# Environmental diagnosis of a site potentially contaminated with mercury
# Case study in Uruguay

PHC Natalia Barboza - National Environmental Directorate (DINAMA) - Uruguay

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# Uruguay

## 176,215 km²

## 3,3 million Population

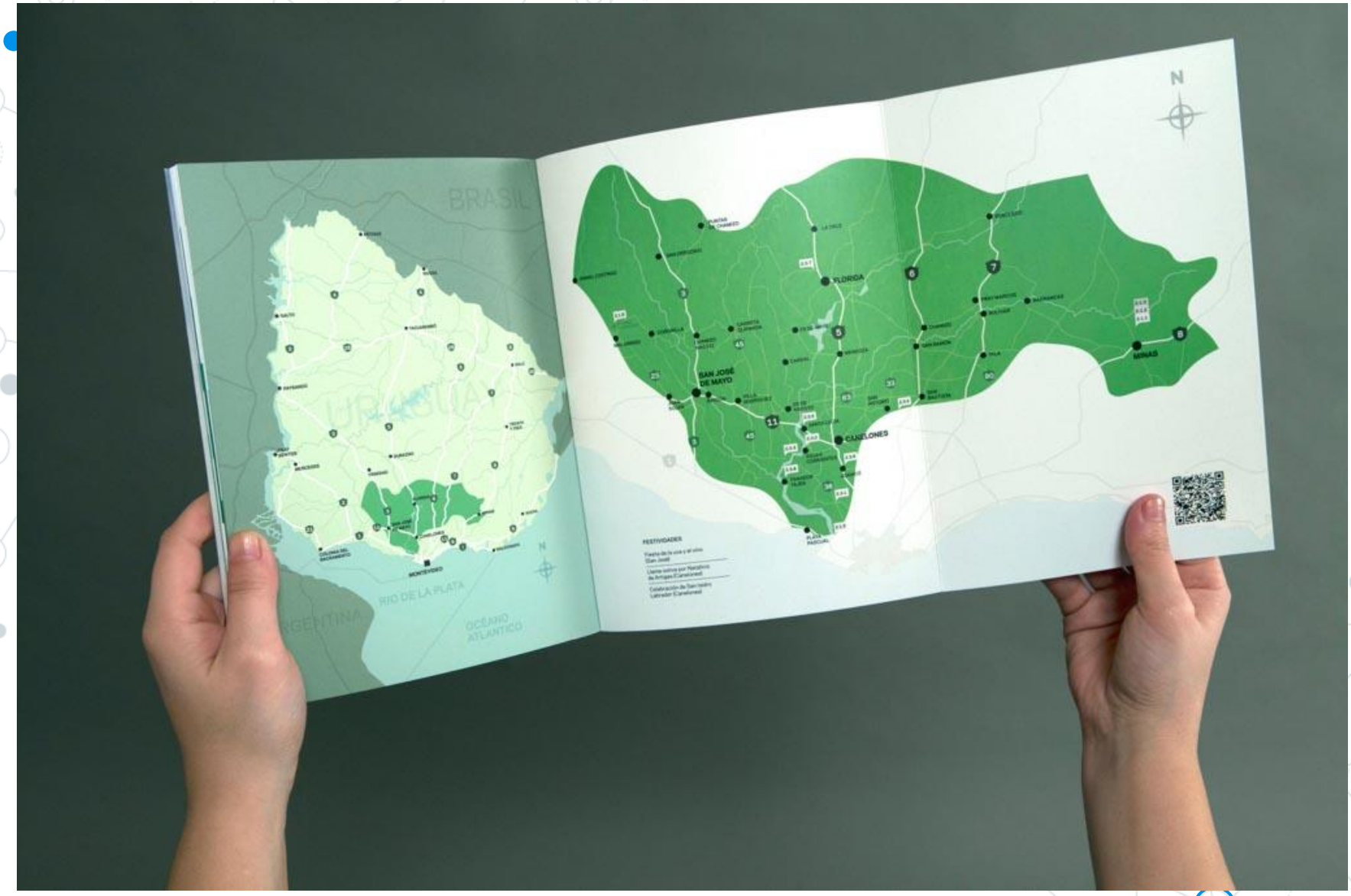
133rd most populous country on Earth

## 19 Departments

Capital: Montevideo
Language: Spanish

## Santa Lucía River

potable water for more than half population


BRASIL
URUGUAY
ARGENTINA
MONTEVIDEO
RIO DE LA PLATA
OCÉANO ATLANTICO
N
FLORIDA
SAN JOSÉ DE MAYO
CANELONES
MINAS
PLAYA PASCUAL
FESTIVIDADES

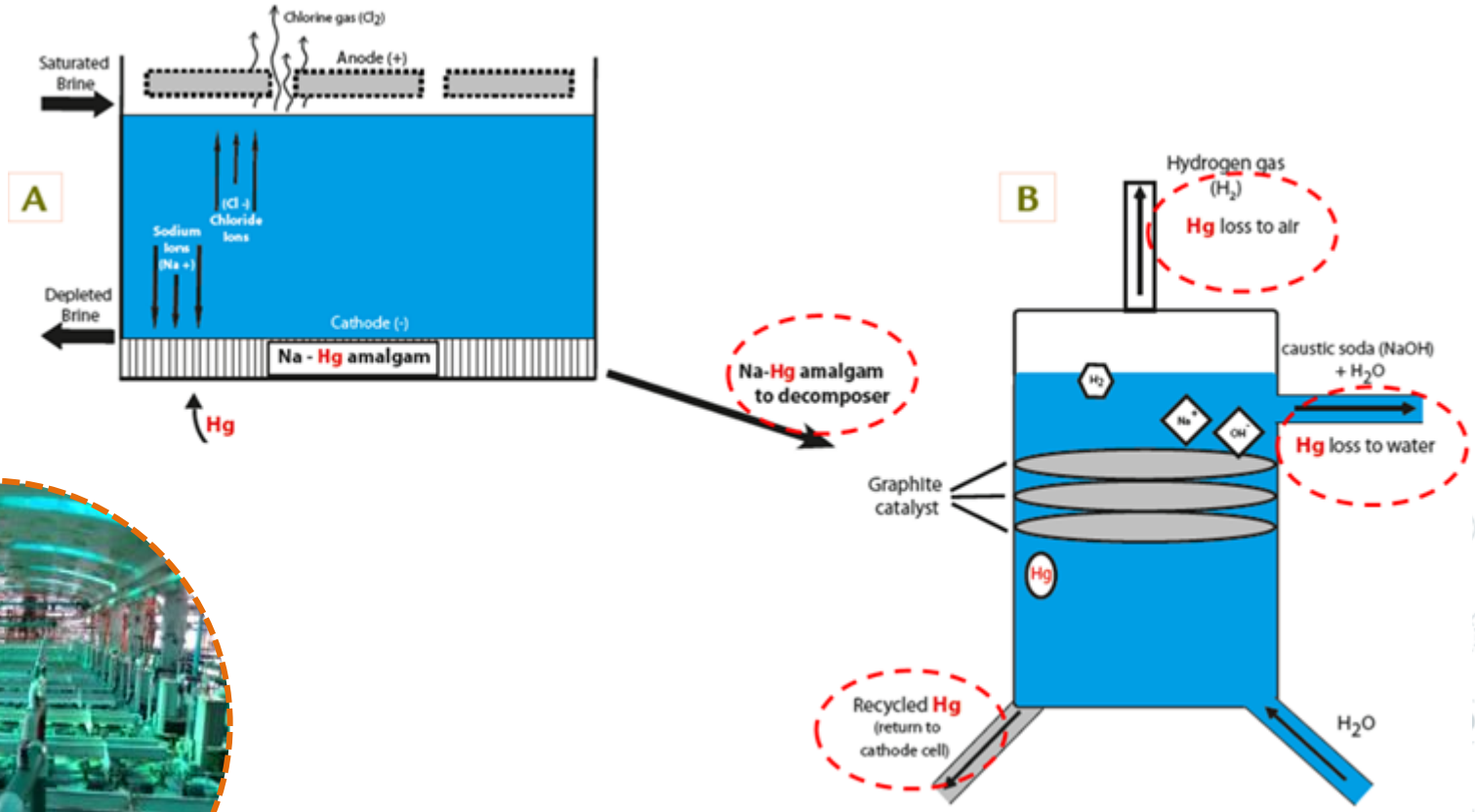

Santa Lucía
ARTIGAS
SALTO
RIVERA
PAYSANDU
TACUAREMBO
CERRO LARGO
TREINTA Y TRES
SORIANO
FLORES
FLORIDA
LAVALLEJA
ROCHA
COLONIA
SAN JOSE
CANELONES
MALDONADO

# Chloride– alkali production plant

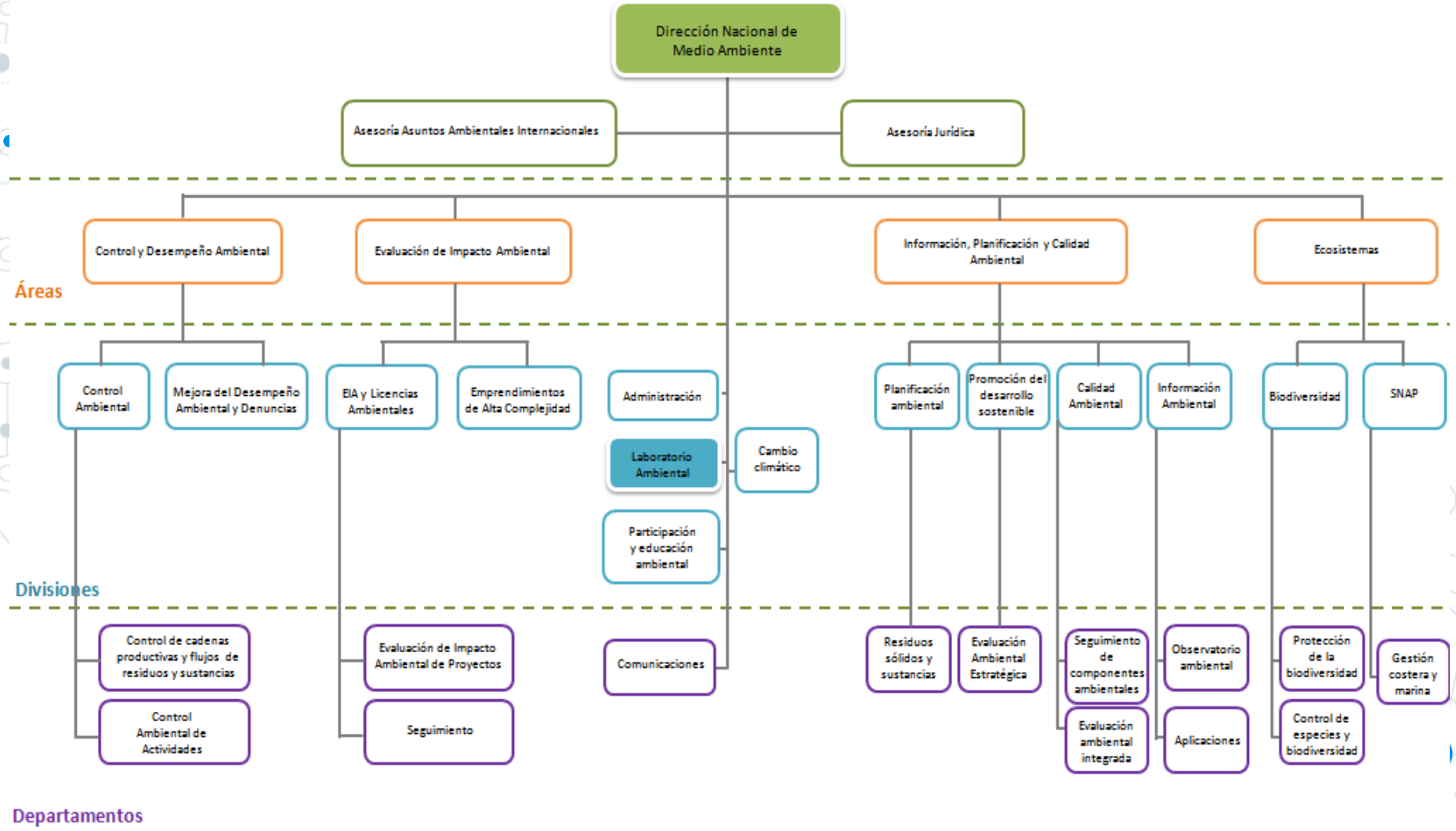
Santa Lucía River

**mercury is used in the production**

# Mercury chloride – alkali manufacturing process




# National Environmental Directorate



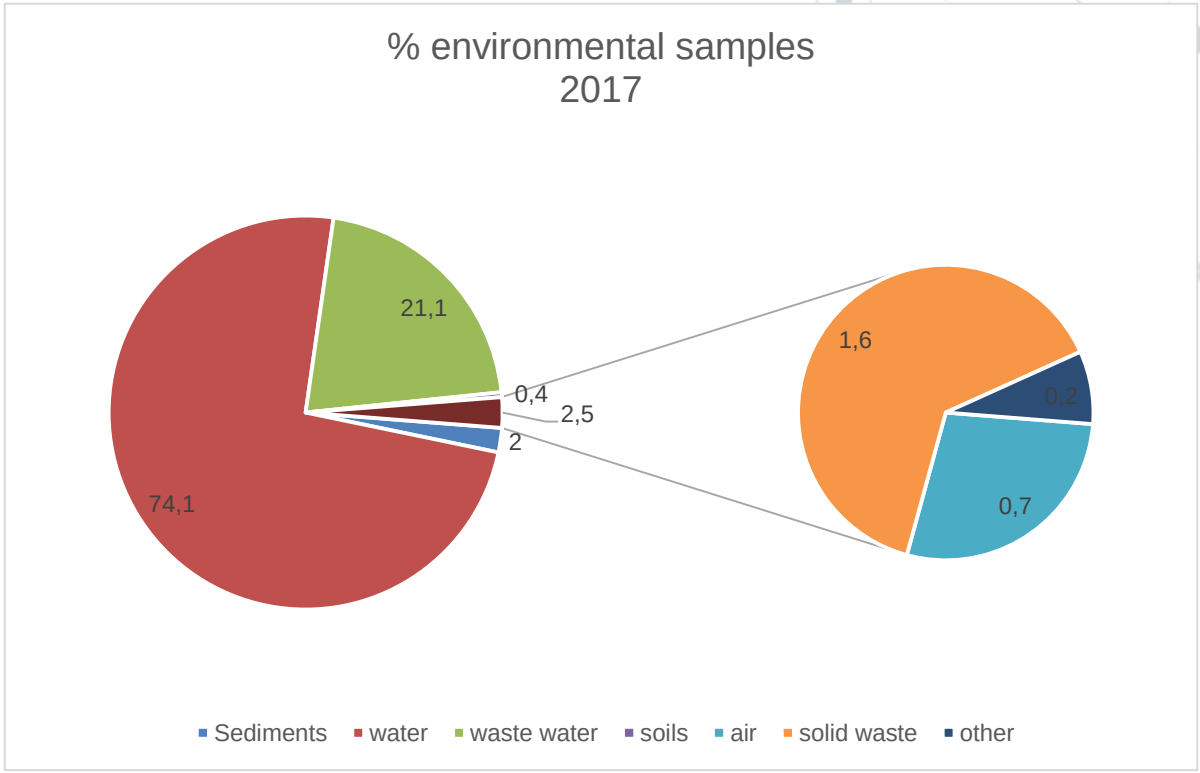
# The Environmental Laboratory Division

## 1000 $m^2$

We are a reference in Uruguay and South America

## +20.000

analytical data from water. Wastewater, soils, and other environmental samples




… and growing


2015/08/20


+ 20.000
anual
analytical data
from
environmental
samples

# Legal framework for mercury in Uruguay

| | |
|---|---|
| **Decree 253/79** | • 0,0002 mg/L water class 1,2,3<br>• 0,002 mg/L water class 4<br>• 0,005mg/L for wastewater to drain a sewer collector public and direct to course<br>• 0,05 mg/L for wastewater to infiltration to the ground |
| **Decree 182/13** | • Solid waste<br>• 0,1 mg/L in leached |
| **Decree 375/11** | • UNIT 833:2008 drinking water<br>• 0,001 mg/L |
| **Ordinance 145/009 MSP** | • Urinary 35 µg/g creatinine<br>• Blood 15 µg/L |

# International Agreements

- Basel Coordinating Center

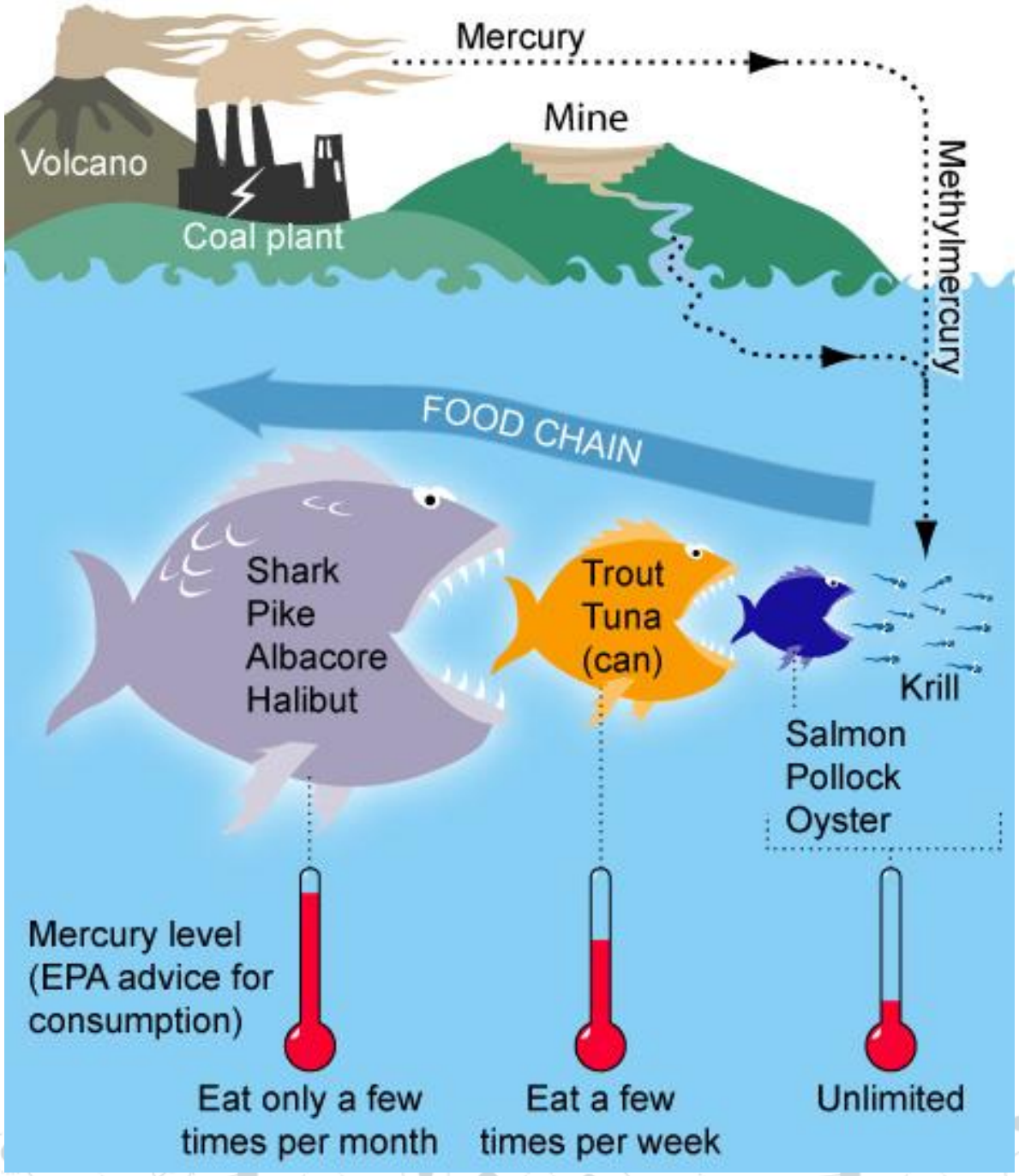
- Stockholm Regional Centre for Latin America and the Caribbean


http://www.ccbasilea-crestocolmo.org.uy/es

PROJECTS RELATED TO THE MINAMATA CONVENTION

# Mercury

# Mercury has been widely used by humans since ancient times


Mercury
Mine
Volcano
Coal plant
Methylmercury
FOOD CHAIN
Shark
Pike
Albacore
Halibut
Trout
Tuna
(can)
Krill
Salmon
Pollock
Oyster
Mercury level
(EPA advice for
consumption)
Eat only a few
times per month
Eat a few
times per week
Unlimited

# Health effects

- Mercury is considered by WHO as one of the top ten chemicals or groups of chemicals of major public health concern.

- Exposure mainly occurs through consumption of fish and shellfish contaminated with methylmercury and through worker inhalation of elemental mercury vapours during industrial processes.

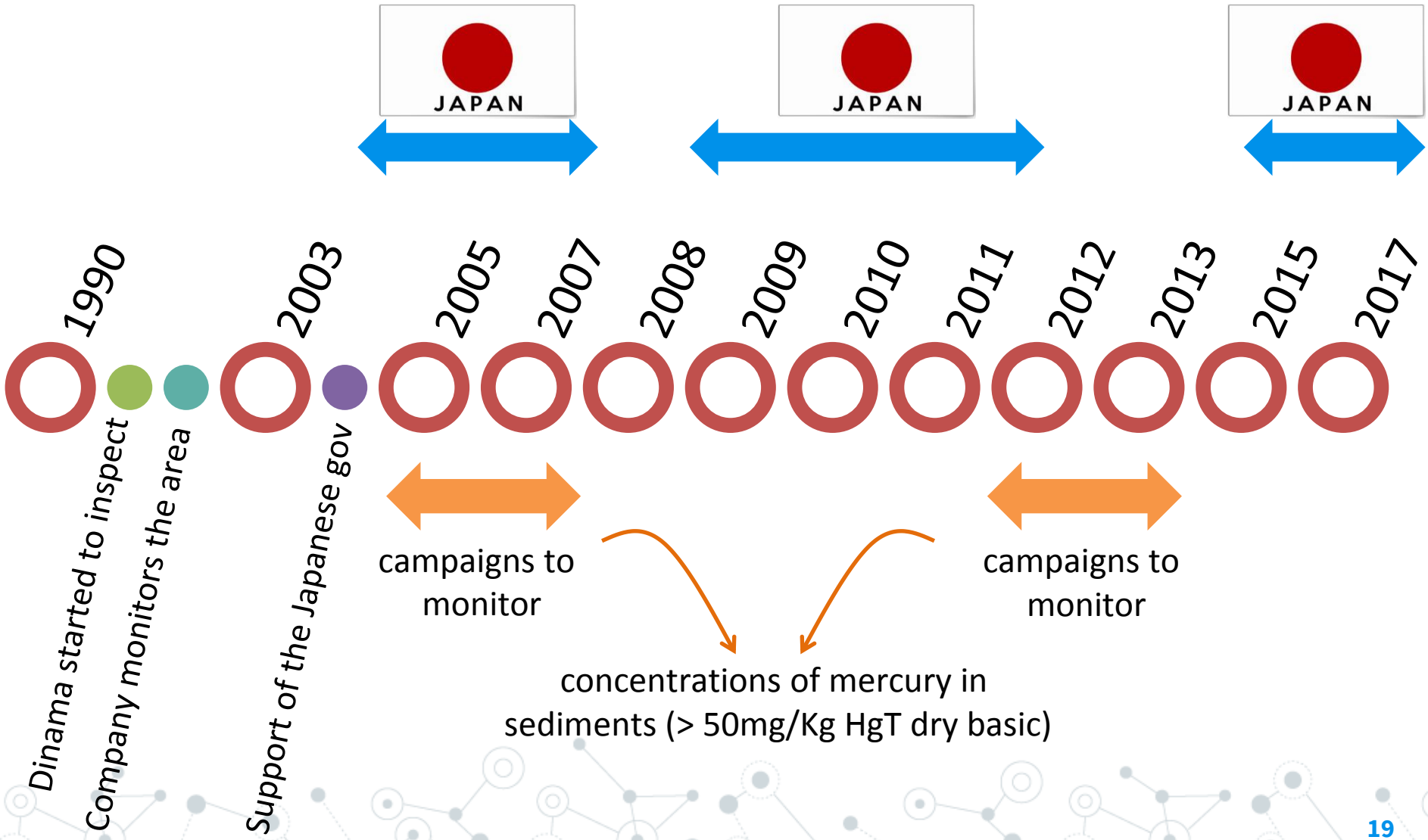
http://www.who.int/news-room/fact-sheets/detail/mercury-and-health

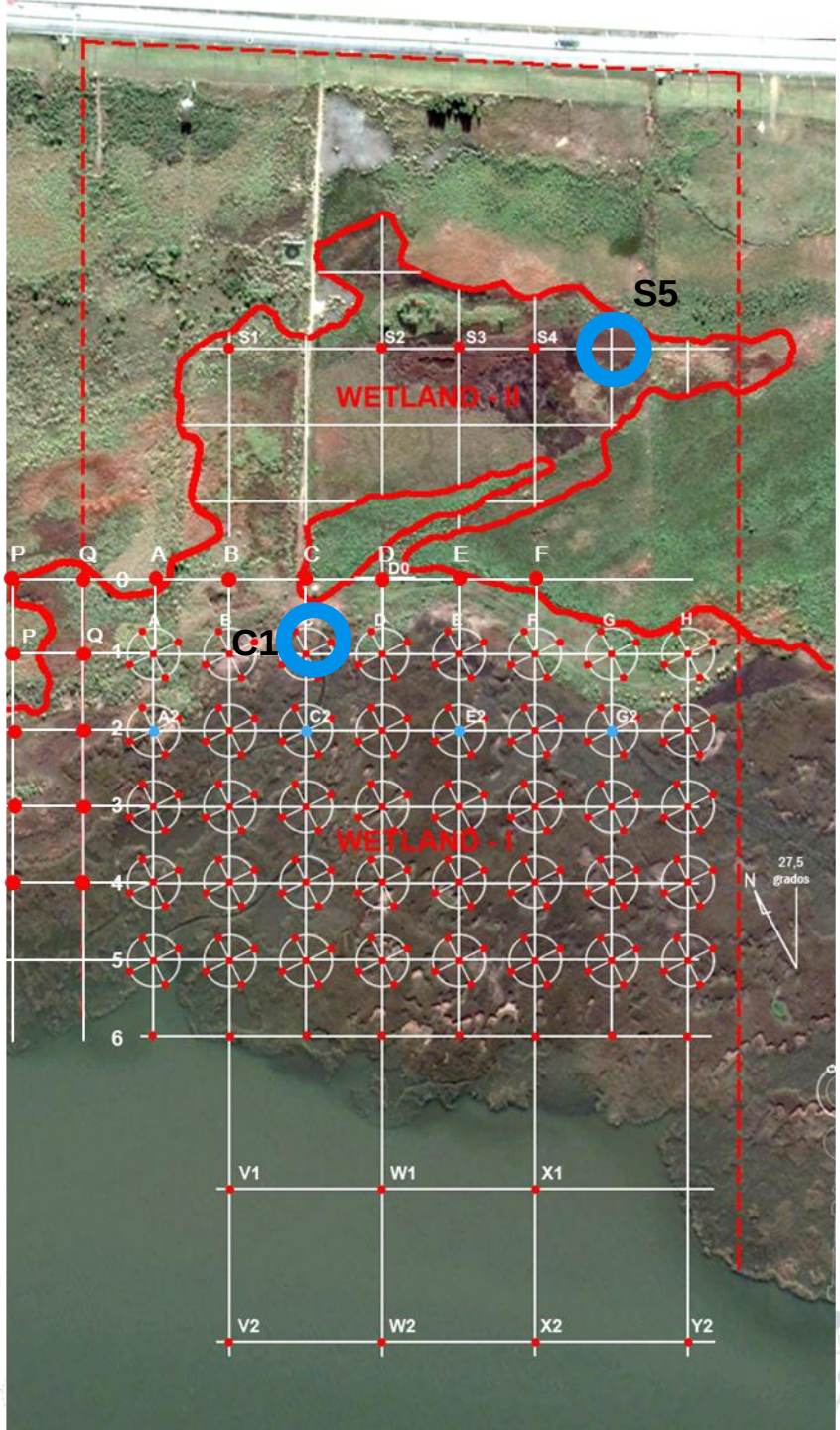
# Health effects

- Symptoms

- muscle weakness
- poor coordination
- numbness in the hands and feet
- skin rashes
- anxiety
- memory problems
- trouble speaking
- trouble hearing, or trouble seeing.

# DINAMA's most important activities related to the production plant






# Project for technical cooperation on diagnosis of actual situation and action plan design for the remediation of coastal strip of La Plata river having an environmental burden of mercury sediments

| Site | Description | Total [Hg ] mg/L | Remarks |
|---|---|---|---|
| C1 | Surface water | 0,034 | Water in wetland (close to the outlet of industrial wastewater drain) |
| S5 | Surface water | 0,0051 | Water in wetland |

# Analytical methods and contact with NIMD

Pretreatment of the sample: Method 3051A, microwave assisted acid digestion of sediment, sludge, solis and oils, National reference: 3262UY
Equipments, Microwave Anton Paar Multiwave 3000.

ISO 5666:1999 . Water quality -- Determination of mercury.
National reference: 3141UY.
Equipments: FIMS-100 Flow inyection mercury. Perkin Elmer.

Organic mercury analysis based on the formation of complexes with ditizone / toluene, cleanup and subsequent determination by GC / ECD

2015- First time in Minamata, in NIMD with Hg in hair

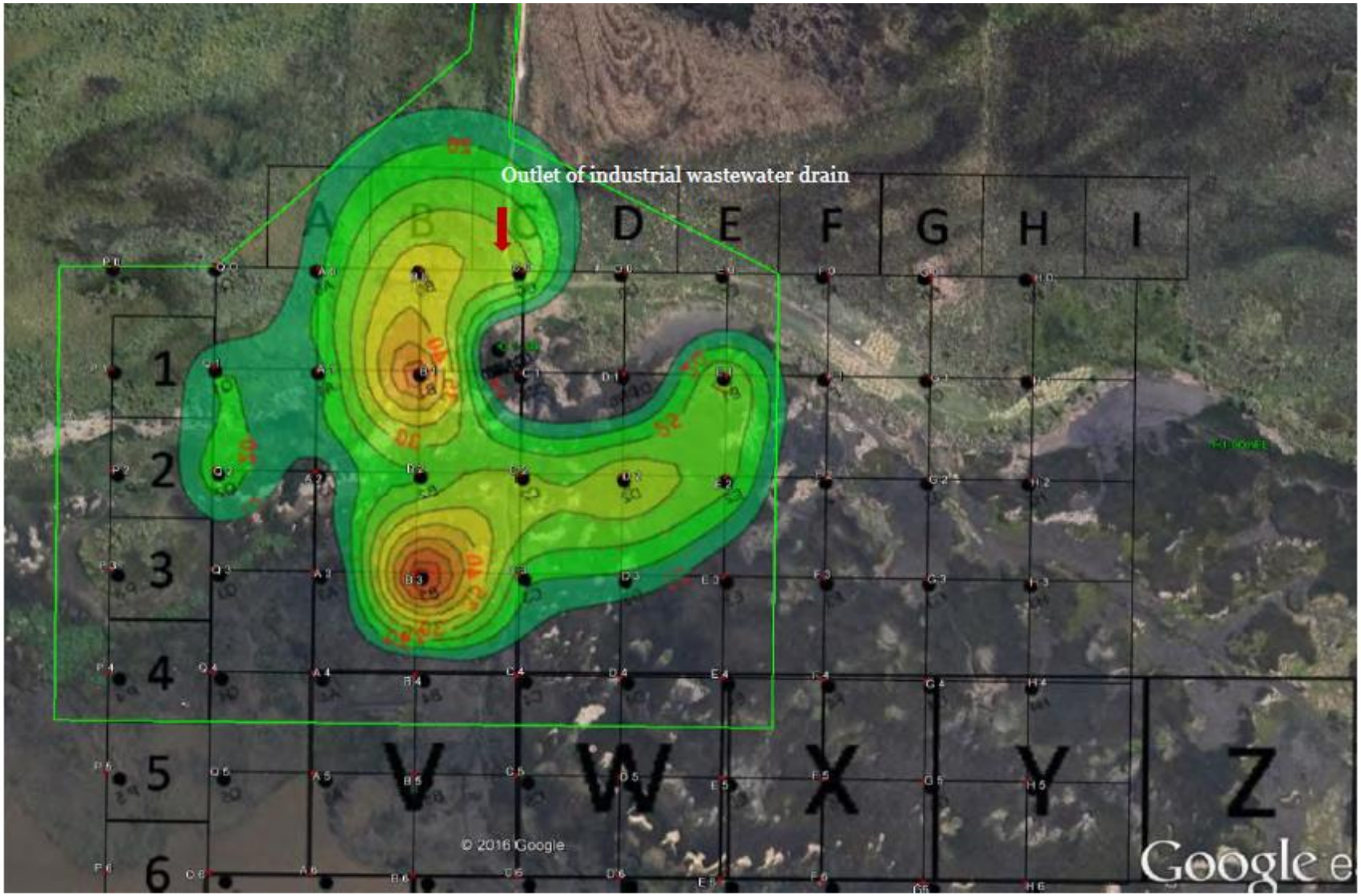
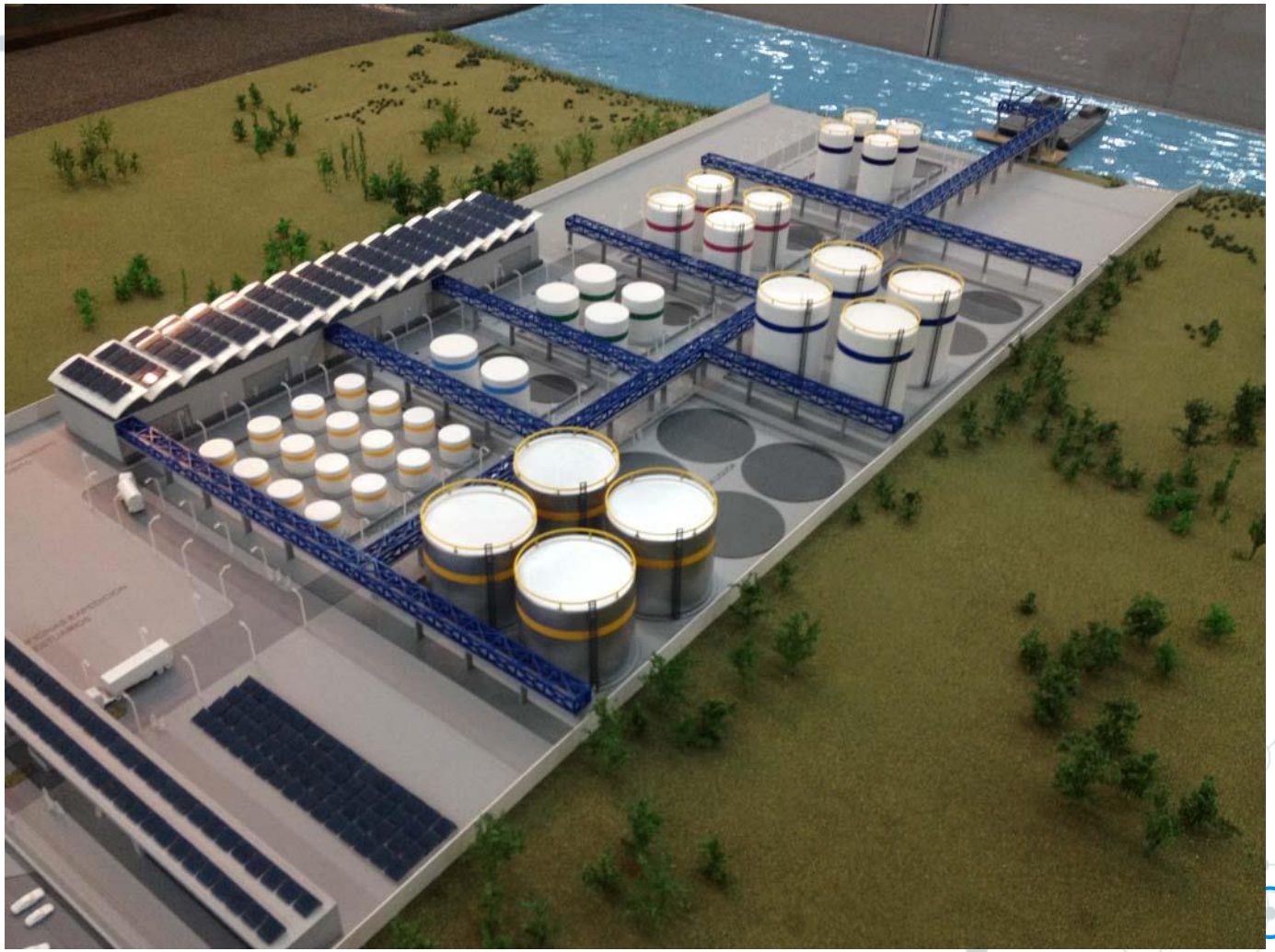



**Figure 13:** Spatial variation of total mercury concentration (mg/kg). The geographical location of the grid is shown in Figure 8 (Wetland I).

# Lessons learned from 2015 – 2017 experience

- Mercury contamination is located at certain points, without drift.
- Non quantifiable results on exposed workers, fish and groundwater
- Control measures were taken to avoid access to the contaminated areas
- Work together with the company to implement the technological change.

# Technological change of the chlorine – alkali production plant



# Current production data and data projection with new technology

| | average production in the last 3 years | maximum capacity of the actual plant | production capacity for the first year with new technology |
|---|---|---|---|
| Production of soda (dry basis, at 36% and 50%) | 36.9 | 47 | 169 |
| Chlorine gas | 32.8 | 42 | 150 |
| Hydrogen gas | 0.9 | 1.2 | 4.75 |
| ferric chloride 40$ dry basis | 1.6 | 23.3 | 66 |
| caustic soda at 70% dry basis | 4.4 | 18 | 110 |
| PAC 18% dry basis | Does not exist | | 170 |
| PAC 30% dry basis | Does not exist | | 100 |
| bicalcium phosphate | Does not exist | | 70 |
| hydrochloric acid | 23.4 | 53 | 150 |
| calcium chloride 34% | 7.9 | 56.7 | 170 |
| calcium chloride today at 60% in Omega, at 78% | 2.5 | 4.5 | 20 |
| sodium hypochlorite (m3 from NaClO, 100gCl2/L) | 66.5 | 118 | 40 to 300 |
| liquid chlorine | 19.2 | 31 | 75 |
| calcium carbonate | Does not exist | | 47 |

# Dismantling plan

## Environmental aspects:

- Hg metalic in cells
- Solid waste with high concentration of mercury
- Waste water with mercuy, generated from the decontamination of equipment and pipelines
- Risk of Hg and Cl2 emissions to the air from the decontamination process

# Thank you !