ELEVENTH ANNUAL REPORT TO EPA

CHLOR-ALKALI INDUSTRY
MERCURY USE AND EMISSIONS
IN THE UNITED STATES
For the Year 2007

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INTRODUCTION and SUMMARY

The Chlorine Institute, Inc. ("Institute" or "CI") continues to be a proactive leader in the effort to reduce mercury use and emissions in the United States. This Eleventh Annual Report to the U.S. Environmental Protection Agency ("EPA" or "Agency") illustrates the chlor-alkali industry's continuing progress in voluntarily reducing mercury use and emissions.

In 1996, the Chlorine Institute volunteered to reduce mercury use by 50 percent over the base years of 1990 through 1995. Since then the Institute and its members have worked cooperatively with federal and state authorities to meet and exceed that goal. Since 1995, a twelve-year period, total annual mercury used by the chlor-alkali industry has been reduced by over 97%.

CI's member companies that use mercury cell technology to manufacture chlorine are safe and perform above and beyond all applicable laws and regulations pertaining to mercury use and emissions. The chlor-alkali industry reaffirms its support for the sound management of mercury by committing to four action steps:

- Continue to account fully for mercury used;
- Further reduce the mercury used;
- Continue to improve methods to more accurately measure emissions from the cell rooms at each mercury cell chlor-alkali facility; and
- Further reduce air emissions by implementing and complying with EPA's National Emission Standard for Hazardous Air Pollutants: Mercury Emissions from Mercury Cell Chlor-Alkali Plants ("NESHAP").

The Institute, over the past twelve years, has met these commitments and will continue such efforts for the foreseeable future.

The remainder of this report will focus on the following:

- Status of chlor-alkali mercury cell facilities in the United States;
- Mercury purchases and use during the calendar year 2007;
- Reductions in mercury emissions to the environment; and
- Key initiatives by companies, the Chlorine Institute and the World Chlorine Council ("WCC") to further the industry's commitment to the safe use of mercury.

MERCURY CELL FACILITIES

In 1996, when the industry's original commitment to mercury reductions was made, there were 14 operating mercury cell plants. As of the end of 2007, seven mercury cell facilities were in operation in the United States. Since 1996 two facilities[1] have converted to membrane cell technology and five facilities[2] have simply closed.

As of the date of this report two facilities have announced plans to convert to membrane cell technology by the end of 2008 and 2009. A third facility has already closed in the second quarter of 2008. These actions will further reduce the chlor-alkali industry's mercury use and emissions. Based on the currently announced plans, only four mercury cell facilities will be in operation in the United States at the end of 2009 or early 2010[3].

MERCURY USE AND PURCHASES

Using 1990 to 1995 as the baseline, the chlor-alkali industry has reduced its mercury usage by over 97% (see Figure 1 below). Mercury use in 2007 was 9,871 pounds. Mercury use is detailed in Table 1 found in Appendix A.

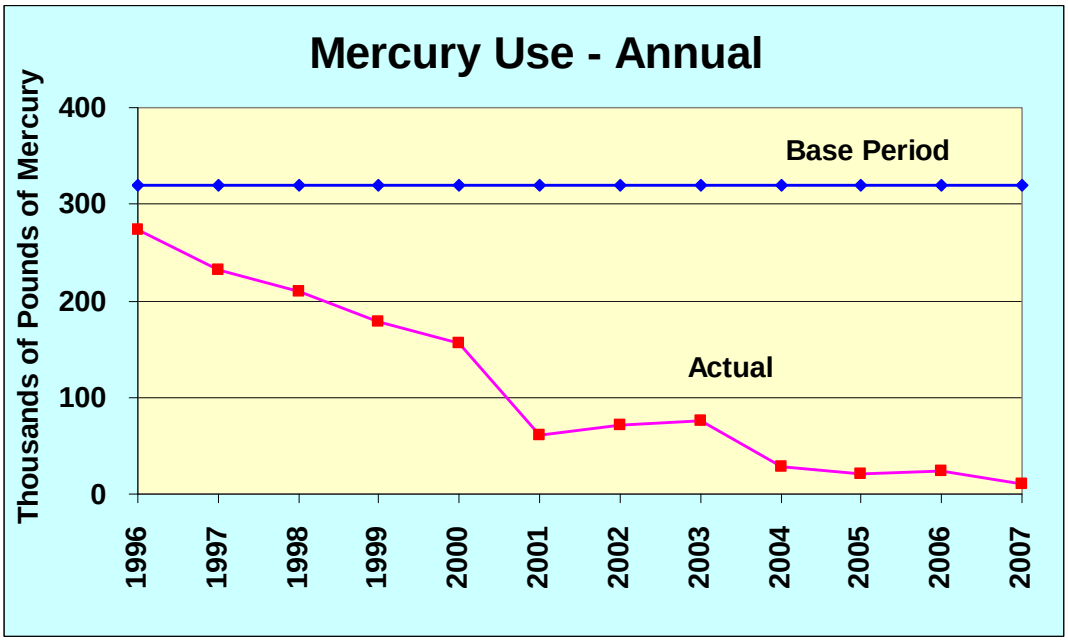

Figure 1

Chlor-alkali mercury use in the United States per ton of chlorine capacity for 2007 was 0.011 lb/ton

[1] Westlake/Kentucky - 2001 and PPG/Louisiana - 2007.

[2] Georgia Pacific/Washington – 1999, HoltraChem/North Carolina – 1999, HoltraChem/Maine – 2000, Occidental/TX – 2001 and Occidental/Delaware - 2005

[3] In 2006 the WCC estimated that approximately 135 mercury cell chlor-alkali plants existed world wide.

chlorine capacity (see Figure 2 below).

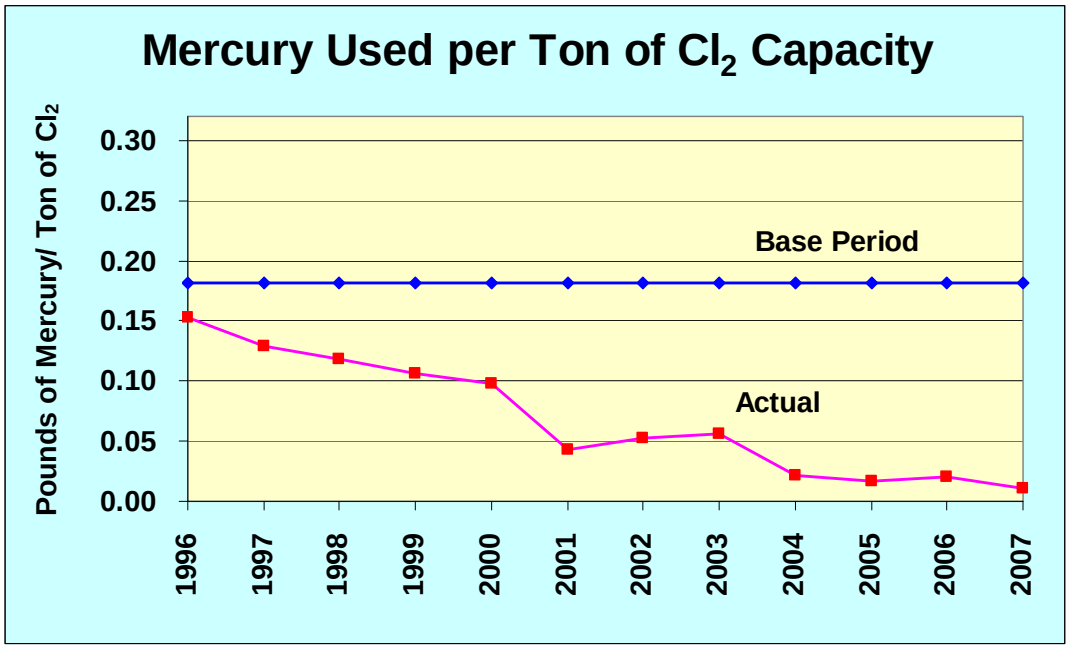

Figure 2

Figure 2 clearly shows that the chlor-alkali industry has significantly reduced its use of mercury, not just because of facility closures, but more importantly because of the industry's efforts to improve on the existing technology thus resulting in the more efficient utilization of mercury. This is reflected in a 94% reduction in the 2007 mercury used per ton of chlorine capacity when compared to the 1990 through 1995 baseline.

As is evident from both Figures 1 and 2, reductions in mercury use have slowed. This trend can be attributed to the effectiveness of past reduction efforts; nevertheless, CI's goal continues to be zero.

Mercury purchases in 2007 were 92,427 pounds (see Figure 3 next page). As explained in past reports, mercury purchases do not necessarily equate to mercury use. Process upgrades can necessitate the use of higher volume equipment and longer piping runs require that more mercury be added to the process. More mercury in the process does not equate to greater mercury emissions. In fact, most upgrades typically instituted as part of programs to upgrade cell room technology and improve system performance, also minimize mercury releases. Installation of new and better designed equipment minimizes fugitive emissions. Other upgrades allow the facilities to operate longer between scheduled cell maintenance activities. Less frequent cell maintenance means fewer openings of the cell and thus a reduction in mercury emissions. Annual mercury purchases rise or fall depending on the quantity of upgrades. As noted in past reports, mercury sales by closed facilities are not considered as an offset against mercury purchases.

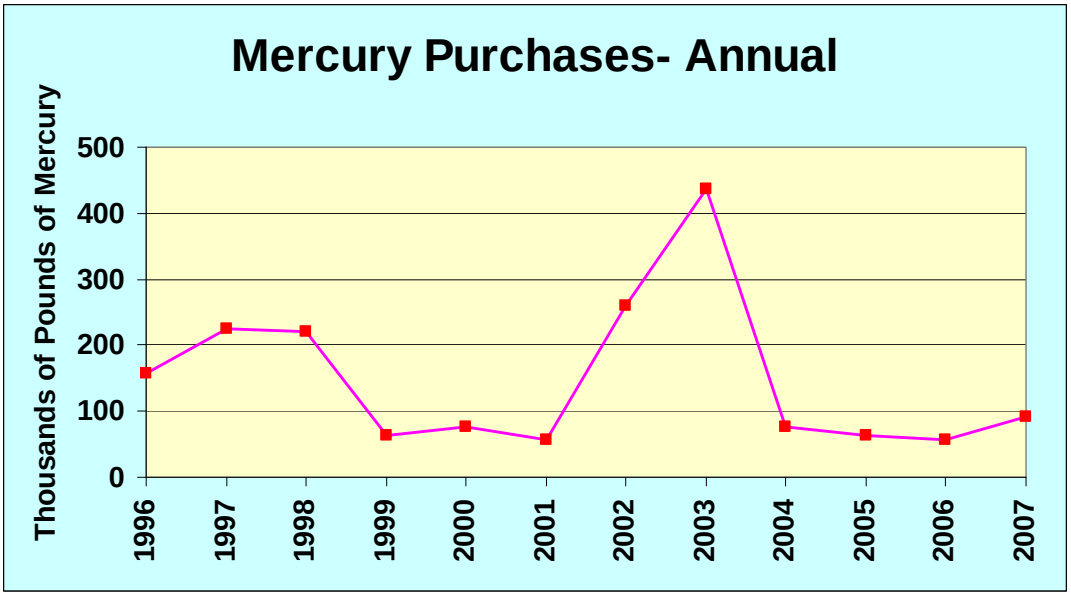

Figure 3

MERCURY RELEASES TO THE ENVIRONMENT

Mercury releases to the environment from the chlor-alkali industry were approximately 6,823 pounds (see Figure 4 below) in 2007. Mercury emissions are detailed in Table 2 found in Appendix A. This latest information shows a 79% reduction in the chlor-alkali industry mercury emissions[4] since 2001. The chlor-alkali industry mercury emissions are a very small portion (approximately 3%) of the total mercury releases occurring in the United States[5] and have fallen at a greater rate than the overall decline.

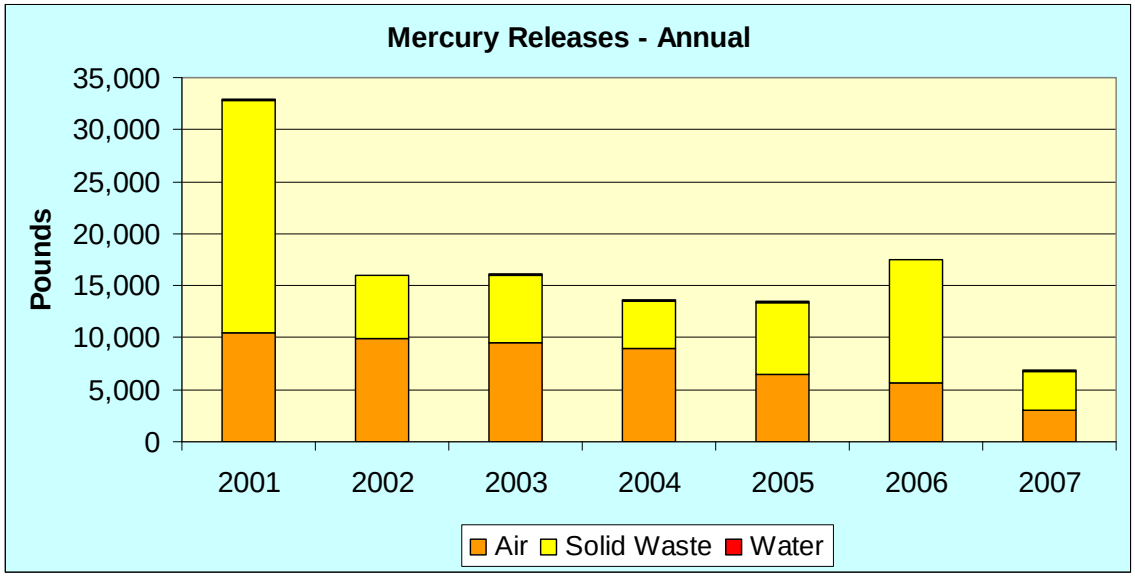

Figure 4

[4] Mercury releases directly to water are not easily depicted in Figure 4 since these quantities are less than 0.1% of the total.

[5] 2002 U.S. mercury releases estimated at 111.4 tons (GLBTS 2006 Progress Report, February 2007).

KEY PROJECTS – NEW AND CONTINUING

In general, process changes allow for reductions of mercury emissions in two ways. First, because much of the newer equipment being installed is larger than the previously installed equipment, operating cycles between maintenance activities are lengthened. Maintenance activities nearly always require equipment openings. Even though many improvements in techniques to reduce mercury emissions during equipment openings have been made, emissions can not be totally eliminated. Therefore, a lower number of openings results in reduced mercury emissions. Secondly, newer equipment is better designed to reduce fugitive emissions. Sealless mercury pumps, sealed end boxes, and improved hydrogen cooler design are examples of equipment changes that result in reduced fugitive emissions.

Facility Specific Projects in 2007

Below is a summary of key projects completed and/or started at mercury cell facilities during the 2007 calendar year. These projects resulted in reduced mercury emissions but may have also resulted in a short term increase in mercury purchases since sometimes these projects require an increase in mercury process inventories.

The following process modifications occurred in 2007[6]:

- Plant A added activated carbon beds on its hydrogen fume system and retort stacks to reduce emissions; and

- Plant B has announced plans to close its mercury cell chlorine production process. As part of the preparations for closure of the mercury cells the facility removed a wastewater treatment tank, which was discovered to contain a significant amount of mercury containing sludge. 23,160 lbs of elemental mercury was recovered from this sludge in the calendar year 2007. The balance was recovered during 2008. It is uncertain the exact time that this tank was installed, but it had been in service for many decades. Similarly records are uncertain, but it is not believed that during its life the tank had ever been emptied, significantly cleaned or otherwise taken out of service. This recovered mercury should be credited towards the unaccounted for mercury that the industry's enhanced inventory analysis procedures have identified[7]. This recovered mercury was not considered as a reduction in use of mercury in computing the 2007 mercury use data.

[6] Plant designations (A, B, C, etc.) are purposely not applied to the same facilities from year to year.

[7] As part of its annual accounting activity some quantities of mercury were labeled as "unaccounted for" by the Chlorine Institute. Up until now, EPA and others have considered unaccounted for mercury as mercury lost to the environment. In contrast, the industry has repeatedly countered that this unaccounted for mercury has not been emitted to the environment but has rather been lost within the production equipment. To further clarify, this means that the mercury has moved into and accumulated (due to its very high density) in other areas of the chlor-alkali process to which there is zero or limited access on any regular basis and that this mercury would eventually be discovered and accounted for when these process units (tanks, piping, etc) were eventually opened.

Industry-Wide Efforts

Besides aggressively pursuing specific facility-based opportunities for mercury use and emissions reductions, the U.S. chlor-alkali industry's voluntary efforts have also focused more broadly both domestically and worldwide. For many years the Institute has coordinated the industry's ongoing efforts to reduce mercury use and emissions. Specifically, CI and its member companies have worked on the following projects:

- Mercury NESHAP

The new Mercury NESHAP (40 *CFR* Part 63)[8] became effective on December 19, 2006. This new regulation replaces the old 40 *CFR* Part 61 Mercury NESHAP rule. The new regulation contains numerical emission limits for the three primary air sources of mercury at mercury cell facilities: 1) end-box ventilation system vents, 2) by-product hydrogen system vents, and 3) mercury thermal recovery unit vents. It also requires that the plants either install continuous mercury emission monitors or test each vent at least once per week. Six of the seven facilities have voluntarily chosen to install continuous mercury emission monitors.

The new rule also contains a set of work practice standards (representing the best practices of the industry) that are considerably more stringent than the fugitive emissions limits or procedures required under the old Part 61 Mercury NESHAP. The new rule contains an alternative program that involves continuous mercury air concentration monitoring and problem correction when a fugitive emission action level is exceeded. All operating mercury cell facilities are in compliance with this new regulation.

The EPA has recently published proposed amendments to 40 *CFR* Part 63[9]. The primary changes proposed by the Agency would require:

- Daily work practices;
- Continuous mercury emissions monitoring in the cell rooms (no longer optional);
- Detailed recordkeeping of the work practices for the time period during the semi-annual setting and resetting of the action level of the continuous cell room monitors;
- Resetting the continuous monitoring action level at least every six months;
- Calculating the action level at the 90th percentile of the data acquired during the resetting time period(s); and
- Thermal recovery units (that continue to operate in order to assist in the clean up of the site after the mercury cells have ceased to operate) to comply with the emission limitations for thermal recovery units in § 63.8190.

[8] *See* 68 Fed. Reg. 70,904 (December 19, 2003).
[9] *See* 73 Fed. Reg. 33,258 (June 11, 2008).

Besides the proposed changes to the rule, the Agency includes discussion of new and extensive emissions studies (conducted in 2005/2006), which concluded that:

- Based on a material balance analysis on new plant-wide emissions data, no significant fugitive sources of mercury come from outside the cell room;
- The levels of fugitive emissions for mercury cell chlor-alkali plants are approximately 450 g/day (less than half of the 1,300 g/day level assumed in the old Part 61 Mercury NESHAP) with total fugitive emissions from the five operating facilities estimated at less than 1 ton per year. Much less than the levels suggested by NRDC (3 to 5 tons/yr/plant);
- Fugitive mercury emissions have been reduced by approximately 86 percent, including plant closures.

These facts further validate the industry's efforts to reduce mercury emissions.

- Chlorine Institute - Annual Mercury Issues Workshop

The number of operating mercury cell facilities in the United States continues to decrease. This fact led the Institute to combine its annual Mercury Issues Workshop with the Institute's annual International Meeting. This first combined event was held during the Chlorine Institute's Annual Meeting in Dallas, TX on April 6, 2008, session topics specific to mercury included:

- United Nations Environmental Program ("UNEP") activities; and
- Regional activities - Representatives from Clorosur, Euro Chlor, and the Chlorine Institute summarized regional activities concerning legislation requiring phase out, export bans, storage issues, regulations on emission limits, mercury in products requirements, and/or health issues.

The event was well attended and continues to serve as a useful forum for both U.S. and international users of mercury cell technology.

- World Chlorine Council

The World Chlorine Council (www.worldchlorine.com) is a global network of national and regional chlor-alkali associations in over 27 countries and five continents, representing more than 80 percent of global chlorine and caustic-soda production. The WCC voluntarily engages in global programs to reduce mercury use, consumption and emissions from the mercury cell manufacturing process. CI is a WCC managing partner.

It is well understood that mercury in the environment is not entirely attributable to local sources. Mercury released in other parts of the world can be deposited in the United States. Mercury is a global pollutant and thus requires globally coordinated solutions. International efforts by CI (through the WCC) to reduce mercury emissions are a critical component of the industry's mercury reduction efforts.

WCC's global programs augment the programs and commitments made by regional WCC organizations. Emissions from this sector will continue to decline as the industry implements best available techniques and transitions to alternative, non-mercury technologies.

As part of these efforts, the WCC has been an active supporter of the UNEP Global Mercury Program and has made a sustained effort to help mercury cell chlor-alkali producers around the world reduce mercury use and emissions. Furthermore, the WCC agreed to support and contribute to the UNEP Global Partnership on Mercury Reduction in the Chlor-Alkali Sector. This Partnership builds upon WCC's long-standing commitment to share best practices globally for reducing the use and release of mercury from mercury-cell chlor-alkali facilities. WCC has strived to work with governments, chlor-alkali producers, and the UNEP to help make this partnership a success.

Update on 2004 Commitments

In its 2004 Annual Report to EPA, The Chlorine Institute discussed two new commitments made to the Binational Toxics Strategy. Specifically, the Chlorine Institute and its members committed to 1) enhancing cell room air monitoring, and 2) fully accounting for the industry's mercury inventory. The Chlorine Institute believes it has fully met these commitments as summarized below:

- Enhancing Cell Room Air Monitoring

EPA, with the assistance and cooperation of chlor-alkali facilities, has completed mercury emissions testing, validation of mercury continuous emissions monitoring systems, analysis of the impact of cell room maintenance on emissions, calculation of fugitive emissions from outside of the cell rooms, new fugitive mercury emissions estimates for the cell rooms, the use of mercury monitoring systems as a work practice tool and estimates of the efficiency of the cell room monitoring program to reduce fugitive emissions. The Agency has published its findings in the *Federal Register*[10]. The Agency's findings specific to these studies concluded that:

- The data collection, calculation, and archiving systems for continuous mercury emissions monitoring systems were confirmed as accurate; and
- The use of continuous mercury emissions monitoring systems as a work practice tool will result in continued decreases in fugitive mercury emissions as plants will be able to identify emission-reducing improvements in their processes and practices.

Six of the seven existing facilities have installed cell room mercury monitoring systems[11].

[10] *See* 73 Fed. Reg. 33,258 (June 11, 2008).
[11] The remaining facility has selected the work practices and controls option and is in compliance with the current Mercury NESHAP.

- Fully Accounting for Mercury Inventory

The Chlorine Institute believes it has made outstanding progress in its efforts to fully account for the mercury used by the chlor-alkali industry. Nevertheless, CI and the remaining mercury cell facilities continue to refine data collection and analysis methodology. In 2004, in order to further clarify the facts, CI added a new table, Table 2 (Appendix A), to this report. Table 2 is a compilation of data for the calendar years 2002 through 2006 showing the differences between mercury purchases, mercury use, reported toxics release inventory (TRI) emissions, and mercury contained in chlor-alkali products. The key line item, "unaccounted for mercury", is near the bottom of the table.

Mercury process inventory is typically measured using the radioactive isotope technique discussed in Chlorine Institute publication, *Guidelines for Conducting a Mercury Balance,* May 1999. The methodology has a variability of between 0.1 and 0.3 percent. Applying this variability to the 2007 year ending mercury inventory of 2,102 tons reveals the data to be accurate to within two to six tons. The 2007 unaccounted for mercury equaled 3.5 tons or 0.17 percent of the total inventory. This is a reduction of approximately 86 percent since 2003.

Past Efforts Continue to Provide Environmental Benefits

Since the industry's commitment to mercury reductions, facilities have taken many steps to reduce emissions. These changes have been detailed in prior reports but are summarized below because each historic process improvement continues to pay dividends in the form of emissions reductions in every year that follows. Past activities have included the design, use and installation of:

- Improved collection devices to more effectively capture mercury during cell maintenance;
- New decomposer compression system design to improve efficiency of amalgam decomposition;
- New gasket materials to provide better seals on mercury containing equipment;
- Additional collection devices such as weirs to cell room trenches to more effectively recapture and reuse accumulated mercury;
- Process changes to reduce mercury carry-over with the water exiting the end boxes resulting in less mercury handling;
- More efficient electrical current distribution equipment;
- Larger decomposers, thus lengthening the time between scheduled maintenance (i.e. reducing the need to open the equipment); and
- Continuous emissions monitoring equipment in mercury cell rooms.

CONCLUSION

The Chlorine Institute believes it has proactively addressed the concerns regarding the use and release of mercury into the environment by mercury cell chlor-alkali facilities. CI and its members believe this voluntary effort, no matter how it is measured, has been a total success. The Institute's commitments to the Binational Toxics Strategy have been met and this will be the last report delivered to EPA. The Chlorine Institute has plans to continue its efforts to reduce mercury use and environmental releases in the chlor-alkali sector both in the United States and internationally through its member programs and participation in WCC activities and UNEP Global Mercury Program.

ABOUT CI

The Chlorine Institute Inc., founded in 1924, is a non-profit trade association of companies and other entities involved or interested in the safe production, distribution and use of chlorine, sodium and potassium hydroxides, and sodium hypochlorite, and the distribution and use of hydrogen chloride.

Because of chlorine's nature and its widespread and varied applications, the promotion of its safe use and handling has long been an accepted responsibility of its producers, packagers, distributors and users. The Institute is the focal point for their joint efforts.

For more information on CI's mission, go to www.chlorineinstitute.org.

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APPENDIX A
Data Tables

Table 1
Mercury Purchase and Usage[1]
Chlor-Alkali Industry - Mercury Cell Process

	BASELINE (Average 1990 – 95)	1996	1997	1998	1999[2]	2000[3]	2001[4]	2002	2003	2004	2005[5]	2006	2007[6]	2008[7]	2009[7]
otal Mercury Purchases, .	296,408	242,015	320,460	340,658	214,749	172,885	69,932	259,069	437,434	75,982	63,829	57,304	92,427		
otal Mercury Purchases, ns	148	121	160	170	107	86	35	130	219	38	32	29	46		
otal Mercury Used, lb.	319,715	273,659	232,056	210,213	177,968	156,403	61,506	71,052	75,309	28,637	20,660	24,210	9,871		
otal Mercury Used, tons	160	137	116	105	89	79	30	36	38	14	10	12	5		
nnual Chlorine apacity, 1,000 tons	1,758	1,784	1,801	1,785	1,676	1,589	1,436	1,355	1,353	1,363	1,221[8]	1,206	932		
otal Number of Mercury ells	762	762	762	762	706	682	646	594	594	594	506	506	432		
otal Mercury Cell acilities Operating at nd of Year	--	14	14	14	14	12	11	9	9	9	8	8	7	5	4
ercury Cell Facilities losed During the Year	--	0	0	0	2	1	1	0	0	0	1	0	0	1	0
ercury Cell Facilities onverted to Membrane uring the Year	--	0	0	0	0	0	1	0	0	0	0	0	1	1	1
ercury Used, lb/ton of hlorine Capacity	0.182	0.153	0.129	0.118	0.106	0.102	0.044	0.052	0.056	0.021	0.017	0.020	0.011		

otes:

ton = 2,000 lb

Data is collected from only those plants in operation at the end of the calendar year.

Georgia Pacific Corp./Bellingham, WA and HoltraChem Mfg. Co./Reiglewood, NC closed.

HoltraChem Mfg. Co./Orrington, ME closed.

Occidental Chemical Corp./Deer Park, TX closed. Westlake CA&O Corp./Calvert City, KY converted to membrane cell technology.

Occidental Chemical Corp./Delaware City, DE closed.

PPG Industries, Inc. plant/Lake Charles, LA converted to membrane cell technology.

Projections based on publicly available announcements.

In 2005 U.S. facilities accounted for approximately 12% of the global mercury cell chlorine production capacity (Page 47, *Summary of Supply, Trade and Demand Information on Mercury*, UNEP, November 2006).

Table 2
Mercury Balance and Release[1, 2]
Chlor-Alkali Industry - Mercury Cell Process
(in tons)

		2002	2003	2004[3]	2005	2006[4]	2007
1	Mercury Virgin Inventory as of Jan 1	67	46	166	90	44	21
2	Mercury Process Inventory as of Jan 1	2,478	2,593	2,654	2,493	2,561	2,082
3	Total Mercury Inventory as of Jan 1 [3] = [1] + [2]	2,545	2,639	2,820	2,583	2,605	2,103
4	Mercury purchases during calendar year	130	219	38	32	29	46
5	Total Mercury Available [5] = [3] + [4]	2,675	2,858	2,858	2,615	2,634	2,149
6	Mercury Virgin Inventory at on site storage as of Dec 31	46	166	96	45	34	21
7	Mercury Process Inventory as of Dec 31	2,593	2,654	2,748	2,560	2,579	2,102
8	Total Mercury Inventory as of Dec 31 [8] = [6] + [7]	2,639	2,820	2,844	2,605	2,613	2,123
9	Mercury Transferred Out[5]	0	0	1	0	9	19
10	Total Mercury Used (Consumed) [10] = [5] – [8] - [9]	36	38	13	10	12	7
11	Mercury Released to the Environment (TRI)	8	8	7	7	9	3
12	Mercury Contained in Products	0	0	0	0	0	0
13	Total Mercury Losses to Environment and Products [13] = [11] + [12]	8	8	7	7	9	4
14	Unaccounted for Mercury [14] = [10] – [13]	28	30	6	3	3	4

Notes:

[1] For facilities operating at year end in the calendar year.

[2] Numbers may not add due to rounding.

[3] 2004 ending inventory and 2005 beginning inventory data adjusted to reflect shutdown of Delaware City, DE facility.

[4] 2006 ending inventory and 2007 beginning inventory data adjusted to reflect conversion of Lake Charles, LA facility.

[5] Sent off-site for recovery, not returned during calendar year.