neither from effluents from the Industrial Park in Gualaguaychú.

*With respect to metal content in mud, the results on both shores are also similar and, considering that the observed concentration of Cr, Zn and Cu corresponds to the solid phase it is concluded that these values should be ascribed to the soil composition and, hence, no environmental harm is expected.*

Data on dioxins and furans cannot be measured in Argentina and the samples should be sent to one of the few certified labs that can do these determinations.

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