WCC – Mercury reporting to UNEP

European Hg emissions and consumption evolution in 2007

Emissions

The 2007 figures for the European chlor-alkali industry reported by Euro Chlor showed a further reduction in mercury emissions (air, liquid effluents and products) of about 19% in absolute value (from 5.7 to 4.6 tonnes mercury).

This was due to the continuing programme of conversion for shut down of the mercury technology (the installed production capacity with mercury technology went down about 12% compared to 2006), but also to the continued reduction of plant emissions, from a global figure of 1.05 to 0.97 g mercury/tonne chlorine capacity.

The emissions in products are at the level of 0.07 g Hg/t Cl2 and quite stable at this low level but a few less performing units still require additional efforts to improve.

For the case of liquid effluents, with values at about the same level, the reduction is mainly due to the implementation of the best practices recommended by the industry in some less performing sites.

For the emissions into air, the continued improvement results from the efforts made at several sites. There are a few units investigating practical solutions to reduce their emissions.

Consumption

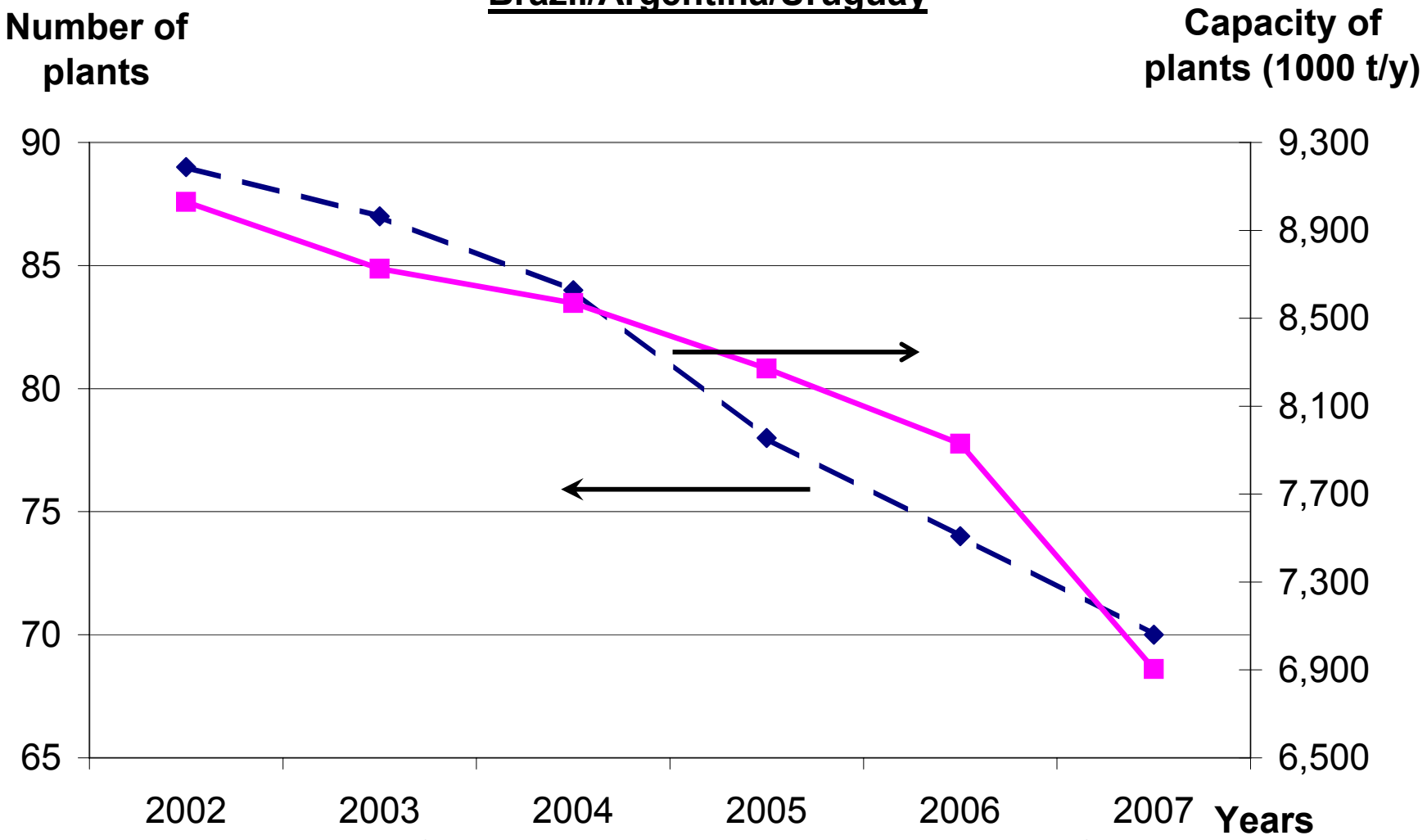
With respect to 2006, the Hg consumption in Europe increased with about 61 tonnes in 2007, even with a reduction of the number of plants (from 44 to 42).

The higher consumption/use is explained by temporary increase of mercury containing waste at 3 locations, which is stored on site waiting to be treated for recoverage and recycling of the metallic mercury.

After recovery, the consumption/use figure will come down by the same effect.

WCC - Chlor-Alkali Industry

Number of plants and capacity of mercury electrolysis units in USA/Canada, Europe, Russia, India and Brazil/Argentina/Uruguay



Note: For consistency reasons, data for 2002-2004 have been adjusted to take into account the addition of one plant from Uruguay and three plants from Russia

Evolution for USA/Canada + Europe + India + Brazil/Argentina (and 1 plant in Uruguay from 2005 onwards) plus 3 Russian plants from 2005 onwards

Considering 1 Urugyian pl
3 Russian plants from

Absolute values

Year	Hg plants	Capacity	Purchases /Sales	Consumption /Use	Emission to products	Emission to water	Emission to air	Total emissions	Solid waste
	Number	In 1000 t Cl2/y	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y
2002	85	8,584	688	249,944	***(1)**	821	***(1)**	23,265	***(1)**
2003	83	8,281	402,444	205,274	2,402	820	15,821	19,043	129,730
2004	80	8,124	263,511	159,806	1,448	657	14,217	16,321	69,601
2005	78	8,271	227,470	176,706	1,361	774	11,662	13,797	116,257
2006	74	7,929	70,891	162,049	782	555	9698	11035	175,116
2007	70	6,904	202,279	236,476	615	455	7288	8358	198,342

Hg plants	Capacity
Number	In 1000 t Cl2/y
89	9,029
87	8726
84	8569
78	8,271
74	7929
70	6904

(1) no data reported for the Indian plants

without Russian plants data

Relative values (/t chlorine capacity)

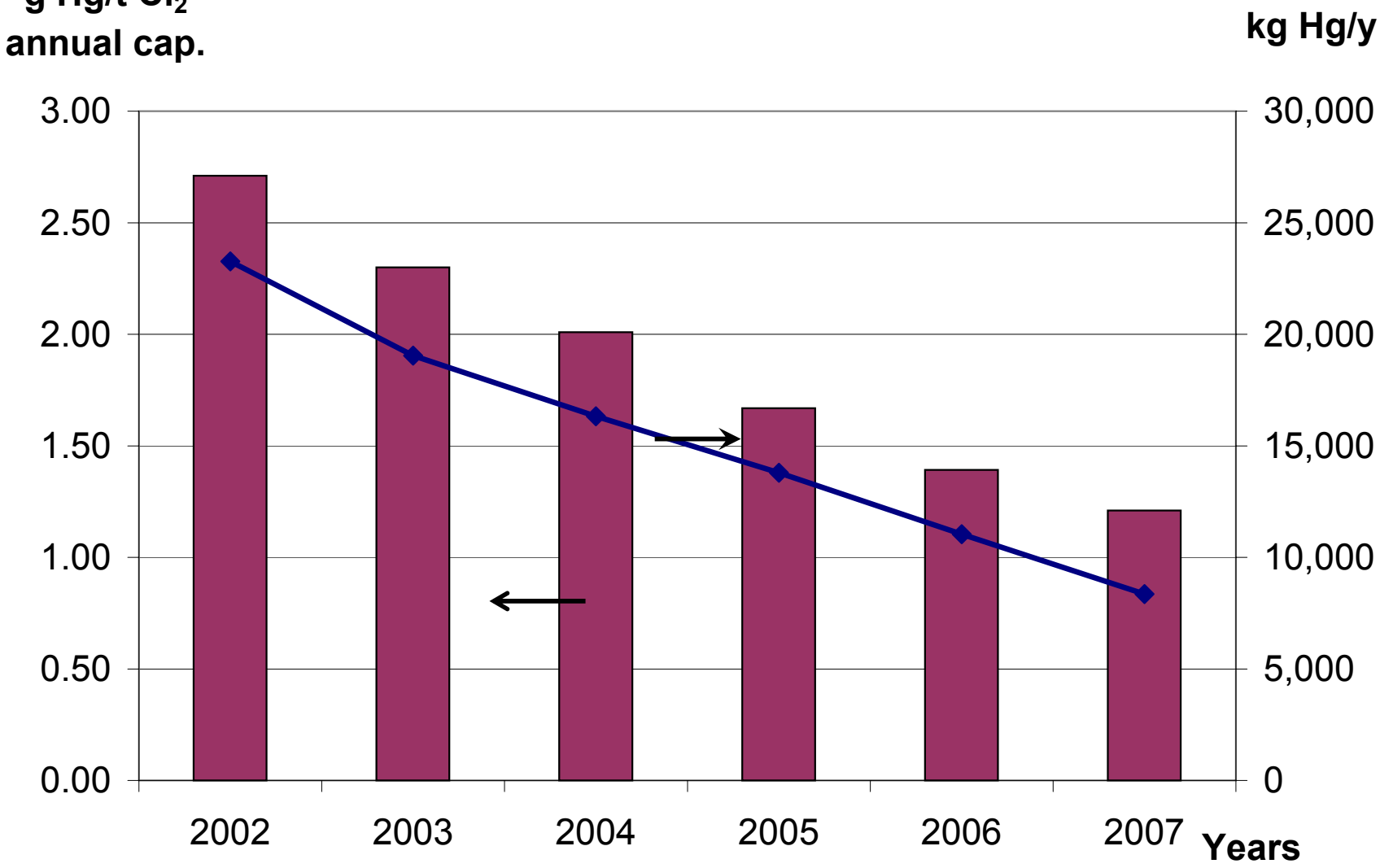
Year	Hg plants	Capacity	Purchases /Sales	Consumption /Use	Emission to products	Emission to water	Emission to air	Total emissions	Solid waste
	Number	In 1000 t Cl2/y	g Hg /t Cl_2	g Hg /t Cl_2	g Hg /t Cl_2	g Hg /t Cl_2	g Hg /t Cl_2	g Hg /t Cl_2	g Hg /t Cl_2
2002	85	8,584	0.08	29.12	***(1)**	0.10	***(1)**	2.71	***(1)**
2003	83	8,281	48.60	24.79	0.29	0.10	1.91	2.30	15.67
2004	80	8,124	32.44	19.67	0.18	0.08	1.75	2.01	8.57
2005	78	8,271	29.01	22.54	0.16	0.09	1.41	1.67	14.06
2006	74	7,929	9.42	21.53	0.10	0.07	1.22	1.39	22.09
2007	70	6,904	31.11	34.25	0.09	0.07	1.06	1.21	28.73

(1) no data reported for the Indian plants

without Russian plants data

WCC - Chlor-Alkali Industry

Total mercury emissions (air + water + products) for USA/Canada, Europe, India and Brazil/Argentina (plus 1 Uruguayan and 3 Russian plants from 2005 onwards)



Explanation of the table

Number Hg plants: number of electrolysis production units in activity using the mercury technology.

Capacity: nameplate chlorine production capacity according to authorisations (expressed in thousands metric tonnes chlorine per year).

Mercury data: the quantities of mercury are expressed in kilograms per year.

Purchases / Sales: quantity of mercury coming in or leaving (negative value) the production site (from or to other sites of the same company, other companies, traders, suppliers …). If the mercury comes from a unit already closed, even on the same production site, it will also be considered as "Purchase". The quantity of mercury contained in solid waste sent to **external** treatment units for metal recovery will be considered here as "Sales"; if (and when) recovered metallic mercury is reintegrated back in the production site, the corresponding quantity will then be considered as "Purchases".

Consumption / Use: mercury added to the production cells and circuits (negative value if removed) to keep the amount of mercury contained in the cells and circuits at the same constant level (structurally immobilised in the process); this value correspond to the "Purchases /Sales" figure corrected to remove the effect of mercury inventory variation in the warehouse of the site, and/or any voluntary change in the installation inventory (cells …). A comment has to be added is there is a voluntary increase or decrease of the inventory.

Emission to air: quantity of mercury emitted to the air (including process exhaust, hydrogen vented or burned, diffuse emissions from cell room …).

Emission to water: quantity of mercury emitted with the water effluents leaving the production unit (after treatment).

Emission with products: quantity of mercury emitted with the products (mainly caustic soda/potash and hydrogen used as chemical); this does not include the hydrogen vented or burned. If mercury emission with HCl, hypochlorite … is separately accounted, care must be taken to avoid double counting (with mercury in hydrogen, caustic …).

Total emissions: sum of emissions to air, water and with products.

Solid waste to deposit: estimation/measure of the quantity of mercury included in the solid waste sent to final waste disposal (internal or external).
The mercury contained in the waste waiting for recovery treatment or to be sent to final disposal, and temporarily stored on the site, will still be considered as being part of the site inventory for this reporting.

Difference to balance: this calculated value (not indicated in the tables) corresponds to the difference between the consumption and the sum of the total emissions (air, water, products) and the mercury in the waste sent to final disposal; it integrate the inaccuracies of the measures and the mercury accumulated in the installation but not measured.

WCC - Chlor-Alkali Industry
Mercury Consumption and Emissions in g Hg / t chlorine annual capacity

Production year: 2007									
Country or Area	**Hg plants**	**Capacity**	**Purchases /Sales**	**Consumption /Use**	**Emission to products**	**Emission to water**	**Emission to air**	**Total emissions**	**Solid waste**
	Number	In 1000 t Cl_2/y	g Hg / t Cl_2 (- if sold)	g Hg / t Cl_2	g Hg / t Cl_2	g Hg / t Cl_2	g Hg / t Cl_2	g Hg / t Cl_2	g Hg / t Cl_2
Europe	42	4780	28.41	38.54	0.07	0.08	0.82	0.97	33.89
United States of America + Canada	8	967	43.35	4.42	0.08	0.03	1.45	1.56	12.64
India	10	308	29.38	28.33	0.16	0.00	0.74	0.90	3.64
Brazil + Argentina (1 plant) + Uruguay (1 plant)	7	447	34.73	39.43	0.12	0.04	2.77	2.93	10.46
Russia *(4)	3	402	***(3)**	53.76	0.21	0.07	1.28	1.55	45.56
Total	**70**	**6,904**	**31.11**	**34.25**	**0.09**	**0.07**	**1.06**	**1.21**	**28.73**

For India, only Hg purchases (sales data not available)
(3) no data reported for one Russian plant
(4) data estimated from previous years for one plant

WCC - Chlor-Alkali Industry
Mercury consumption and emissions in kg/year (absolute data)

Production year: 2007									
Country or Area	**Hg plants**	**Capacity**	**Purchases /Sales**	**Consumption /Use**	**Emission to products**	**Emission to water**	**Emission to air**	**Total emissions**	**Solid waste**
	Number	In 1000 t Cl_2/y	kg Hg /y (- if sold)	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y
Europe	42	4,780	135,782	184,239	355	379	3,904	4,638	162,008
United States of America + Canada	8	967	41,924	4,274	75	32	1,402	1,509	12,224
India	10	308	9,048	8,726	50	0	229	279	1,120
Brazil + Argentina (1 plant) + Uruguay (1 plant)	7	447	15,525	17,624	52	17	1,239	1,308	4,676
Russia *(4)	3	402	***(3)**	21,613	83	27	514	624	18,314
Total	**70**	**6,904**	**202,279**	**236,476**	**615**	**455**	**7,288**	**8,358**	**198,342**

For India, only Hg purchases (sales data not available)

(3) no data reported for one Russian plant

(4) data estimated from previous years for one plant

Mercury control by the chlor-alkali sector
Voluntary initiatives

Summary

The current productive capacity of chlorine in Brazil amounts to 1,384 thousand metric tons/year, being that 24% of this is produced using mercury technology. The five units currently using this technology have factories with the most advanced techniques and practices applicable in mercury use control, environmental protection and human health. As of 2009, the Brazilian chlor-alkali sector will have an installed capacity of 1,520 thousand metric tons/year, with 14% using mercury technology. This reduction in the participation of mercury cell technology started in 1980, initially with three factories closing down and more recently through conversion to membrane cells, a process that started in 2003 with one cell room, followed by the total conversion of a unit and increment of the installed capacity using membrane technology in 2008.

This situation is the result of the voluntary initiatives and investments of these companies since the beginning of the 70s, when the sector had eight factories with mercury technology, passing through the 80s and 90s and continuing until present. With the measures adopted, the sector has been ensuring results in all units that go beyond the legal requirements, with a significant reduction in the use and emissions of mercury into the environment.

Use and emissions control

Estimates suggest that in the 70s the average consumption of mercury stood at around 350/400 grams per metric ton of chlorine produced at the eight companies that operated with this technology at the time. The loss reduction and environmental and health control efforts that sprouted in Europe and in the US, started to be adopted by the Brazilian industries.

The techniques and practices for loss reduction and mercury use control were permanent themes at Abiclor's Management Committee meetings. Technical visits between the companies were made, although without approaching specific problems or practices. These efforts on behalf of the companies using mercury technology, made it possible, in the 80s and 90s, to reduce the use/emissions of Hg to 80/100 grams per metric ton of chlorine produced.

As of 1998, Abiclor promoted four technical meetings gathering associated companies to exchange experiences (benchmark) and level-out the knowledge and operational practices. These meetings were based on the success experiences that the companies had with differentiated approaches to a certain subject, which had not yet been examined in greater depth together. Also the evolution in the international scenario, more specifically:

1998 – Technical presentations and practices of each company and results obtained. Focus on the difficulties faced and innovations implemented.

1999 – Discussion and generation of mercury use and emissions indicators.

2004 – Analysis of the improvements made, discussions on techniques and practices and assessment of the mercury use and emissions indicators.

2006 – Themes developed within the scope of the WCC/UNEP and the commitments of the chlor-alkali sector, performance of facilities and control of mercury use/emissions, with emphasis on universal indicators.

Among the specific themes covered in these meetings, are the following:

- Liquid effluents
- Gas emissions
- Emissions in products
- Industrial hygiene – monitoring
- Occupational health
- Housekeeping
- Conservation and maintenance of facilities
- Legislation
- Personnel qualification

Besides these internal gatherings, other international events were held with the objective of sharing international experience, namely:
2002 – I Global Stewardship Workshop, promoted by Clorosur with the support of the World Chlorine Council including technical presentations by The Chlorine Institute, Euro Chlor, Clorosur/Abiclor. Also included technical visit to an industrial unit.

2004 - IV Technical Seminar promoted by Clorosur in Buenos Aires/Argentina covering the theme about conversion from mercury to membrane technology.

The charts below show the evolution resulting from these efforts..

Chart I – Evolution of the mercury factor, quantity effectively consumed (measured by the radioactive Hg method)

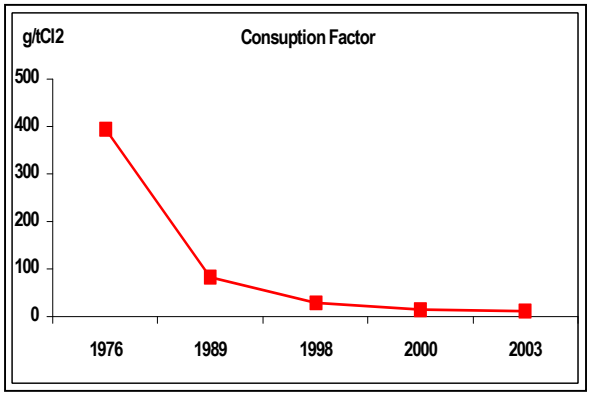


Chart II A – Calculated values of emissions into the air, water and products (Adopted as of WCC commitment with UNEP)

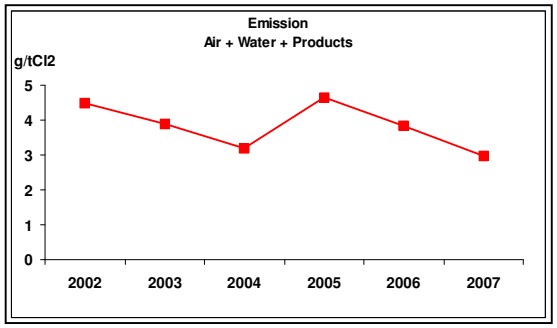
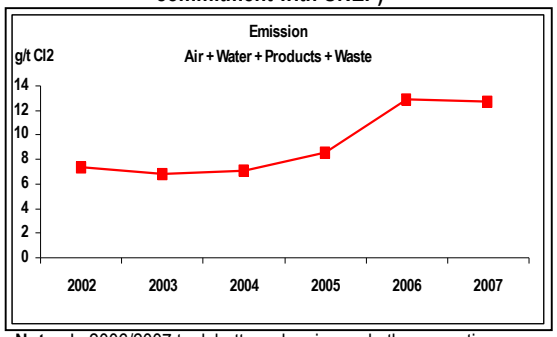


Chart II B
Calculated values of emissions into the air, water, products and solid residues (Adopted as of WCC commitment with UNEP)



Note: In 2006/2007 tank bottom cleaning and other operations that are not frequent were registered.

Health Control

The environmental monitoring and health vigilance initiatives were already carried out since the 70s, but as of the 80s great developments took place towards perfecting industrial hygiene and occupational health practices. The Hg urine indicator shows the results achieved from these efforts.

One of the main indicators referred to Urine Hg. On average, close to 2,500 tests are carried out annually, and rarely the values found (les than 1% of the cases) exceed the control limit of 35 µg Hg/gC. In these cases the collaborator is immediately removed from this work area. Charts III A and III B show the improvements achieved as a result of these efforts.

Chart III A – Average of the sector including all functions (mechanics, operators, others)

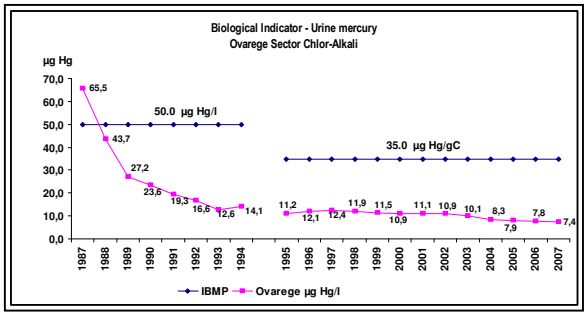
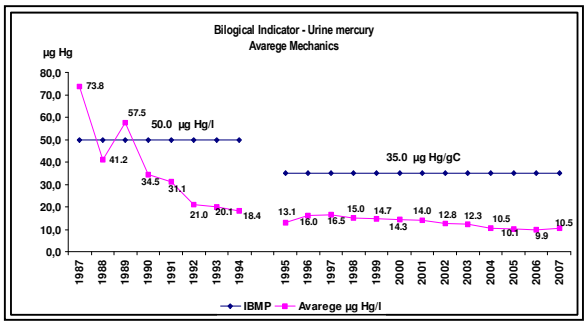


Chart III B – Average of the sector for the most exposed function: mechanics



IBMP – Maximum Allowed Biological Index: this is the maximum value of the biological indicator to which supposedly the majority of occupationally exposed people do not run any risk of health damage. Above this value means excessive exposure.

Achievements

Many improvements were made in this period, as shown by the examples below:

- Liquid effluents – collection of all mercury waters, reduction of the volume generated, improvement of the insolubility techniques with sulfide and ionic exchange.
- Emissions into the atmosphere – collection of mercury vapors at the headers of the cells, in the mercury boxes, in the caustic soda reservoirs, in the distillation ovens and treatment using washing and/or cooling towers.
- Filtration of caustic soda – installation of filters and improvements in performance.
- Purification of hydrogen – cooling, washing and filtration of mercury through active carbon.
- Brine treatment – utilization of process to eliminate salt impurities in chlorinated medium.
- Fugitive emissions and site conservation – reduction of maintenance time and alteration of operational procedure for opening cells, impermeable coating of floors (elastomeric polyurethane and epoxy resins), cleaning of areas with aspiration/filtration and washing, segregation of parts contaminated with mercury and washing with water and sodium hypochlorite before maintenance.
- Environmental monitoring – visual inspection with UV light bulb at specific points and daily inspections with portable Hg detector and use of individual sampler for exposure verification.
- Care regarding exposure to Hg – use of double clothing, hygiene habits (bath, uniform changes) and use of appropriate IPEs.
- Knowledge of the risks and control measures – awareness lectures to all new employees and hired personnel, Hg training (dangers and precaution measures), training in the tasks and breathing protection.
- Medical control – medical exams every half year (minimum), including Hg urine and tests related to exposure.