# Appendix C: Analysis of Original CAAP Progress Metrics

In the original CAAP, published in November of 2006, the expected emissions reductions to be achieved by the plan were forecasted from the 2005 CAAP baseline year through 2011. Emission reduction estimates were developed using the emissions reductions expected to be achieved by the various control measures compared to "uncontrolled" emissions, grown based upon anticipated cargo activity increases.

The original CAAP 2005 baseline emission estimates were based on the 2001 POLA and 2002 POLB ocean-going vessel (OGV) and heavy-duty truck (HDV) emissions grown to 2005 activity levels, and draft 2005 CHE emissions from both ports. It is important to note that the CAAP was released prior to finalization of the 2005 inventories and only the draft 2005 CHE emission estimates were available at that time. Rail and harbor craft emissions were not included in the original CAAP emission reduction estimates because of uncertainties in both fleet characteristics and control strategy implementation.

In Section 6.1 of the original CAAP document, Effects of Growth on Emissions Reduction Measures, there were three tables (6.1 through 6.3) that estimated the effectiveness of the CAAP measures based on CARB's Goods Movement Plan (GMP) growth forecast. These tables, which presented percent reductions of controlled versus uncontrolled emissions estimates for OGV, CHE, and HDV each year from 2007 through 2011, are provided below for reference.

### Table 6.1: Effect of Growth & Clean Air Action Plan on DPM Emissions

| Category | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DPM Emissions with Growth, no Control Measures | | | | | | | | | | | |
| OGVs | 1,231 | 1,436 | 1,641 | 1,847 | 2,052 | 2,175 | 2,298 | 2,421 | 2,544 | 2,667 | 2,780 |
| CHE | 181 | 174 | 166 | 159 | 152 | 152 | 152 | 152 | 152 | 152 | 152 |
| HDVs | 1,236 | 1,168 | 1,101 | 1,033 | 966 | 966 | 966 | 966 | 966 | 966 | 966 |
| Total | 2,648 | 2,778 | 2,909 | 3,039 | 3,170 | 3,293 | 3,416 | 3,539 | 3,662 | 3,785 | 3,898 |
| DPM Emissions with Growth and CAAP Control Measures | | | | | | | | | | | |
| OGVs | 1,231 | 1,436 | 1,641 | 1,847 | 2,052 | 2,175 | 2,196 | 2,116 | 1,921 | 1,864 | 1,836 |
| CHE | 181 | 174 | 166 | 159 | 152 | 152 | 138 | 100 | 67 | 58 | 48 |
| HDVs | 1,236 | 1,168 | 1,101 | 1,033 | 966 | 966 | 944 | 730 | 524 | 354 | 184 |
| Total | 2,648 | 2,778 | 2,909 | 3,039 | 3,170 | 3,293 | 3,278 | 2,946 | 2,512 | 2,276 | 2,068 |
| Percent Reduction | | | | | | | 4% | 17% | 31% | 40% | 47% |

### Table 6.2: Effect of Growth & Clean Air Action Plan on NOx Emissions

| Category | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NOx Emissions with Growth, no Control Measures | | | | | | | | | | | |
| OGVs | 13,574 | 15,452 | 17,329 | 19,207 | 21,085 | 22,207 | 23,329 | 24,451 | 25,573 | 26,696 | 27,800 |
| CHE | 4,352 | 4,243 | 4,134 | 4,025 | 3,916 | 3,916 | 3,916 | 3,916 | 3,916 | 3,916 | 3,916 |
| HDVs | 9,569 | 9,744 | 9,919 | 10,094 | 10,269 | 10,269 | 10,269 | 10,269 | 10,269 | 10,269 | 10,269 |
| Total | 27,495 | 29,439 | 31,383 | 33,326 | 35,270 | 36,392 | 37,514 | 38,636 | 39,758 | 40,881 | 41,985 |
| NOx Emissions with Growth and CAAP Control Measures | | | | | | | | | | | |
| OGVs | 13,574 | 15,452 | 17,329 | 19,207 | 21,085 | 22,207 | 20,174 | 19,255 | 17,653 | 17,304 | 16,828 |
| CHE | 4,352 | 4,243 | 4,134 | 4,025 | 3,916 | 3,916 | 3,665 | 2,949 | 2,330 | 2,279 | 2,163 |
| HDVs | 9,569 | 9,744 | 9,919 | 10,094 | 10,269 | 10,269 | 10,102 | 8,498 | 6,940 | 5,491 | 4,041 |
| Total | 27,495 | 29,439 | 31,383 | 33,326 | 35,270 | 36,392 | 33,940 | 30,703 | 26,924 | 25,074 | 23,032 |
| Percent Reduction | | | | | | | 10% | 21% | 32% | 39% | 45% |

Table 6.3: Effect of Growth & Clean Air Action Plan on SOx Emissions

| Category | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SOx Emissions with Growth, no Control Measures | | | | | | | | | | | |
| OGVs | 7,749 | 8,902 | 10,054 | 11,207 | 12,360 | 13,119 | 13,878 | 14,638 | 15,397 | 16,157 | 16,916 |
| CHE | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| HDVs | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Total | 7,766 | 8,919 | 10,071 | 11,224 | 12,377 | 13,136 | 13,895 | 14,655 | 15,414 | 16,174 | 16,933 |
| SOx Emissions with Growth and CAAP Control Measures | | | | | | | | | | | |
| OGVs | 7,749 | 8,902 | 10,054 | 11,207 | 12,360 | 13,119 | 11,939 | 10,174 | 8,895 | 8,474 | 8,046 |
| CHE | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| HDVs | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 7 | 7 |
| Total | 7,766 | 8,919 | 10,071 | 11,224 | 12,377 | 13,136 | 11,956 | 10,191 | 8,910 | 8,490 | 8,061 |
| Percent Reduction | | | | | | | 14% | 30% | 42% | 48% | 52% |

The 2011 goals of the CAAP's effectiveness as represented in these tables were:

- Reduce DPM by 47% compared to uncontrolled emissions growth
- Reduce NOx by 45% compared to uncontrolled emissions growth
- Reduce SOx by 52% compared to uncontrolled emissions growth

It's important again to note that in the original CAAP the forecasted 2011 controlled and uncontrolled emission estimates were based on CARB's GMP growth forecast and regulations that were in effect in May of 2005.

***Comparing Actual Progress to the Original CAAP Estimates***

To complete a comparison of the original CAAP's estimated effectiveness and actual progress, the following steps must be performed:

Step 1. For 2007 through 2009, controlled emission estimates are based on actual activity data modeled with the 2005 methods and assumptions with the exception of HDV emissions where actual call weighted emissions are included. For calendar year 2005 there was no significant difference in call weighted versus population weighted HDV emissions. However, this difference became more pronounced in recent years due to the implementation of ports' Clean Truck Program and the disincentive for using older trucks.

Step 2. Forecast 2010 through 2014 controlled and uncontrolled emission estimates using the 2005 methods and assumptions and the updated 2007 cargo forecast for HDVs , emissions for forecasted years are based on population weighted age distribution forecasted from 2005. The difference between the population weighted and call weighted approach is no longer expected to be significant as the CTP becomes fully implemented in 2012 and all trucks are required to meet the same performance standard.

These steps are further detailed in the findings presented below.

Step 1 - Actual 2007, 2008 and 2009 activity for both ports was reloaded into the 2005 emissions inventory databases and modeled with the 2005 methods and assumptions with the exception of HDV as mentioned above. The results are presented below in Tables C-1 through C-3.

**Table C-1: 2007 to 2009 DPM Uncontrolled & Controlled Emission Estimates**

**Using 2005 Methodology**

| | DPM, tpy | | |
|---|---|---|---|
| **Sources** | **2007** | **2008** | **2009** |
| *Uncontrolled* | | | |
| OGV, HDV, CHE | 1,994 | 2,063 | 2,132 |
| *Controlled* | | | |
| OGV, HDV, CHE | 1,396 | 1,368 | 894 |
| ***Percent Reduced*** | ***30%*** | ***34%*** | ***58%*** |

**Table C-2: 2007 to 2009 NOx Uncontrolled & Controlled Emission Estimates Using 2005 Methodology**

| | NOx, tpy | | |
|---|---|---|---|
| **Sources** | **2007** | **2008** | **2009** |
| *Uncontrolled* | | | |
| OGV, HDV, CHE | 32,253 | 33,740 | 35,292 |
| *Controlled* | | | |
| OGV, HDV, CHE | 29,778 | 26,128 | 18,396 |
| ***Percent Reduced*** | ***8%*** | ***23%*** | ***48%*** |

**Table C-3: 2007 to 2009 SOx Uncontrolled & Controlled Emission Estimates Using 2005 Methodology**

| | SOx, tpy | | |
|---|---|---|---|
| **Sources** | **2007** | **2008** | **2009** |
| *Uncontrolled* | | | |
| OGV, HDV, CHE | 14,223 | 15,210 | 16,163 |
| *Controlled* | | | |
| OGV, HDV, CHE | 9,176 | 9,817 | 6,345 |
| ***Percent Reduced*** | ***35%*** | ***35%*** | ***61%*** |

Step 2 – Forecasting future-year emissions (2010 through 2011) for both controlled and uncontrolled emissions is based on growing uncontrolled emissions by the growth estimates in the 2007 cargo growth forecast and then applying the emissions controls of the CAAP measures and applicable regulations to those emissions, similar to what was done in developing tables 6.1 through 6.3 in the original CAAP. Regulations that were not promulgated prior to May 2005 were not included. The results are presented below in Tables C-4 through C-6.

**Table C-4: 2007-2011 DPM Uncontrolled & Controlled Emission Estimates Using 2005 Methodology***

| | DPM, tpy | | | | |
|---|---|---|---|---|---|
| **Sources** | **2007** | **2008** | **2009** | **2010** | **2011** |
| *Uncontrolled* | | | | | |
| OGV, HDV, CHE | 1,994 | 2,063 | 2,132 | 2,232 | 2,324 |
| *Controlled* | | | | | |
| OGV, HDV, CHE | 1,396 | 1,368 | 894 | 654 | 659 |
| ***Percent Reduced*** | ***30%*** | ***34%*** | ***58%*** | ***71%*** | ***72%*** |

**Table C-5: 2007-2011 NOx Uncontrolled & Controlled Emission Estimates Using 2005 Methodology***

| | NOx, tpy | | | | |
|---|---|---|---|---|---|
| **Sources** | **2007** | **2008** | **2009** | **2010** | **2011** |
| *Uncontrolled* | | | | | |
| OGV, HDV, CHE | 32,253 | 33,740 | 35,292 | 35,938 | 36,528 |
| *Controlled* | | | | | |
| OGV, HDV, CHE | 29,778 | 26,128 | 18,396 | 27,969 | 28,444 |
| ***Percent Reduced*** | ***8%*** | ***23%*** | ***48%*** | ***22%*** | ***22%*** |

**Table C-6: 2007-2011 SOx Uncontrolled & Controlled Emission Estimates Using 2005 Methodology***

| | SOx, tpy | | | | |
|---|---|---|---|---|---|
| **Sources** | **2007** | **2008** | **2009** | **2010** | **2011** |
| *Uncontrolled* | | | | | |
| OGV, HDV, CHE | 14,223 | 15,210 | 16,163 | 17,189 | 18,090 |
| *Controlled* | | | | | |
| OGV, HDV, CHE | 9,176 | 9,817 | 6,345 | 4,237 | 4,271 |
| ***Percent Reduced*** | ***35%*** | ***35%*** | ***61%*** | ***75%*** | ***76%*** |

* Except for HDV emissions where actual call weighted emissions were used for 2007 to 2009

As shown above, in 2009, the ports exceeded the original CAAP goals established for 2011 for DPM and SOx (based on the original CAAP methods and assumptions, and utilizing actual activity data and an updated forecast) and are forecasted (even with the higher 2007 cargo forecast) to go even further throughout 2010 and 2011. The 2011 NOx estimate, using the 2007 cargo forecast and the described modeling methodology, indicates that the ports would fall short of the 45% NOx reduction estimate included in the original CAAP. This estimated shortfall is due to changes from the assumptions that were made for the original CAAP analysis, including changes to the implementation timeline and changes in the fleet mix. For example opportunities to implement requirements through new or renewed leases have not come about on the schedule originally anticipated. Finally, the decrease in NOx emissions in 2010 is less than 2007 through 2009 because uncontrolled emissions are based on estimated higher growth from the 2007 cargo forecast, whereas controlled emissions in 2007 and 2009 reflect the actual decline in growth that occurred during those years.

Despite the modeled estimates, the ports anticipate they will actually meet or exceed the original NOx goal before 2011. This is expected to a result from the recent economic downturn, where actual cargo volumes are lower than predicted by the 2007 cargo forecast. Actual emissions from the ports will continue to be calculated and made available through each port's annual Emission Inventory.