APPENDIX C

STATISTICAL ANALYSIS OF HAZARDOUS AIR POLLUTANT CONCENTRATIONS FROM HAZARDOUS WASTE COMBUSTORS

FINAL REPORT

STATISTICAL ANALYSIS OF HAZARDOUS AIR POLLUTANT CONCENTRATIONS FROM HAZARDOUS WASTE COMBUSTORS

Submitted to:

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February 16, 1996

EPA Contract No. 68-W4-0030, Work Assignment 106
SAIC Project No. 01-0813-03-4393-000

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INTRODUCTION

The U.S. Environmental Protection Agency (EPA) regulates the burning of hazardous waste in incinerators and boilers and industrial furnaces (BIFs) under 40 CFR Part 264, Subpart O and Part 266, Subpart H respectively. EPA currently is revising these rules under the technology based Clean Air Act (CAA) §112 MACT provisions. This report presents statistical analyses to support this rulemaking effort. The statistical analyses evaluate emissions data on hazardous air pollutants (HAPs) from three major industrial categories: hazardous waste burning incinerators, cement kilns (CKs), and light weight aggregate kilns (LWAKs).

This report presents:

- Evaluation of the HAP concentration data used in the analyses, including documentation of data conventions used in the analyses and distributional assessments of the data.
- Discussion of the statistical methodology used in the analyses.
- Estimated standards based on the best 12 percent performers
- Estimated standards based on the highest emitting source among the best 6 percent performers
- Estimated standards based on beyond the floor technologies
- Supplemental analyses for estimation of emission standards

1. DATA

The data analyzed in this report are hazardous air pollutant (HAP) concentrations from trial burns conducted at hazardous waste combustors. Three types of hazardous waste combustors are included in this analysis: incinerators, cement kilns, and light weight aggregate kilns (LWAKs).

The proposed limits are set such that the emission limit is no more stringent than the average emission from the best performing 12 percent of the devices in the Nation. There are two databases from which the proposed limits can be determined. The first is to identify the best performing 12 percent of the devices and calculate a limit such that the average of these devices will meet the emission limit. The second option is to select the best performing 6 percent of the devices and determine the limit from the highest emitting source among these devices. Both of these approaches are used in this analysis. The database used for the first approach is referred to, in this report, as the 12 percent database. The database used for the second approach is referred to as the 6 percent database.

The best performing 6 percent devices are selected by identifying the three existing sources with the lowest average emission concentrations and selecting all devices from the expanded universe of hazardous waste combustors that use the same treatment technology.

Each of the databases defined by the best performing devices (12% and 6%) are further defined by the Maximum Theoretical Emissions Concentration at each device and test condition. The databases that do not consider the MTEC are referred to as the non-MTEC databases. The databases that are defined using the MTEC to select the best performing devices are referred as the full-MTEC databases. A third option uses hazardous waste only data to calculate the MTEC at each test condition; databases using this option are referred to as hazardous waste only-MTEC (or HW-MTEC) databases.

Databases defined by new sources are selected based on the treatment technology of the single source with the lowest average emissions concentration. The new source databases are also defined by the MTEC methodologies: non-MTEC, full-MTEC, and hazardous waste only-MTEC.

The databases used for the majority of the analyses in this report are defined below:

- 12% Full-MTEC from Existing Sources
- 12% HW-MTEC from Existing Sources
- 6% Full-MTEC from Existing Sources
- 6% HW-MTEC from Existing Sources
- Full-MTEC from New Sources
- HW-MTEC from New Sources

The 6 percent and 12 percent existing source databases and the new source databases were defined by the arithmetic average emission concentration from each device and test condition.

The emission concentration data used in this analysis were collected from individual runs from each test condition at each device. Typically three runs were analyzed per test condition. Throughout this report, each test condition will be treated separately, rather than combining test conditions from the same device. Because each test condition is different from the other test conditions, even within a device, each test condition essentially functions as a separate device.

1.1 Distributional Assessments

Data from the 12% full-MTEC database were used to assess the distribution of the data because it contains the largest group of devices and test conditions. Assessments were made from available data because no other sources of information were available that document the distribution of HAP concentrations from hazardous waste combustors.

Probability plots were used to assess the distribution of the HAP emission concentrations. These plots are contained in Appendix B. The first set of probability plots (Figures B-1-x) compare the normal and lognormal distributions. The second set of plots (Figures B-2-x) are similar to the first set, but the concentration data have been adjusted to remove test condition effects by subtracting the test condition mean from each run. The third set of probability plots (Figures B-3-x) display all of the data with the nondetects set equal to one-half of the detection limit fit to the lognormal distribution and only the detected concentrations fit to the lognormal distribution. These plots are used to assess whether the nondetected samples follow the same distribution as the detected samples.

From the first two sets of plots, the data appear to fit the lognormal distribution better than the normal distribution. A Shapiro-Wilk test was also used to test the hypotheses of the data following normal or lognormal distributions. As in all statistical hypothesis tests, it is not possible to prove that the hypothesis is true; we can only fail to reject the hypothesis. From the tests of the HAP concentration data, the hypothesis of a lognormal distribution is rejected less often than the hypothesis of a normal distribution. From this, in conjunction with the graphical assessments of the empirical distributions of the data, it is concluded that the HAP concentration data follow a lognormal distribution.

The third set of probability plots show slight differences between the distribution of detected samples only and the distributions that also contain the nondetected samples, which were set equal to one-half of the detection limit (e.g., mercury from incinerators). From this it is concluded that the detected and nondetected samples come from different distributions, and will be used in the statistical analyses accordingly.

1.2 Data Conventions

For aggregate pollutants (e.g., low volatile metals (LVM), semi-volatile metals (SVM), and dioxin/furans), the composite sample is treated as a nondetect only if all of the individual samples were not measured above the minimum detection level. If at least one of the individual samples was measured as a detected sample, then the composite sample is treated as a detect.

A portion of the dioxin/furan samples were reported in the databases without information regarding the detection limit and whether these samples were measured above the minimum detection level or not. This information is not available because it was not reported by the facilities that collected the data. Therefore, these samples were treated as detected samples in the statistical analyses.

The test conditions that were reported in the databases without individual concentration data from each run were not used in the statistical analyses, because only the average concentration, across all runs, was reported for these test conditions.

2. STATISTICAL METHODOLOGY

The goal of the statistical analyses in this report is to estimate the mean and upper percentiles from the emission concentration data. The upper percentile estimates will be used to determine potential emission standards and the estimated mean will be used as an indicator of the emission level necessary to meet the standard a certain percentage of the time, dependent upon which percentile estimate is used for the standard. For example, if the 99th percentile is used as the emissions standard, then devices operating at the estimated average emission level will be expected to meet the standard 99 percent of the time.

The emission concentration data is assumed to follow a lognormal distribution, and contains censored values as the result of concentrations not measured above the minimum detection level. There are three potential statistical methodologies for generating estimates from this type of data. These are: generation of estimates from the modified delta-lognormal distribution, the censored maximum likelihood estimation procedure, and regression on order statistics. These methods have been used by EPA, in particular by the Office of Water for the establishment of effluent guidelines. The delta-lognormal methodology is the most widely used methodology by EPA in the development of regulatory limits and has withstood critique from industry and the public. The three statistical methodologies are described in detail in Appendix A.

The modified delta-lognormal methodology was selected for the analyses in this report for three main reasons. First, it allows detected and nondetected samples to come from separate distributions. In the data used for these analyses, the detects and nondetects appear to follow different distributions, as demonstrated by the probability plots in Appendix B. Secondly, the mean can be estimated after removing between-test condition and between-device effects by first averaging concentration within test conditions, then averaging the test condition means across devices, and finally averaging the device means. The third reason for using the modified delta lognormal methodology is that it allows the variance to be estimated from the pooled within-condition variability. The censored maximum likelihood and regression on order statistics methods use the variance of all data points regardless of device and test condition. The variance components used in the modified delta lognormal method are calculated from the available data, using within-test condition variance, which is a measure of the variability of the pollutant concentration measurements without influence from the particular device or test condition from which the data were collected.

2.1 Application of Statistical Methodology

This report focusses on two primary sets of analyses. The first uses the 12 percent databases, and the second uses the 6 percent databases. The first analysis estimates upper percentile emission concentrations from the best performing 12 percent of the devices and the estimated average emission level at which the devices should operate at so that they do not exceed the percentile limit a specified percentage of the time. The second analysis estimates upper percentiles on emission concentrations based on the highest emitting source among the best performing 6 percent of the devices. Again, the average emission level at which the devices should operate at so that they do not exceed the percentile limit a specified percentage of the time is estimated.

2.1.1 Analysis of the 12% MACT Database

Using the delta-lognormal methodology, the mean and upper percentiles are estimated from the HAP concentration data. Estimates are generated separately for each HAP and source (incinerators, cement kilns, and LWAKs) from each of the 12 percent databases (Full-MTEC and HW-MTEC). Only the 12 percent data is used for this analysis because it is not meaningful to base the emission standard on the estimated mean and associated percentiles from only the best performing 6 percent of the devices.

The three parameters necessary for the modified delta-lognormal methodology are the percentage of nondetect samples (δ), the mean of the natural logarithm of the detected concentrations (μ), and the standard deviation of the natural logarithm of the concentrations (σ).

- The percentage of nondetects (δ) is calculated from the number of nondetect samples at each detection limit. The percentage of samples at each detection limit, across all runs and all test conditions, is represented by δ_i, where I indicates the ith detection limit. The percentage of nondetects (δ) is the sum of the δ_i's across all detection limits.

- The mean (μ) is estimated from the natural logarithm of the concentration data. First, the mean of the natural logarithm of the concentration data is calculated for each test condition within each device. The mean of these test condition means is then calculated for each device. The device means are then exponentiated back to the measurement space, and the median of these device means is determined. The natural logarithm of this median is used as μ.

- The standard deviation (σ) also is estimated from the natural logarithm of the concentration data. The variance is estimated as the pooled within-test condition variability across all devices and test conditions. The standard deviation (σ) is the square root of the estimated variance. The formula for calculating σ^2 is defined below:

$$\sigma^2 = \frac{\sum_i \sum_j (y_{ij} - \bar{y}_{i.})^2}{n - r}$$

where,

y_{ij} = natural logarithm concentration from the jth run at the ith test condition
$\bar{y}_{I.}$ = mean of the natural logarithm concentrations from the ith test condition
n = total number of runs
r = number of test conditions

Using these parameter estimates, the upper percentiles, based on individual run data, are estimated by:

$$P = \exp\left[\mu + \Phi^{-1}\left(\frac{p-\delta}{1-\delta}\right)\cdot\sigma\right]$$

where, p corresponds to the percentile of interest (e.g., 0.95 or 0.99).

Based on 3-run averages of the run data, which is how compliance to the standard is measured, the upper percentiles are estimated by:

$$P_3 = \exp\left[\mu_3 + \Phi^{-1}\left(\frac{p-\delta^3}{1-\delta^3}\right)\cdot\sigma_3\right]$$

where,

$$\mu_3 = \log\left[\frac{E(U) - \delta^3 E(X_d)}{1-\delta^3}\right] - \frac{1}{2}\sigma_3^2$$

$$\sigma_3^2 = \log\{1 + \frac{Var(U)(1-\delta^3)}{3[E(U)-\delta^3 E(X_d)]^2} - \frac{\delta^3(1-\delta^3)Var(X_d)}{3[E(U)-\delta^3 E(X_d)]^2}$$

$$- \frac{\delta^3(1-\delta^3)^2\left[E(X_d) - \frac{E(U)-\delta^3 E(X_d)}{1-\delta^3}\right]^2}{[E(U)-\delta^3 E(X_d)]^2}\}$$

$$E(U) = \sum_i \delta_i D_i + (1-\delta)\exp(\mu + \frac{1}{2}\sigma^2)$$

$$E(X_d) = mean\ of\ detected\ concentrations$$

$$Var(X_d) = variance\ of\ detected\ concentrations$$

The mean emission level, based on these percentile estimates, is estimated by:

$$E(X) = \sum_i \delta_i D_i + (1-\delta)\exp(\mu + \frac{1}{2}\sigma^2)$$

The estimated percentiles based on grab samples should, theoretically, be greater than the estimated percentiles based on 3-run averages. However, if the nondetected samples have large detection limit values relative to the detected concentrations, then the estimated percentiles based on grab samples may be smaller than the estimated percentiles based on 3-run averages. This is because the nondetect values are weighted more heavily in the grab sample-based estimation than in the 3-run average-based estimation in the modified delta-lognormal methodology. This can be seen by the use of δ (the percentage of nondetect values) in the grab sample estimation and δ^3, which is less than δ, in the 3-run average estimation.

2.1.2 Analysis of the 6% MACT Database

To estimate potential standards from the databases containing the best performing 6 percent of the devices, the methodology focusses on the highest emitting source in the data set. It can be argued that the highest emitting source in the best performing 6 percent of the devices is equivalent to the average of the sources in the best performing 12 percent. Therefore, the standard can be based upon an upper percentile estimate from the emission concentrations from the highest emitting source in the best performing 6 percent. In this analysis, the upper percentile selected on which to base the standard is the 99th percentile. The highest emitting source is determined by the average emissions concentration from each test condition.

Assuming that the emission concentrations follow a lognormal distribution within each test condition, the 99th percentile from the highest emitting source is estimated from the following parameters. Because, on average, data from only three runs were collected from each test condition, the modified delta-lognormal methodology cannot be applied. The variance of the detected samples (σ^2) cannot be calculated from test conditions with less than two detected samples, which is common with only three data points per test condition. Therefore, in this analysis, the nondetect samples were set equal to the detection limit. In this case, the resulting estimates will be the largest possible values, because it is known that the nondetect samples have associated concentrations less than or equal to the reported detection limit.

The 99th percentile based on the highest emitting source, assuming a lognormal distribution of emission concentrations within test conditions, requires estimates of the mean of the natural logarithm of the concentrations (μ) and the standard deviation (σ). The log-mean (μ) is estimated from the mean concentration at the highest emitting source. This is calculated by estimating the log-mean (μ_i) and the log-variance (σ_i^2) from the runs within that test condition. The test condition mean is estimated as:

$$E(X) = \exp(\mu_i + \frac{1}{2}\sigma_i^2)$$

and the log-mean (μ) is estimated as the natural logarithm of this mean.

The standard deviation is estimated from the pooled within-test condition variability across all test conditions below, and including, the highest emitting source. This is similar to the estimation of the standard deviation used in the analysis of the 12 percent databases, except that not all of the test conditions in the database are used in the calculation. The pooled variance is used to determine the 99th percentile so that the variation of the runs at only the highest emitting source does not influence the standard at which all devices will be regulated. If the highest emitting source has an extremely large variance in the three runs from the test condition, compared to all other devices and test conditions, then the 99th percentile would be excessively high. Alternatively, if the highest emitting had a tight variability in the three test condition runs, then the 99th percentile would be too restrictive compared to the test conditions with lower average emission levels.

The 99th percentile about the highest emitting source, based on 3-run average data, is then estimated as:

$$P_3 = \exp\left[\mu_3 + \Phi^{-1}(0.99)\cdot\sigma_3\right]$$

where,

$$\mu_3 = \log(E(U)) - \frac{1}{2}\sigma_3^2$$

$$\sigma_3^2 = \log\left[\frac{Var(U)}{3[E(U)]^2} + 1\right]$$

$$E(U) = \exp(\mu + \frac{1}{2}\sigma^2)$$

$$Var(U) = (\exp(\sigma) - 1)\cdot\exp(2\mu + \sigma)$$

Assuming that the data follow a lognormal distribution, and that the standard is set at the 99th percentile, then the expected mean emission level at which devices would need to operate in order to meet the standard 99 percent of the time is estimated as:

$$E(X) = \exp\{\log(P) + \frac{1}{2}\log(\frac{1}{3}\exp(\sigma^2) + \frac{2}{3}) - \Phi^{-1}(.99)\left[\log(\frac{1}{3}\exp(\sigma^2) + \frac{2}{3})\right]^{\frac{1}{2}}\}$$

2.1.3 Analysis of Beyond the Floor Technology Standards

This section presents a detailed description of the statistical methodology used to estimate the "adjusted" standards, based on predetermined design levels from "beyond the floor technologies." The intent of these statistical analyses is to estimate the emission standard based on the design level (expected mean) that is established by engineering judgement, while accounting for an increased variability with increased emission levels. The following methodology was used to estimate these "adjusted" standards.

Step 1. Apply 6% MACT data analysis methodology

The first step estimates the standard (99th percentile) and expected mean level, based on the highest emitting source in the database. This analysis is identical to the analysis of 6% MACT data. The analysis uses the pooled within-test condition variance to estimate the 99th percentile on the highest emitting source. The expected mean level (or design level) is the mean based on this 99th percentile estimate, using the pooled within-test condition variance, such that facilities operating at the expected level will operate below the estimated standard 99 percent of the time.

It is assumed that the emission concentrations follow a lognormal distribution within each test condition. Because, on average, data from only three runs were collected from each test condition, the modified delta-lognormal methodology cannot be applied. The variance of the detected samples (σ^2) cannot be calculated from test conditions with less than two detected samples, which is common with only three data points per test condition. Therefore, in this analysis, the nondetect samples were set equal to the detection limit. In this case, the resulting estimates will be the largest possible values, because it is known that the nondetect samples have associated concentrations less than or equal to the reported detection limit.

The 99th percentile based on the highest emitting source, assuming a lognormal distribution of emission concentrations within test conditions, requires estimates of the mean of the natural logarithm of the concentrations (μ) and the standard deviation (σ). The log-mean (μ) is estimated from the mean concentration at the highest emitting source. This is calculated by estimating the log-mean (μ_i) and the log-variance (σ_i^2) from the runs within that test condition. The test condition mean is estimated as:

$$E(X) = \exp(\mu_i + \frac{1}{2}\sigma_i^2)$$

and the log-mean (μ) is estimated as the natural logarithm of this mean.

The standard deviation is estimated from the pooled within-test condition variability across all test conditions below, and including, the highest emitting source. The pooled variance is used to determine the 99th percentile so that the variation of the runs at only the highest emitting source does not influence the standard at which all devices will be regulated.

The 99th percentile about the highest emitting source, based on 3-run average data, is then estimated as:

$$P = \exp\left[\mu_3 + \Phi^{-1}(0.99)\cdot\sigma_3\right]$$

where,

$$\mu_3 = \log(E(U)) - \frac{1}{2}\sigma_3^2$$

$$\sigma_3^2 = \log\left[\frac{Var(U)}{3[E(U)]^2} + 1\right]$$

$$E(U) = \exp(\mu + \frac{1}{2}\sigma^2)$$

$$Var(U) = (\exp(\sigma)-1)\cdot\exp(2\mu+\sigma)$$

Assuming that the data follow a lognormal distribution, and that the standard is set at the 99th percentile, then the expected mean emission level at which devices would need to operate in order to meet the standard 99 percent of the time is estimated as:

$$E(X) = \exp\{\log(P) + \frac{1}{2}\log(\frac{1}{3}\exp(\sigma^2) + \frac{2}{3}) - \Phi^{-1}(.99)\left[\log(\frac{1}{3}\exp(\sigma^2) + \frac{2}{3})\right]^{\frac{1}{2}}\}$$

This equation is derived from the equation for the 99th percentile, and solving for E[X] in terms of the variance (σ^2):

$$
\begin{aligned}
P_{99} &= \exp(\mu_3 + z_{.99} \cdot \sigma_3) \\
&= \exp\left(\log(E[X]) - \frac{1}{2}\sigma_3^2 + z_{.99} \cdot \sigma_3 \right) \\
&= \exp\left(\log(E[X]) - \frac{1}{2}\log\left[\frac{V(X)}{3 \cdot E[X]^2} + 1 \right] + z_{.99} \cdot \sqrt{\log\left[\frac{V(X)}{3 \cdot E[X]^2} + 1 \right]} \right) \\
&= \exp\left(\log(E[X]) - \frac{1}{2}\log\left[\frac{1}{3}\exp(\sigma^2) + \frac{2}{3} \right] + z_{.99}\left[\log(\frac{1}{3}\exp(\sigma^2) + \frac{2}{3}) \right]^{\frac{1}{2}} \right)
\end{aligned}
$$

where

$$V(X) = (\exp(\sigma^2) - 1) \cdot \exp(2\mu + \sigma^2)$$

Step 2. Repeat 6% MACT data analysis on every test condition

Once the estimated standards are established in Step 1, the relationship between the mean and the pooled variance is estimated by calculating the pooled variance and the associated expected mean level for every test condition in the database. This uses the same methodology as the estimates from the 6% MACT data, but calculates the estimates for each individual test condition. For each iteration, the pooled variance is calculated from all test conditions with average emissions below the current test condition. This results in a pooled variance (σ^2_i) and expected mean ($E[X_i]$) for every test condition (I).

Step 3. Establish the relationship between the mean and the variance

The relationship between the pooled within-test condition variance (σ^2) and the expected mean level (E[X]) is modeled by the regression equation:

$$\sigma_i^2 = \alpha + \beta \cdot E[X]_i$$

Step 4. Estimation of adjusted standards

Using the regression equation from Step 3, the "adjusted" pooled variance (σ^{2*}) is estimated from the predetermined design level ($E[X]^*$).

$$\sigma^{2*} = \hat{\alpha} + \hat{\beta} \cdot E[X]^*$$

This adjustment accounts for the increase in variance with an increase in mean emission levels. The adjusted variance (σ^{2*}) and the predetermined mean level ($E[X]^*$) are used to estimate the 99th percentile (P^*) associated with the predetermined design level:

$$P^* = \exp(\mu_3^* + \Phi^{-1}(.99)\cdot\sigma_3^*)$$

where

$$\mu^* = \log(E[X]^*) - \frac{1}{2}\sigma^{2*}$$

$$V[X]^* = (\exp(\sigma^{2*})-1)\cdot\exp(2\mu^*+\sigma^{2*})$$

$$\sigma_3^{2*} = \log\left(\frac{V[X]^*}{3(E[X]^*)^2}+1\right)$$

$$\mu_3^* = \log(E[X]^*) - \frac{1}{2}\sigma_3^{2*}$$

2.2 Supplementary Analyses

Apart from the two primary statistical analyses described above, additional analyses were conducted to support the development of emission standards and to assess the statistical properties of the emission standards. Potential emission standards were estimated from the test conditions with emission levels below the engineering-based "breakpoint" level. The statistical properties of the standard based on the "breakpoint" analysis were examined, as were the potential standards based on specific percentile test conditions. Potential emission standards also were estimated from test conditions that were selected without using the maximum theoretical emission concentrations (non-MTEC).

2.2.1 Analysis of Breakpoint Facilities

The Agency used an engineering-based approach for establishing potential emission standards, called the "breakpoint analysis". The approach used the 6% MACT database to identify the emission level below which the majority of the test conditions were operating at a similar emission level. This "breakpoint" emission level was established by examining plots of the test conditions ranked by ascending average emission levels and identifying the highest emitting test condition prior to a large increase in average emissions. The second derivative of the lines fit between adjacent test condition emission means were also examined to identify the test condition at which there was a large increase in the average emissions.

Statistical analyses were conducted to assess the emission standard that was based on the breakpoint analysis. This statistical analysis used the 6% MACT data to estimated the 99th percentile emission concentration based on the average emissions of the "breakpoint facility". The breakpoint facility is defined as the highest emitting test condition below the established breakpoint. Based on the estimated 99th percentile of the breakpoint facility, the average emission level is estimated such that facilities operating at this average emissions level should expect to meet the emission standard 99 percent of the time. The expected mean levels are estimated based on the assumption that the limitation on 3-run averages is set equal to the 99th percentile of the breakpoint facility. The statistical methodology for calculating these estimates is similar to the analysis of the highest emitting source in the 6% databases, except that only test conditions below the breakpoint are used, rather than all test conditions in the 6% MACT database. These analyses assume a lognormal distribution of emission concentrations and use a within-test condition variation pooled across all facilities below the breakpoint level.

Potential emission standards also were estimated from the 6% MACT databases, using only the test conditions with emission levels below the breakpoint. These analyses are similar to the analyses of the 12% MACT databases, but are restricted to the test conditions below the breakpoint selected from the best performing 6% of the population, rather than from the best performing 12% of the population.

2.2.2 Analysis of Percentile Facilities

Potential emission standards were estimated based on percentile facilities, similar to the estimation based on the maximum facilities. The 50th percentile (median), 75th percentile, 90th percentile, and 99th percentile test conditions were determined based on the average emissions at each test condition. The test condition emission averages were estimated assuming a lognormal distribution of emission concentrations within each test condition. The 50th, 75th, 90th, and 95th percentiles of these test condition means were estimated, also assuming that the test condition averages follow a lognormal distribution. At each of the percentiles, emission percentiles (90th, 95th, and 99th) were calculated similar to the analysis of the highest emitting device. The log-mean (μ) for calculating the emission percentiles was calculated from the natural logarithm of the test condition percentile. The log-variance (σ^2) was calculated from the within-test condition variation pooled across all facilities.

2.2.3 Analysis of Non-MTEC Database

Test conditions that were selected without using maximum theoretical emission concentrations (non-MTEC) were used to establish potential emission standards similar to the analysis of the Full-MTEC data. The emission standards were estimated as the upper percentiles from the complete database, similar to the analysis of the 12% Full-MTEC data. However, the Non-MTEC database contained only the best performing 6% of the population.

3. RESULTS

This section presents results from the statistical analysis of the 12% and 6% MACT databases that are described in Sections 2.1.1 and 2.1.2. There are two primary sets of analyses in this section. The first analysis estimates upper percentile emission concentrations from the best performing 12 percent of the devices and the estimated average emission level at which the devices should operate at so that they do not exceed the percentile limit a specified percentage of the time. The second analysis estimates the 99th percentiles on emission concentrations based on the highest emitting source among the best performing 6 percent of the devices. Again, the average emission level at which the devices should operate at so that they do not exceed the percentile limit 99 percent of the time is estimated. The estimated percentiles in these analyses are based on 3-run average data.

The analyses of the 12% databases include analyses of existing sources in the Full-MTEC and Hazardous Waste Only-MTEC databases and on selected subsets of the test conditions within each of these databases. The analyses of the 6% databases include analyses of existing sources in the Full-MTEC and Hazardous Waste Only-MTEC databases and on selected subsets of the test conditions within each of these databases. Analyses similar to the analyses of the 12% and the 6% databases were conducted on new sources from the Full-MTEC and Hazardous Waste Only-MTEC databases.

Analyses also were performed on the 6%, 12%, and new source data sets using a revised set of mercury data using only flue gas emissions measurements and hazardous waste MTECs. Additional analyses were performed on "beyond the floor technologies" that determine the estimated 99th percentile emission standard based on a design level established by engineering analyses.

3.1 Analysis of Existing Sources from 12% Full-MTEC Data

Table 1 presents estimated percentiles for emissions from the 12% Full-MTEC database, based on 3-run average data. The estimated 90th, 95th, and 99th percentiles are based on the average emission concentrations. The estimated mean represents the emission level at which facilities should operate in order to meet the standard a given percentage of the time, corresponding to the percentile used for the emission standard. That is, if the 99th percentile estimate is used to establish the emission standard, then the estimated mean is the level at which facilities should operate in order to meet the standard 99 percent of the time.

Estimates for semi-volatile metals (SVM) from light weight aggregate kilns (LWAKs) were calculated twice; once using all test conditions, and a second time with test conditions 307C1, 307C2, 307C3, and 307C4 combined as a single test condition.

Additional analyses were conducted on a subset of test conditions for mercury and HCl from cement kilns and light weight aggregate kilns (LWAKs). Table 2a lists the test conditions used in this analysis, and the estimated percentiles are presented in Table 2b.

Table 1.

Estimated Percentiles from 12% Full MTEC Data
Using the Complete Data Set
(Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Total Chlorine (ppmv)	INC	26	50	158	91.8	8.61	14.20	16.89	23.42
HCl (ppmv)	CK	28	38	133	96.2	11.06	17.02	19.66	25.78
HCl (ppmv)	INC	31	66	213	91.5	5.41	9.37	11.41	16.52
HCl (ppmv)	LWAK	7	10	33	100.0	1256.76	1572.40	1684.00	1915.16
HCl (ppmv)**	LWAK	7	7	33	100.0	1297.51	1719.33	1877.76	2215.36
LVM (µg/dscm)	CK	20	27	89	77.5	21.20	33.17	38.63	51.42
LVM (µg/dscm)	INC	10	22	66	84.8	28.47	42.29	48.15	61.44
LVM (µg/dscm)	LWAK	9	9	27	100.0	36.67	46.00	49.30	56.16
Mercury (µg/dscm)	CK	24	31	111	79.3	36.55	48.38	52.74	62.00
Mercury (µg/dscm)	INC	16	29	82	61.0	5.73	9.35	11.20	15.69
Mercury (µg/dscm)	LWAK	7	7	21	57.1	12.50	17.49	19.41	23.55
Particulate Matter (gr/dscf)	CK	20	33	118	100.0	0.024	0.033	0.036	0.043
Particulate Matter (gr/dscf)	INC	57	142	446	99.8	0.012	0.017	0.020	0.024
Particulate Matter (gr/dscf)	LWAK	11	14	44	100.0	0.006	0.009	0.010	0.012
SVM (µg/dscm)	CK	21	29	103	68.9	91.73	147.84	173.98	235.95
SVM (µg/dscm)	INC	12	18	58	75.9	21.62	33.99	39.73	53.21
SVM (µg/dscm)	LWAK	9	12	39	100.0	28.00	39.70	44.43	54.88
SVM (µg/dscm)**	LWAK	9	9	39	100.0	28.85	42.37	48.06	60.87
D/F TEQ (ng/dscm)	INC	19	39	123	92.7	0.12	0.17	0.20	0.25

D/F TEQ (ng/dscm)	KILNS	13	20	57	96.5	0.14	0.18	0.20	0.23

* Estimated from a modified delta-lognormal distribution.
** Test conditions 307C1, 307C2, 307C3, and 307C4 collapsed into a single test condition.

Table 2a.
Subset of Test Conditions from the 12% Full MTEC Data

HAP	Cement Kilns	LWAKs
Mercury	202C1 317C1 317C2 315C1 315C2 323C1 203C1	225C1 224C1 310C1 312C1 223C1
HCl	317C3 317C2 317C1 320C1 305C3 205C1 208C1	225C1 310C1 227C1 311C1 314C1

Table 2b.
Estimated Percentiles from the Subset of 12% Full MTEC Existing Sources
(Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	5	7	22	100.0	4.09	5.02	5.34	6.01
HCl (ppmv)	LWAK	5	5	15	100.0	1204.15	1325.33	1363.00	1436.57
Mercury (µg/dscm)	CK	5	7	22	81.8	26.75	33.11	38.17	44.64

Mercury (µg/dscm)	LWAK	5	5	15	80.0	14.38	18.14	19.47	22.22

* Estimated from a modified delta-lognormal distribution.

3.2 Analysis of Existing Sources from 12% HW-MTEC Data

Table 3 presents estimated percentiles for emissions from the 12% HW-MTEC database, based on 3-run average data. The estimated 90th, 95th, and 99th percentiles are based on the average emission concentrations. The estimated mean represents the emission level at which facilities should operate in order to meet the standard a given percentage of the time, corresponding to the percentile used for the emission standard. That is, if the 99th percentile estimate is used to establish the emission standard, then the estimated mean is the level at which facilities should operate in order to meet the standard 99 percent of the time.

Estimates for semi-volatile metals (SVM) from light weight aggregate kilns (LWAKs) were calculated twice; once using all test conditions, and a second time with test conditions 307C1, 307C2, 307C3, and 307C4 combined as a single test condition.

Additional analyses were conducted on a subset of test conditions for mercury and HCl from cement kilns and light weight aggregate kilns (LWAKs). Table 4a lists the test conditions used in this analysis, and the estimated percentiles are presented in Table 4b.

Table 3.

Estimated Percentiles from 12% Hazardous Waste MTEC Data Using the Complete Data Set (Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Total Chlorine (ppmv)	CK	26	38	130	96.2	10.82	16.56	19.10	24.94
Total Chlorine (ppmv)	LWAK	7	10	33	100.0	1252.12	1539.65	1639.52	1844.65
HCl (ppmv)	CK	26	37	129	96.1	8.97	13.88	16.08	21.19
HCl (ppmv)	LWAK	7	10	33	100.0	1256.76	1572.40	1684.00	1915.16
HCl (ppmv)**	LWAK	7	7	33	100.0	1297.51	1719.33	1877.76	2215.36
LVM (µg/dscm)	CK	20	27	89	77.5	19.12	29.76	34.60	45.91
LVM (µg/dscm)	LWAK	8	8	24	100.0	36.44	46.18	49.67	56.95
Mercury (µg/dscm)	CK	25	31	108	83.3	37.62	49.97	54.57	64.38
Mercury (µg/dscm)	LWAK	9	10	27	66.7	13.89	18.78	20.61	24.50
SVM (µg/dscm)	CK	21	29	103	68.9	91.73	147.84	173.98	235.95
SVM (µg/dscm)	LWAK	9	12	39	100.0	28.00	39.70	44.43	54.88
SVM (µg/dscm)**	LWAK	9	9	39	100.0	28.85	42.37	48.06	60.87

* Estimated from a modified delta-lognormal distribution.
** Test conditions 307C1, 307C2, 307C3, and 307C4 collapsed into a single test condition.

Table 4a.
Subset of Test Conditions from the 12% HW-MTEC Data

HAP	Cement Kilns	LWAKs
Mercury	208C2 317C1 317C2 204C1 207C2 319C1	225C1 224C1 227C1 310C1 312C1
HCl	317C1 317C2 202C1 320C1 315C2 208C1	227C1 310C1 225C1 311C1 314C1

Table 4b.
Estimated Percentiles from the Subset of 12% HW-MTEC Existing Sources
(Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	5	6	19	89.5	2.84	3.75	4.08	4.80
HCl (ppmv)	LWAK	5	5	15	100.0	1204.15	1325.33	1363.00	1436.57
Mercury (µg/dscm)	CK	5	6	24	100.0	56.15	60.64	62.01	64.66
Mercury (µg/dscm)	LWAK	5	5	15	80.0	14.39	18.16	19.49	22.26

* Estimated from a modified delta-lognormal distribution.

3.3 Analysis of Existing Sources from 6% Full-MTEC Data

Table 5 presents the estimated 99th percentile based on emissions from the highest emitting device in the 6% Full-MTEC database, based on 3-run average data. The estimated mean represents the emission level at which facilities should operate in order to meet the standard, based on the 99th percentile, 99 percent of the time.

Additional analyses were conducted on a subset of test conditions for mercury and HCl from cement kilns and light weight aggregate kilns (LWAKs). Table 6a lists the test conditions used in this analysis, and the estimated percentiles are presented in Table 6b.

Table 7 presents 99th percentile and mean emission level estimates for cement kilns similar to those presented in Table 5, but the cement kilns are subcategorized by process (i.e., wet and dry processes).

Table 5.

Estimated 99th Percentiles on the Highest Emitting Source from Existing Sources in the 6% Full-MTEC Data (Based on 3-Run Averages)

HAP	Source	Maximum Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
Total Chlorine (ppmv)	INC	714C1	275.22	96.30
HCl (ppmv)	CK	319C6	435.61	183.72
HCl (ppmv)	INC	325C7	62.33	21.76
HCl (ppmv)	LWAK	227C1	2165.59	1397.55
LVM (µg/dscm)	CK	207C1	93.26	38.40
LVM (µg/dscm)	INC	221C4	208.21	107.50
LVM (µg/dscm)	LWAK	313C1	437.41	299.62
Mercury (µg/dscm)	CK	323C1	50.81	38.19
Mercury (µg/dscm)	INC	902C1	101.38	53.46
Mercury (µg/dscm)	LWAK	223C1	77.79	37.12
Particulate Matter (gr/dscf)	CK	30153	0.065	0.032
Particulate Matter (gr/dscf)	INC	503C2	0.107	0.038
Particulate Matter (gr/dscf)	LWAK	314C1	0.049	0.024
SVM (µg/dscm)	CK	317C2	53.34	31.39
SVM (µg/dscm)	INC	221C1	272.06	120.39
SVM (µg/dscm)	LWAK	307C2	11.55	7.45

D/F TEQ (ng/dscm)	INC	330C2	39.96	19.50
D/F TEQ (ng/dscm)	Kilns	203C1	7.96	4.73
D/F Total (ng/dscm)	INC	330C2	694.81	359.04
D/F Total (ng/dscm)	Kilns	323C51	147.65	92.88

Table 6a.
Subset of Test Conditions from the 6% Full-MTEC Data

HAP	Cement Kilns	LWAKs
Mercury	202C1 317C1 317C2 315C1	225C1 224C1 310C1
HCl	317C3 317C1 320C1 305C3	225C1 310C1 227C1

Table 6b.
Estimated 99th Percentiles on the Highest Emitting Source from the Subset of 6% Full MTEC Existing Sources (Based on 3-Run Averages)

HAP	Source	Maximum Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
HCl (ppmv)	CK	317C3	9.16	7.02
HCl (ppmv)	LWAK	227C1	1667.01	1339.82
Mercury (µg/dscm)	CK	315C1	39.41	34.60
Mercury (µg/dscm)	LWAK	224C1	25.03	16.41

Table 7.

Estimated 99th Percentile on the Highest Emitting Source from Existing Sources in the 6% Full-MTEC Data Subcategorized by Cement Kiln Process (Wet/Dry)

HAP	Source	Kiln Process	Maximum Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
D/F TEQ (ng/dscm)	CK	Dry	317C3	3.78	1.62
D/F TEQ (ng/dscm)	CK	Wet	203C1	8.02	4.74
LVM (µg/dscm)	CK	Dry	202C2	48.80	31.12
LVM (µg/dscm)	CK	Wet	319C1	224.64	79.91
Mercury (µg/dscm)	CK	Dry	303C3	150.38	84.62
Mercury (µg/dscm)	CK	Wet	319C1	82.95	57.95
Particulate Matter (gr/dscf)	CK	Dry	30153	0.065	0.032
Particulate Matter (gr/dscf)	CK	Wet	205C1	0.075	0.052
SVM (µg/dscm)	CK	Dry	303C3	57.49	34.12
SVM (µg/dscm)	CK	Wet	207C1	867.47	522.95
Total Chlorine (ppmv)	CK	Dry	335C1	342.62	147.59
Total Chlorine (ppmv)	CK	Wet	319C6	457.90	246.80

3.4 Analysis of Existing Sources from 6% HW-MTEC Data

Table 8 presents the estimated 99th percentile based on emissions from the highest emitting device in the 6% HW-MTEC database, based on 3-run average data. The estimated mean represents the emission level at which facilities should operate in order to meet the standard, based on the 99th percentile, 99 percent of the time.

The analyses of total chlorine and low volatile metals (LVM) from cement kilns were performed twice: once on the complete data set, and secondly after removing a single test condition (319C6 from total chlorine and 207C2 from LVM) because they contained possible outlier concentrations. Semi-volatile metals (SVM) from cement kilns were additionally analyzed using ESPs as equivalent technology (i.e., MACT was redefined using ESPs with SCA>500 as equivalent technology to FFs with A/C>2).

Additional analyses were conducted on a subset of test conditions for mercury and HCl from cement kilns and light weight aggregate kilns (LWAKs). Table 9a lists the test conditions used in this analysis, and the estimated percentiles are presented in Table 9b.

Table 8.

Estimated 99th Percentiles on the Highest Emitting Source from Existing Sources in the 6% HW-MTEC Data (Based on 3-Run Averages)

HAP	Source	Maximum Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
Total Chlorine (ppmv)	CK	319C6	634.68	271.86
Total Chlorine (ppmv)[a]	CK	305C1	442.09	188.25
Total Chlorine (ppmv)	LWAK	227C1	2072.29	1386.05
HCl (ppmv)	CK	305C1	436.98	186.94
HCl (ppmv)	LWAK	227C1	2165.59	1397.55
LVM (µg/dscm)	CK	319C1	175.24	73.33
LVM (µg/dscm)[b]	CK	319C1	128.80	66.78
LVM (µg/dscm)	LWAK	314C1	340.41	228.74
Mercury (µg/dscm)	CK	208C2	144.94	110.17
Mercury (µg/dscm)	LWAK	336C1	1763.30	909.08
SVM (µg/dscm)	CK	303C3	57.49	34.12
SVM (µg/dscm)[c]	CK	308C1	155.71	98.52
SVM (µg/dscm)	LWAK	307C2	11.55	7.45

[a]Test condition 319C6 removed from the data set as a possible outlier.
[b]Test condition 207C2 removed from the data set as a possible outlier.
[c]MACT redefined using ESPs as equivalent technology.

Table 9a.
Subset of Test Conditions from the 6% HW-MTEC Data

HAP	Cement Kilns	LWAKs
Mercury	208C2 317C1 317C2 204C1	225C1 224C1 227C1
HCl	317C1 317C2 202C1 320C1	227C1 310C1 225C1

Table 9b.
Estimated 99th Percentiles on the Highest Emitting Source
from the Subset of 6% HW-MTEC Existing Sources
(Based on 3-Run Averages)

HAP	Source	Maximum Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
HCl (ppmv)	CK	317C2	6.38	3.70
HCl (ppmv)	LWAK	227C1	1667.01	1339.82
Mercury (µg/dscm)	CK	208C2	128.82	108.69
Mercury (µg/dscm)	LWAK	227C1	25.45	17.65

3.5 Analysis of New Sources from Full-MTEC Data

Tables 10 and 11 present estimated percentiles for emissions from the new sources in the Full-MTEC database, based on 3-run average data. Table 10 presents the estimated 90th, 95th, and 99th percentiles that are based on the average emission concentrations from the complete database. The estimated mean represents the emission level at which facilities should operate in order to meet the standard a given percentage of the time, corresponding to the percentile used for the emission standard. That is, if the 99th percentile estimate is used to establish the emission standard, then the estimated mean is the level at which facilities should operate in order to meet the standard 99 percent of the time.

Table 11 presents the estimated 99th percentile based on emissions from the highest emitting device among the new sources in the Full-MTEC database, based on 3-run average data. The estimated mean represents the emission level at which facilities should operate in order to meet the standard, based on the 99th percentile, 99 percent of the time.

Table 10.

Percentile Estimates Based on Average Emissions from New Sources in the Full-MTEC Data (Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Total Chlorine (ppmv)	INC	20	36	112	95.5	13.00	21.38	25.42	35.17
HCl (ppmv)	CK	21	27	90	94.4	12.32	19.91	23.49	32.03
HCl (ppmv)	INC	6	12	42	90.5	4.23	7.74	9.69	14.78
HCl (ppmv)	LWAK	1	1	15	100.0	26.03	37.60	42.38	53.05
LVM (µg/dscm)	CK	5	7	21	57.1	11.19	15.29	17.43	22.23
LVM (µg/dscm)	INC	3	5	15	80.0	25.05	39.89	46.73	62.88
LVM (µg/dscm)	LWAK	8	8	24	100.0	35.84	43.86	46.64	52.32
Mercury (µg/dscm)	CK	6	9	31	67.7	21.87	30.94	34.36	41.81
Mercury (µg/dscm)	INC	11	20	57	71.9	7.18	10.85	12.55	16.47
Mercury (µg/dscm)	LWAK	6	6	18	66.7	12.05	17.22	19.23	23.63
Particulate Matter (gr/dscf)	CK	6	13	42	100.0	0.016	0.023	0.026	0.033
Particulate Matter (gr/dscf)	INC	13	34	104	99.0	0.003	0.005	0.005	0.007
Particulate Matter (gr/dscf)	LWAK	8	8	23	100.0	0.006	0.009	0.011	0.014
SVM (µg/dscm)	CK	3	3	9	66.7	15.50	21.74	24.63	31.13
SVM (µg/dscm)	INC	8	11	35	60.0	23.74	38.54	46.02	64.11
SVM (µg/dscm)	LWAK	2	2	6	100.0	2.54	2.90	3.02	3.25

* Estimated from a modified delta-lognormal distribution.

Table 11.

Estimated 99th Percentiles on the Highest Emitting Source from New Sources in the Full-MTEC Data (Based on 3-Run Averages)

HAP	Source	Maximum Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
Total Chlorine (ppmv)	INC	319C6	634.68	271.86
HCl (ppmv)	CK	319C6	449.83	185.68
HCl (ppmv)	INC	325C7	72.31	23.00
HCl (ppmv)	LWAK	307C1	59.56	33.31
LVM (µg/dscm)	CK	303C1	44.29	25.87
LVM (µg/dscm)	INC	221C4	259.22	114.74
LVM (µg/dscm)	LWAK	313C1	437.41	299.62
Mercury (µg/dscm)	CK	323C1	50.81	38.19
Mercury (µg/dscm)	INC	902C1	115.45	55.47
Mercury (µg/dscm)	LWAK	223C1	77.79	37.12
Particulate Matter (gr/dscf)	CK	30153	0.066	0.032
Particulate Matter (gr/dscf)	INC	351C4	0.039	0.017
Particulate Matter (gr/dscf)	LWAK	314C1	0.054	0.025
SVM (µg/dscm)	CK	317C3	50.19	30.87
SVM (µg/dscm)	INC	221C1	244.06	116.37
SVM (µg/dscm)	LWAK	224C1	5.15	4.03

3.6 Analysis of New Sources from HW-MTEC Data

Tables 12 and 13 present estimated percentiles for emissions from the new sources in the HW-MTEC database, based on 3-run average data. Table 12 presents the estimated 90th, 95th, and 99th percentiles that are based on the average emission concentrations from the complete database. The estimated mean represents the emission level at which facilities should operate in order to meet the standard a given percentage of the time, corresponding to the percentile used for the emission standard. That is, if the 99th percentile estimate is used to establish the emission standard, then the estimated mean is the level at which facilities should operate in order to meet the standard 99 percent of the time.

Table 13 presents the estimated 99th percentile based on emissions from the highest emitting device among the new sources in the HW-MTEC database, based on 3-run average data. The estimated mean represents the emission level at which facilities should operate in order to meet the standard, based on the 99th percentile, 99 percent of the time.

Table 12.

Percentile Estimates Based on Average Emissions from New Sources in the HW-MTEC Data (Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Total Chlorine (ppmv)	CK	23	33	107	95.3	9.73	15.34	17.90	23.93
Total Chlorine (ppmv)	LWAK	1	4	15	100.0	26.28	34.71	37.86	44.57
HCl (ppmv)	CK	25	34	117	95.7	7.31	11.54	13.47	18.02
HCl (ppmv)	LWAK	1	1	15	100.0	26.03	37.60	42.38	53.05
LVM (µg/dscm)	CK	5	7	21	57.1	11.19	15.29	17.43	22.23
LVM (µg/dscm)	LWAK	5	5	15	100.0	24.85	30.86	32.97	37.31
Mercury (µg/dscm)	CK	14	20	72	84.7	31.97	41.57	45.07	52.43

Mercury (µg/dscm)	LWAK	8	9	24	75.0	13.72	18.78	20.70	24.83
SVM (µg/dscm)	CK	3	4	12	75.0	16.69	22.60	25.01	30.23
SVM (µg/dscm)	LWAK	2	2	6	100.0	2.54	2.90	3.02	3.25

* Estimated from a modified delta-lognormal distribution.

Table 13.

Estimated 99th Percentiles on the Highest Emitting Source from New Sources in the HW-MTEC Data (Based on 3-Run Averages)

HAP	Source	Maximum Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
Total Chlorine (ppmv)	CK	319C6	634.68	271.86
Total Chlorine (ppmv)	LWAK	307C1	61.80	36.43
HCl (ppmv)	CK	305C1	436.98	186.94
HCl (ppmv)	LWAK	307C1	59.56	33.31
LVM (µg/dscm)	CK	303C1	44.29	25.87
LVM (µg/dscm)	LWAK	312C1	54.80	36.49
Mercury (µg/dscm)	CK	208C2	144.94	110.17
Mercury (µg/dscm)	LWAK	336C1	1763.30	909.08
SVM (µg/dscm)	CK	303C3	53.71	33.60
SVM (µg/dscm)	LWAK	224C1	5.15	4.03

3.7 Analysis of Mercury Considering Only Flue Gas Emissions

Table 14 presents estimated standards from revised mercury data considering only flue gas emissions measurements and hazardous waste MTECs. These analyses correspond to the analyses of hazardous waste MTEC data in Sections 3.2, 3.4, and 3.6, but are based on a revised data set. The estimated 99th percentiles are based on the average emission concentrations from the complete database. The estimated mean represents the emission level at which facilities should operate in order to meet the standard a given percentage of the time, corresponding to the percentile used for the emission standard. That is, if the 99th percentile estimate is used to establish the emission standard, then the estimated mean is the level at which facilities should operate in order to meet the standard 99 percent of the time.

Table 14.
Estimated Standards from Revised Mercury Data
Considering Only Flue Gas Emissions and HW-MTECs

MERCURY (μg/dscm)			
Source	**Data**	**Estimated Mean**	**Estimated 99th Percentile**
Incinerators	6% Existing	57.30	128.40
	12% Existing	5.57	12.59
	New (Average-based)	5.03	11.62
	New (Based on Highest Source)	58.11	134.18
Cement Kilns	6% Existing	81.35	126.71
	12% Existing	20.65	32.16
	New (Average-based)	19.37	27.39
	New (Based on Highest Source)	57.81	81.72
LWA Kilns	6% Existing	36.30	72.06
	12% Existing	16.77	32.27

3.8 Analysis of Beyond the Floor Technology Standards

Table 15 presents the estimated emission standards for "beyond the floor technologies." The intent of these statistical analyses is to estimate the emission standard based on the design level (expected mean) that is established by engineering judgement. The concern about calculating the standard corresponding to the predetermined design level is that it appears from data plots that the variability increases with increased emission levels. The following methodology was used to estimate these "adjusted" standards. Details regarding the statistical methodology are presented in Section 2.1.3.

First, the standard (99th percentile) and expected mean level were estimated, based on the highest emitting source in the database. This analysis is identical to the analysis of 6% MACT data. The analysis uses the pooled within-test condition variance to estimate the 99th percentile on the highest emitting source. The expected mean level (or design level) is the mean based on this 99th percentile estimate, using the pooled within-test condition variance, such that facilities operating at the expected level will operate below the estimated standard 99 percent of the time. These estimates are reported in Table 15 under "estimated standards".

Once the estimated standards are established, the relationship between the mean and the pooled variance is estimated by calculating the pooled variance and the associated expected mean level for every test condition in the database. This uses the same methodology as the estimates from the 6% MACT data, but calculates the estimates for each individual test condition. For each iteration, the pooled variance is calculated from all test conditions with average emissions below the current test condition. The relationship between the pooled variance and the expected mean level is modelled by the equation:

$$\text{Pooled variance} = \alpha + \beta * \text{Mean}.$$

The predetermined design level is plugged into this equation as the mean to establish an "adjusted" within-test condition variance. This accounts for the increase in variance with an increase in mean emission levels. The adjusted variance and the predetermined mean level are used to estimate the 99th percentile associated with the predetermined design level. These estimates are reported in Table 15 under "adjusted standards".

The specific data sets that were used for the analyses of the beyond the floor technologies, and the predetermined design levels, are listed below.

Mercury

- Design level: 30 µg/dscm

  Data set 1: Test conditions using carbon injection.

  Data set 2: All existing sources from the 6% MACT pool database, plus the test conditions from the carbon injection data used in data set 1. The data from the 6% MACT pool database were aggregated across all three sources (cement kilns, LWAKs, and incinerators).

- Design level: 5 µg/dscm

  Data set 1: Test conditions using carbon injection.

  Data set 2: All existing sources from the 6% MACT pool database, plus the test conditions from the carbon injection data used in data set 1. The data from the 6% MACT pool database were aggregated across all three sources (cement kilns, LWAKs, and incinerators).

PCDD/PCDF TEQ

- Design level: 0.2 ng/dscm

  Data set 1: All test conditions using carbon injection from hazardous waste, MWC, and MWI burners. The TEQ value of 0.27 ng/dscm from the WTI facility and test condition "Aug 93" was deleted from the data because it was identified by the reporting facility as an outlier due to contamination of the sample.

  Data set 2: All existing sources, except facility #222, from the 6% MACT pool database, plus the test conditions from the carbon injection data used in data set 1. Facility #222 was deleted from the 6% MACT pool data set because it also is represented in the carbon injection data set. The data from the 6% MACT pool database were aggregated across all sources (kilns and incinerators).

SVM

- Design level: 35 µg/dscm

  Data set: All new sources using incinerators in the 6% MACT pool database.

LVM

- Design level: 35 µg/dscm

  Data set: All new sources using incinerators in the 6% MACT pool database.

Total Chlorine

- Design level: 25 ppmv

  Data set: All existing sources using incinerators with wet scrubbers.

- Design level: 210 ppmv

  Data set: All existing sources using cement kilns. These estimates are used to set standards on LWAKs.

Table 15.
Estimated Standards and Adjusted Standards for Beyond the Floor Technologies

Pollutant/Data Set	Number of Test Conditions	Estimated Standards		Adjusted Standards[a]	
		Design Level (Mean)	Standard (99th Percentile)	Design Level (Mean)	Standard (99th Percentile)
MERCURY (µg/dscm) Test conditions using carbon injection	11	507.56	1,246.01	30	49.98
				5	8.02
MERCURY (µg/dscm) Existing sources from 6% MACT pool (incinerators, CKs, and LWAKs) plus test conditions using carbon injection	54	263.14	520.44	30	55.64
				5	9.23
PCDD/PCDF TEQ (ng/dscm) Hazardous waste, MWC, and MWI burners using carbon injection	11	0.28	0.43	0.2	0.31
PCDD/PCDF TEQ (ng/dscm) Existing sources from 6% MACT pool (incinerators and kilns) plus hazardous waste, MWC, and MWI burners using carbon injection	63	18.73	34.53	0.2	0.32

Table 15. (Continued)
Estimated Standards and Adjusted Standards for Beyond the Floor Technologies

Pollutant/Data Set	Number of Test Conditions	Estimated Standards		Adjusted Standards[a]	
		Design Level (Mean)	Standard (99th Percentile)	Design Level (Mean)	Standard (99th Percentile)
SVM (µg/dscm) New sources from 6% MACT pool using incinerators	11	116.37	244.06	35	62.04
LVM (µg/dscm) New sources from 6% MACT pool using incinerators	5	114.74	259.22	35	59.50
TOTAL CHLORINE (ppmv) Existing sources using incinerators with wet scrubbers	135	596.75	1,691.84	25	67.31
TOTAL CHLORINE (ppmv) Existing sources using cement kilns (to be used for LWAK standards)	51	256.55	526.10	210	454.59

[a]Adjusted standards based on predetermined design level and adjusted within-test condition variance.

4. RESULTS FROM SUPPLEMENTARY ANALYSES

In addition to the primary statistical analyses of the 12% and 6% databases that are presented in Section 3, supplementary analyses were conducted to support the development of emission standards and to assess the statistical properties of the emission standards. Potential emission standards were estimated from the test conditions with emission levels below the engineering-based "breakpoint" level. The statistical properties of the standard based on the "breakpoint" analysis were examined, as were the potential standards based on specific percentile test conditions. Potential emission standards also were estimated from test conditions that were selected without using the maximum theoretical emission concentrations (non-MTEC). Results from these supplementary analyses are presented in this section.

4.1 Analysis of 6% Non-MTEC Data

The following tables present estimated percentiles for emissions from the 6% Non-MTEC database, based on 3-run average data. Tables 16a and 16b present estimates from existing sources; Tables 17a and 17b present estimates from new sources. The estimated percentiles that are presented in Part A of each table are based on grab samples (or single run data). The estimated percentiles that are presented in Part B of each table are based on 3-run average data. The analyses are similar to those performed for the 12% Full-MTEC database in Section 3.1. The estimated mean represents the emission level at which facilities should operate in order to meet the standard a given percentage of the time, corresponding to the percentile used for the emission standard. That is, if the 99th percentile estimate is used to establish the emission standard, then the estimated mean is the level at which facilities should operate in order to meet the standard 99 percent of the time.

Table 16a.

Estimated Percentiles from Existing Sources in the Non-MTEC Data (Based on Grab Samples)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Chlorine (ppmv)	CK	34	49	164	54.3	0.25	0.50	0.64	1.00
Chlorine (ppmv)	INC	17	38	127	82.7	0.43	0.80	0.98	1.43
Chlorine (ppmv)	LWAK	3	6	21	100.0	0.41	0.78	1.00	1.58
HCl (ppmv)	CK	34	52	179	96.6	18.16	32.49	39.93	58.71
HCl (ppmv)	INC	33	73	227	79.7	4.30	8.46	10.96	17.70
HCl (ppmv)	LWAK	3	6	21	100.0	24.58	37.37	42.97	55.85
LVM (µg/dscm)	CK	25	33	111	78.4	19.51	34.76	45.30	73.73
LVM (µg/dscm)	INC	33	61	192	92.7	62.75	110.27	134.63	195.35
LVM (µg/dscm)**	INC**	32	60	189	92.6	53.39	93.50	114.31	166.27
LVM (µg/dscm)	LWAK	8	8	24	100.0	35.84	49.75	55.24	67.23
Mercury (µg/dscm)	CK	32	43	154	81.8	47.34	80.39	94.45	127.18
Mercury (µg/dscm)	INC	32	64	201	79.1	12.90	22.17	29.80	51.36
Mercury (µg/dscm)	LWAK	10	13	42	78.6	15.44	22.04	24.07	28.31
Particulate Matter (gr/dscf)	CK	8	16	51	100.0	0.016	0.028	0.034	0.049
Particulate Matter (gr/dscf)	INC	19	56	175	99.4	0.004	0.008	0.010	0.017
Particulate Matter (gr/dscf)	LWAK	10	10	29	100.0	0.005	0.009	0.011	0.016
SVM (µg/dscm)	CK	9	14	46	52.2	20.50	21.13	24.44	31.60

SVM (µg/dscm)	INC	16	29	98	85.7	41.93	72.01	86.99	123.49
SVM (µg/dscm)	LWAK	6	9	30	100.0	5.82	9.02	10.46	13.79
D/F TEQ (ng/dscm)	INC	22	43	120	92.5	0.17	0.30	0.37	0.55
D/F TEQ (ng/dscm)	KILNS	13	20	57	96.5	0.14	0.21	0.25	0.32
D/F Total (ng/dscm)	INC	23	44	124	89.5	4.52	7.47	9.06	13.00
D/F Total (ng/dscm)	KILNS	12	19	55	96.4	3.47	5.13	5.83	7.42

* Estimated from a modified delta-lognormal distribution.
** Excluding data from device 359C6 because the LVM concentrations are extremely large in comparison to all other devices and test conditions.

Table 16b.

Estimated Percentiles from Existing Sources in the Non-MTEC Data (Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Chlorine (ppmv)	CK	34	49	164	54.3	0.25	0.41	0.48	0.65
Chlorine (ppmv)	INC	17	38	127	82.7	0.43	0.66	0.75	0.97
Chlorine (ppmv)	LWAK	3	6	21	100.0	0.41	0.65	0.75	1.00
HCl (ppmv)	CK	34	52	179	96.6	18.16	26.96	30.71	39.20
HCl (ppmv)	INC	33	73	227	79.7	4.30	7.06	8.38	11.57
HCl (ppmv)	LWAK	3	6	21	100.0	24.58	32.06	34.82	40.66
LVM (µg/dscm)	CK	25	33	111	78.4	19.51	30.12	34.89	45.93
LVM (µg/dscm)	INC	33	61	192	92.7	62.75	92.25	104.68	132.67
LVM (µg/dscm)**	INC**	32	60	189	92.6	53.39	78.62	89.27	113.28
LVM (µg/dscm)	LWAK	8	8	24	100.0	35.84	43.86	46.64	52.32
Mercury (µg/dscm)	CK	32	43	154	81.8	47.34	68.34	76.95	96.11
Mercury (µg/dscm)	INC	32	64	201	79.1	12.90	23.73	29.94	46.31
Mercury (µg/dscm)	LWAK	10	13	42	78.6	15.44	20.04	21.70	25.21
Particulate Matter (gr/dscf)	CK	8	16	51	100.0	0.016	0.023	0.026	0.033
Particulate Matter (gr/dscf)	INC	19	56	175	99.4	0.004	0.007	0.008	0.011
Particulate Matter (gr/dscf)	LWAK	10	10	29	100.0	0.005	0.008	0.009	0.011
SVM (µg/dscm)	CK	9	14	46	52.2	20.50	27.10	30.13	36.69

SVM (µg/dscm)	INC	16	29	98	85.7	41.93	60.70	68.46	85.78
SVM (µg/dscm)	LWAK	6	9	30	100.0	5.82	7.70	8.40	9.91
D/F TEQ (ng/dscm)	INC	22	43	120	92.5	0.17	0.25	0.28	0.36
D/F TEQ (ng/dscm)	KILNS	13	20	57	96.5	0.14	0.18	0.20	0.23
D/F Total (ng/dscm)	INC	23	44	124	89.5	4.52	6.77	7.74	9.95
D/F Total (ng/dscm)	KILNS	12	19	55	96.4	3.47	4.44	4.79	5.52

* Estimated from a modified delta-lognormal distribution.
** Excluding data from device 359C6 because the LVM concentrations are extremely large in comparison to all other devices and test conditions.

Table 17a.

Estimated Percentiles from New Sources in the Non-MTEC Data (Based on Grab Samples)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Chlorine (ppmv)	CK	34	49	164	54.3	0.25	0.50	0.64	1.00
Chlorine (ppmv)	INC	17	38	127	82.7	0.43	0.80	0.98	1.43
Chlorine (ppmv)	LWAK	3	6	21	100.0	0.41	0.78	1.00	1.58
HCl (ppmv)	CK	34	52	179	96.6	18.16	32.49	39.93	58.71
HCl (ppmv)	INC	33	73	227	79.7	4.30	8.46	10.96	17.70
HCl (ppmv)	LWAK	3	6	21	100.0	24.58	37.37	42.97	55.85
LVM (µg/dscm)	CK	8	14	45	62.2	15.47	18.93	21.95	28.62
LVM (µg/dscm)	INC	33	61	192	92.7	62.75	110.27	134.63	195.35
LVM (µg/dscm)**	INC**	32	60	198	92.6	53.39	93.50	114.31	166.27
LVM (µg/dscm)	LWAK	5	5	15	100.0	34.87	45.49	49.42	57.71
Mercury (µg/dscm)	CK	32	43	154	81.8	47.34	80.39	94.45	127.18
Mercury (µg/dscm)	INC	32	64	201	79.1	12.90	22.17	29.80	51.36
Mercury (µg/dscm)	LWAK	10	13	42	78.6	15.44	22.04	24.07	28.31
SVM (µg/dscm)	CK	9	14	46	52.2	20.50	21.13	24.44	31.60
SVM (µg/dscm)	INC	10	18	57	78.9	42.15	74.11	91.53	135.00
SVM (µg/dscm)	LWAK	5	5	15	100.0	5.56	8.57	9.91	13.02

* Estimated from a modified delta-lognormal distribution.
** Excluding data from device 359C6 because the LVM concentrations are extremely large in comparison to all other devices and test conditions.

Table 17b.

Estimated Percentiles from New Sources in the Non-MTEC Data
(Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Chlorine (ppmv)	CK	34	49	164	54.3	0.25	0.41	0.48	0.65
Chlorine (ppmv)	INC	17	38	127	82.7	0.43	0.66	0.75	0.97
Chlorine (ppmv)	LWAK	3	6	21	100.0	0.41	0.65	0.75	1.00
HCl (ppmv)	CK	34	52	179	96.6	18.16	26.96	30.71	39.20
HCl (ppmv)	INC	33	73	227	79.7	4.30	7.06	8.38	11.57
HCl (ppmv)	LWAK	3	6	21	100.0	24.58	32.06	34.82	40.66
LVM (µg/dscm)	CK	8	14	45	62.2	19.47	19.65	21.28	24.69
LVM (µg/dscm)	INC	33	61	192	92.7	62.75	92.25	104.68	132.67
LVM (µg/dscm)**	INC**	32	60	189	92.6	53.39	78.62	89.27	113.28
LVM (µg/dscm)	LWAK	5	5	15	100.0	35.87	40.97	42.99	47.06
Mercury (µg/dscm)	CK	32	43	154	81.8	47.34	68.34	76.95	96.11
Mercury (µg/dscm)	INC	32	64	201	79.1	12.90	23.73	29.94	46.31
Mercury (µg/dscm)	LWAK	10	13	42	78.6	15.44	20.04	21.70	25.21
SVM (µg/dscm)	CK	9	14	46	52.2	20.50	27.10	30.13	36.69
SVM (µg/dscm)	INC	10	18	57	78.9	42.15	62.65	71.38	91.15
SVM (µg/dscm)	LWAK	5	5	15	100.0	5.56	7.33	7.99	9.39

* Estimated from a modified delta-lognormal distribution.
** Excluding data from device 359C6 because the LVM concentrations are extremely large in comparison to all other devices and test conditions.

4.2 Average-Based Analysis of 6% Full-MTEC Data

The following tables present estimated percentiles for emissions from the 6% Full-MTEC database, based on 3-run average data. The analyses are similar to those performed for the 12% Full-MTEC database in Section 3.1. The estimated 90th, 95th, and 99th percentiles are based on the average emission concentrations. The estimated mean represents the emission level at which facilities should operate in order to meet the standard a given percentage of the time, corresponding to the percentile used for the emission standard. That is, if the 99th percentile estimate is used to establish the emission standard, then the estimated mean is the level at which facilities should operate in order to meet the standard 99 percent of the time.

Tables 18a and 18b present estimates from all existing sources in the 6% Full-MTEC database. Tables 19a and 19b present estimates from the existing sources in the 6% Full-MTEC database that have average emission levels below the breakpoint. The estimated percentiles that are presented in Part A of each table are based on grab samples (or single run data). The estimated percentiles that are presented in Part B of each table are based on 3-run average data.

Table 18a.

Percentile Estimates Based on Average Emissions from Existing Sources in the 6% Full-MTEC Data (Based on Grab Samples)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	25	33	113	95.6	14.10	27.26	34.83	55.06
HCl (ppmv)	INC	22	46	151	92.1	3.67	7.38	9.71	16.20
HCl (ppmv)	LWAK	6	6	30	100.0	1116.94	1757.88	2050.66	2737.76
LVM (µg/dscm)	CK	13	20	68	70.6	16.36	26.28	36.22	65.01
LVM (µg/dscm)	INC	7	15	42	85.7	29.10	52.84	64.46	93.20
LVM (µg/dscm)	LWAK	8	8	24	100.0	35.84	49.75	55.24	67.23
Mercury (µg/dscm)	CK	6	9	31	67.7	21.87	35.25	37.74	42.73
Mercury (µg/dscm)	INC	15	28	79	59.5	4.93	6.49	8.36	13.13
Mercury (µg/dscm)	LWAK	6	6	18	66.7	12.05	20.30	22.74	27.92
Particulate Matter (gr/dscf)	CK	8	16	51	100.0	0.016	0.028	0.034	0.049
Particulate Matter (gr/dscf)	INC	19	56	175	99.4	0.004	0.008	0.010	0.017
Particulate Matter (gr/dscf)	LWAK	10	10	29	100.0	0.005	0.009	0.011	0.016
SVM (µg/dscm)	CK	6	10	33	54.5	15.35	12.85	14.98	19.67
SVM (µg/dscm)	INC	10	15	53	73.6	22.60	38.26	50.83	85.48
SVM (µg/dscm)	LWAK	3	4	13	100.0	4.19	6.09	6.88	8.64
D/F TEQ (ng/dscm)	INC	22	43	120	92.5	0.17	0.30	0.37	0.55

D/F TEQ (ng/dscm)	KILNS	13	20	57	96.5	0.14	0.21	0.25	0.32
D/F Total (ng/dscm)	INC	23	44	124	89.5	4.52	7.47	9.06	13.00
D/F Total (ng/dscm)	KILNS	12	19	55	96.4	3.47	5.13	5.83	7.42

* Estimated from a modified delta-lognormal distribution.

NOTE: Test conditions from device 307 were collapsed into a single test condition.

Table 18b.

Percentile Estimates Based on Average Emissions from Existing Sources in the 6% Full-MTEC Data (Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	25	33	113	95.6	14.10	22.43	26.28	35.37
HCl (ppmv)	INC	22	46	151	92.1	3.67	6.10	7.29	10.19
HCl (ppmv)	LWAK	6	6	30	100.0	1116.94	1494.78	1638.19	1945.38
LVM (µg/dscm)	CK	13	20	68	70.6	16.36	25.71	30.13	40.56
LVM (µg/dscm)	INC	7	15	42	85.7	29.10	43.33	49.39	63.14
LVM (µg/dscm)	LWAK	8	8	24	100.0	35.84	43.86	46.64	52.32
Mercury (µg/dscm)	CK	6	9	31	67.7	21.87	30.94	34.36	41.81
Mercury (µg/dscm)	INC	15	28	79	59.5	4.93	8.09	9.79	13.97
Mercury (µg/dscm)	LWAK	6	6	18	66.7	12.05	17.22	19.23	23.63
Particulate Matter (gr/dscf)	CK	8	16	51	100.0	0.016	0.023	0.026	0.033
Particulate Matter (gr/dscf)	INC	19	56	175	99.4	0.004	0.007	0.008	0.011
Particulate Matter (gr/dscf)	LWAK	10	10	29	100.0	0.005	0.008	0.009	0.011
SVM (µg/dscm)	CK	6	10	33	54.5	15.35	20.81	23.52	29.55
SVM (µg/dscm)	INC	10	15	53	73.6	22.60	36.73	43.58	60.04
SVM (µg/dscm)	LWAK	3	4	13	100.0	4.19	5.29	5.69	6.50
D/F TEQ (ng/dscm)	INC	22	43	120	92.5	0.17	0.25	0.28	0.36

D/F TEQ (ng/dscm)	KILNS	13	20	57	96.5	0.14	0.18	0.20	0.23
D/F Total (ng/dscm)	INC	23	44	124	89.5	4.52	6.77	7.74	9.95
D/F Total (ng/dscm)	KILNS	12	19	55	96.4	3.47	4.44	4.79	5.52

* Estimated from a modified delta-lognormal distribution.

NOTE: Test conditions from device 307 were collapsed into a single test condition.

Table 19a.

Percentile Estimates Based on Average Emissions from Existing Sources in the 6% Full-MTEC Data Below the Breakpoint (Based on Grab Samples)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Chlorine (ppmv)	CK	27	36	126	53.2	0.20	0.37	0.45	0.65
Chlorine (ppmv)	INC	9	13	44	70.5	0.30	0.52	0.65	0.98
Chlorine (ppmv)	LWAK	4	7	24	100.0	0.51	0.96	1.22	1.93
HCl (ppmv)	CK	20	28	96	94.8	4.93	9.55	12.21	19.32
HCl (ppmv)	INC	21	42	138	91.3	2.76	5.49	7.19	11.88
HCl (ppmv)	LWAK	5	8	27	100.0	899.53	1315.70	1490.02	1881.70
LVM (µg/dscm)	CK	15	19	66	74.2	17.85	30.36	41.75	74.82
LVM (µg/dscm)	INC	5	8	24	75.0	13.44	20.32	23.16	29.45
LVM (µg/dscm)	LWAK	6	6	18	100.0	30.13	42.15	46.94	57.44
Mercury (µg/dscm)	INC	14	27	76	57.9	4.73	5.88	7.65	12.25
Mercury (µg/dscm)	LWAK	5	5	15	60.0	11.17	20.18	23.07	29.33
Particulate Matter (gr/dscf)	CK	8	12	39	100.0	0.011	0.017	0.019	0.026
Particulate Matter (gr/dscf)	INC	16	49	152	99.3	0.003	0.006	0.007	0.012
Particulate Matter (gr/dscf)	LWAK	9	9	26	100.0	0.004	0.008	0.009	0.014
SVM (µg/dscm)	CK	6	10	33	54.5	15.35	12.85	14.98	19.67
SVM (µg/dscm)	INC	8	13	40	67.5	18.34	30.83	42.21	74.65
SVM (µg/dscm)	LWAK	3	4	13	100.0	4.19	6.09	6.88	8.64

D/F TEQ (ng/dscm)	INC	17	26	77	92.2	0.08	0.13	0.15	0.21
D/F TEQ (ng/dscm)	KILNS	10	15	45	95.6	0.05	0.08	0.09	0.12
D/F Total (ng/dscm)	INC	15	28	76	82.9	1.88	2.20	2.56	3.41
D/F Total (ng/dscm)	KILNS	11	16	50	96.0	3.35	4.99	5.69	7.28

* Estimated from a modified delta-lognormal distribution.

Table 19b.

Percentile Estimates Based on Average Emissions from Existing Sources in the 6% Full-MTEC Data Below the Breakpoint (Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Chlorine (ppmv)	CK	27	36	126	53.2	0.20	0.31	0.36	0.47
Chlorine (ppmv)	INC	9	13	44	70.5	0.30	0.44	0.51	0.65
Chlorine (ppmv)	LWAK	4	7	24	100.0	0.51	0.79	0.92	1.23
HCl (ppmv)	CK	20	28	96	94.8	4.93	7.85	9.21	12.41
HCl (ppmv)	INC	21	42	138	91.3	2.76	4.56	5.43	7.53
HCl (ppmv)	LWAK	5	8	27	100.0	899.53	1141.29	1228.02	1408.87
LVM (µg/dscm)	CK	15	19	66	74.2	17.85	28.95	34.34	47.26
LVM (µg/dscm)	INC	5	8	24	75.0	13.44	17.57	19.09	22.29
LVM (µg/dscm)	LWAK	6	6	18	100.0	30.13	37.07	39.48	44.44
Mercury (µg/dscm)	INC	14	27	76	57.9	4.73	7.82	9.55	13.85
Mercury (µg/dscm)	LWAK	5	5	15	60.0	11.17	16.57	18.70	23.46
Particulate Matter (gr/dscf)	CK	8	12	39	100.0	0.011	0.014	0.016	0.018
Particulate Matter (gr/dscf)	INC	16	49	152	99.3	0.003	0.005	0.006	0.008
Particulate Matter (gr/dscf)	LWAK	9	9	26	100.0	0.004	0.006	0.007	0.009
SVM (µg/dscm)	CK	6	10	33	54.5	15.35	20.81	23.52	29.55
SVM (µg/dscm)	INC	8	13	40	67.5	18.34	29.51	34.94	47.91
SVM (µg/dscm)	LWAK	3	4	13	100.0	4.19	5.29	5.69	6.50

D/F TEQ (ng/dscm)	INC	17	26	77	92.2	0.08	0.11	0.12	0.15
D/F TEQ (ng/dscm)	KILNS	10	15	45	95.6	0.05	0.07	0.07	0.09
D/F Total (ng/dscm)	INC	15	28	76	82.9	1.88	3.60	4.64	7.48
D/F Total (ng/dscm)	KILNS	11	16	50	96.0	3.35	4.30	4.65	5.38

* Estimated from a modified delta-lognormal distribution.

4.3 Analysis of 6% Full-MTEC Data at Breakpoint Facility

The following tables present the expected mean emission levels based on the 99th percentile of the breakpoint facility in the 6% Full-MTEC database. The expected mean emission level is the level at which the facilities should operate at in order to pass the limit 99 percent of the time. Table 20 presents the estimated mean levels from the exiting sources in the 6% Full-MTEC data. Table 21 presents the estimated mean levels from the new sources in the Full-MTEC data. The expected mean levels were estimated based on the assumption that the limitation on 3-run averages was set equal to the 99th percentile of the breakpoint facility.

Table 20.

Expected Mean Levels Based on the 99th Percentile of the Breakpoint Facility from Existing Sources in the 6% Full-MTEC Data (Based on 3-Run Averages)

HAP	Source	Breakpoint Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
LVM	INC	221C4	208.206	107.499
Mercury	INC	221C2	48.757	25.399
Particulate Matter	CK	303C2	0.045	0.026
Particulate Matter	INC	359C1	0.040	0.014
Particulate Matter	LWAK	312C1	0.020	0.010
SVM	INC	327C3 (Option 1) 325C7 (Option 2)	89.581 97.312	41.042 41.126
Total Chlorine	INC	806C2	201.946	68.987

Table 21.

Expected Mean Levels Based on the 99th Percentile of the Breakpoint Facility from New Sources in the Full-MTEC Data (Based on 3-Run Averages)

HAP	Source	Breakpoint Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
LVM	INC	221C2	32.11	17.99
Mercury	INC	221C4	38.47	18.46
Particulate Matter	CK	306C1	0.028	0.017
Particulate Matter	INC	211C1	0.023	0.010
Particulate Matter	LWAK	312C1	0.023	0.010
SVM	INC	229C2	64.79	34.43
Total Chlorine	INC	209C3	138.86	48.20

4.4 Analysis of 6% Full-MTEC Data at Percentile Facilities

The following tables present estimated emission percentiles based on percentile devices, using the 6% Full-MTEC database. The 50th, 75th, 90th, and 95th percentile devices were estimated from the emission concentration means from each of the devices in the expanded MACT pool. Tables 22a and 22b present estimated percentiles from existing sources in the 6% Full-MTEC database. Tables 23a and 23b present estimated percentiles from new sources in the Full-MTEC database. The estimated percentiles that are presented in Part A of each table are based on grab samples (or single run data). The estimated percentiles that are presented in Part B of each table are based on 3-run average data.

Table 22a.

Percentile Estimates Based on Percentile Devices from Existing Sources in the 6% Full-MTEC Data (Based on Grab Samples)

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	50th Percentile	16.38	20.80	32.54
		75th Percentile	63.06	80.06	125.26
		90th Percentile	212.12	269.29	421.34
		95th Percentile	438.41	556.57	870.81
HCl (ppmv)	INC	50th Percentile	5.68	7.59	13.05
		75th Percentile	16.80	22.43	38.56
		90th Percentile	44.54	59.46	102.26
		95th Percentile	79.84	106.59	183.29
HCl (ppmv)	LWAK	50th Percentile	284.61	321.36	403.56
		75th Percentile	1088.49	1229.03	1543.42
		90th Percentile	3640.46	4110.47	5161.95
		95th Percentile	7498.04	8466.08	10631.75
LVM (µg/dscm)	CK	50th Percentile	27.70	35.39	56.05
		75th Percentile	44.48	56.83	90.00
		90th Percentile	68.12	87.04	137.84
		95th Percentile	87.91	112.33	177.89
LVM (µg/dscm)	INC	50th Percentile	47.25	56.77	80.09
		75th Percentile	107.13	128.71	181.58

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
		90th Percentile	223.81	268.88	379.33
		95th Percentile	347.81	417.86	589.51
LVM (µg/dscm)	LWAK	50th Percentile	64.36	71.47	86.98
		75th Percentile	139.88	155.33	189.05
		90th Percentile	281.31	312.37	380.19
		95th Percentile	427.34	474.53	577.55

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Mercury (µg/dscm)	CK	50th Percentile	21.65	23.42	27.15
		75th Percentile	39.32	42.54	49.31
		90th Percentile	67.28	72.80	84.38
		95th Percentile	92.79	100.40	116.38
Mercury (µg/dscm)	INC	50th Percentile	4.31	5.15	7.19
		75th Percentile	15.85	18.93	26.41
		90th Percentile	51.14	61.08	85.25
		95th Percentile	103.11	123.15	171.86
Mercury (µg/dscm)	LWAK	50th Percentile	13.20	16.21	23.82
		75th Percentile	34.56	42.42	62.34
		90th Percentile	82.15	100.86	148.20
		95th Percentile	137.94	169.35	248.84
Particulate Matter (gr/dscf)	CK	50th Percentile	0.019	0.024	0.034
		75th Percentile	0.049	0.060	0.087
		90th Percentile	0.113	0.138	0.200
		95th Percentile	0.186	0.227	0.330
Particulate Matter (gr/dscf)	INC	50th Percentile	0.007	0.009	0.016
		75th Percentile	0.017	0.023	0.038
		90th Percentile	0.037	0.049	0.084
		95th Percentile	0.060	0.079	0.134
Particulate Matter (gr/dscf)	LWAK	50th Percentile	0.008	0.009	0.013
		75th Percentile	0.016	0.020	0.028
		90th Percentile	0.032	0.038	0.055
		95th Percentile	0.047	0.057	0.083

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
SVM (µg/dscm)	CK	50th Percentile	19.58	22.69	29.90
		75th Percentile	32.25	37.37	49.25
		90th Percentile	50.53	58.54	77.16
		95th Percentile	66.11	76.59	100.95

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
SVM (µg/dscm)	INC	50th Percentile	37.43	46.91	71.64
		75th Percentile	78.52	98.41	150.30
		90th Percentile	152.97	191.72	292.82
		95th Percentile	228.00	285.76	436.45
SVM (µg/dscm)	LWAK	50th Percentile	4.90	5.54	6.96
		75th Percentile	8.58	9.69	12.17
		90th Percentile	14.18	16.02	20.13
		95th Percentile	19.17	21.65	27.20
D/F TEQ (ng/dscm)	INC	50th Percentile	0.39	0.48	0.71
		75th Percentile	2.05	2.52	3.69
		90th Percentile	9.10	11.16	16.35
		95th Percentile	22.17	27.18	39.84
D/F TEQ (ng/dscm)	KILNS	50th Percentile	0.16	0.18	0.24
		75th Percentile	0.49	0.57	0.75
		90th Percentile	1.37	1.58	2.07
		95th Percentile	2.51	2.90	3.80
D/F Total (ng/dscm)	INC	50th Percentile	14.87	17.87	25.19
		75th Percentile	91.37	109.75	154.77
		90th Percentile	468.15	562.30	792.95
		95th Percentile	1244.61	1494.92	2108.13
D/F Total (ng/dscm)	KILNS	50th Percentile	7.38	8.39	10.68
		75th Percentile	18.93	21.53	27.40
		90th Percentile	44.19	50.25	63.96
		95th Percentile	73.39	83.46	106.23

Table 22b.

Percentile Estimates Based on Percentile Devices from Existing Sources in the 6% Full-MTEC Data (Based on 3-Run Averages)

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	50th Percentile	13.58	15.74	20.77
		75th Percentile	52.27	60.60	79.95
		90th Percentile	175.84	203.84	268.93
		95th Percentile	363.42	421.28	555.82
HCl (ppmv)	INC	50th Percentile	4.74	5.70	8.06
		75th Percentile	14.01	16.85	23.83
		90th Percentile	37.16	44.69	63.17
		95th Percentile	66.61	80.11	113.23
HCl (ppmv)	LWAK	50th Percentile	247.46	265.78	303.88
		75th Percentile	946.40	1016.46	1162.17
		90th Percentile	3165.24	3399.55	3886.87
		95th Percentile	6519.24	7001.84	8005.54
LVM (µg/dscm)	CK	50th Percentile	22.96	26.74	35.58
		75th Percentile	36.87	42.93	57.13
		90th Percentile	56.47	65.75	87.49
		95th Percentile	72.87	84.86	112.92
LVM (µg/dscm)	INC	50th Percentile	39.62	44.24	54.43
		75th Percentile	89.82	100.31	123.40

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
		90th Percentile	187.64	209.55	257.79
		95th Percentile	291.60	325.66	400.63
LVM (µg/dscm)	LWAK	50th Percentile	56.75	60.34	67.69
		75th Percentile	123.34	131.13	147.12
		90th Percentile	248.04	263.72	295.86
		95th Percentile	376.79	400.62	449.45

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Mercury (µg/dscm)	CK	50th Percentile	19.58	20.49	22.33
		75th Percentile	35.56	37.22	40.56
		90th Percentile	60.84	63.70	69.41
		95th Percentile	83.91	87.85	95.73
Mercury (µg/dscm)	INC	50th Percentile	3.62	4.03	4.92
		75th Percentile	13.32	14.82	18.10
		90th Percentile	42.98	47.81	58.41
		95th Percentile	86.64	96.40	117.76
Mercury (µg/dscm)	LWAK	50th Percentile	10.99	12.45	15.74
		75th Percentile	28.78	32.60	41.20
		90th Percentile	68.41	77.50	97.94
		95th Percentile	114.87	130.13	164.45
Particulate Matter (gr/dscf)	CK	50th Percentile	0.016	0.018	0.023
		75th Percentile	0.041	0.046	0.058
		90th Percentile	0.094	0.106	0.133
		95th Percentile	0.155	0.175	0.219
Particulate Matter (gr/dscf)	INC	50th Percentile	0.006	0.007	0.010
		75th Percentile	0.014	0.017	0.024
		90th Percentile	0.031	0.037	0.052
		95th Percentile	0.050	0.059	0.083
Particulate Matter (gr/dscf)	LWAK	50th Percentile	0.006	0.007	0.009
		75th Percentile	0.013	0.015	0.019
		90th Percentile	0.026	0.030	0.037
		95th Percentile	0.039	0.044	0.055

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
SVM (µg/dscm)	CK	50th Percentile	16.72	18.25	21.49
		75th Percentile	27.54	30.05	35.40
		90th Percentile	43.15	47.08	55.46
		95th Percentile	56.45	61.60	72.56

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
SVM (µg/dscm)	INC	50th Percentile	31.05	35.68	46.28
		75th Percentile	65.15	74.85	97.10
		90th Percentile	126.92	145.81	189.18
		95th Percentile	189.17	217.34	281.97
SVM (µg/dscm)	LWAK	50th Percentile	4.26	4.58	5.24
		75th Percentile	7.45	8.01	9.16
		90th Percentile	12.33	13.24	15.15
		95th Percentile	16.66	17.90	20.47
D/F TEQ (ng/dscm)	INC	50th Percentile	0.33	0.37	0.47
		75th Percentile	1.71	1.94	2.44
		90th Percentile	7.58	8.58	10.82
		95th Percentile	18.47	20.90	26.37
D/F TEQ (ng/dscm)	KILNS	50th Percentile	0.14	0.15	0.17
		75th Percentile	0.42	0.46	0.54
		90th Percentile	1.17	1.27	1.49
		95th Percentile	2.15	2.34	2.74
D/F Total (ng/dscm)	INC	50th Percentile	12.47	13.93	17.13
		75th Percentile	76.61	85.55	105.21
		90th Percentile	392.53	438.30	539.05
		95th Percentile	1043.56	1165.26	1433.12
D/F Total (ng/dscm)	KILNS	50th Percentile	6.38	6.89	7.94
		75th Percentile	16.37	17.66	20.36
		90th Percentile	38.21	41.22	47.52
		95th Percentile	63.46	68.46	78.92

Table 23a.

Percentile Estimates Based on Percentile Devices from New Sources in the Full-MTEC Data (Based on Grab Samples)

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	INC	50th Percentile	3.82	5.23	9.42
		75th Percentile	14.95	20.45	36.81
		90th Percentile	51.01	69.78	125.60
		95th Percentile	106.32	145.44	261.78
LVM (µg/dscm)	CK	50th Percentile	19.13	22.21	29.38
		75th Percentile	31.15	36.16	47.84
		90th Percentile	48.31	56.08	74.20
		95th Percentile	62.81	72.92	96.48
LVM (µg/dscm)	INC	50th Percentile	43.08	53.98	82.42
		75th Percentile	117.36	147.06	224.52
		90th Percentile	289.24	362.43	553.32
		95th Percentile	496.24	621.80	949.31
LVM (µg/dscm)	LWAK	50th Percentile	64.36	71.47	86.98
		75th Percentile	139.88	155.33	189.05
		90th Percentile	281.31	312.37	380.19
		95th Percentile	427.34	474.53	577.55
Mercury (µg/dscm)	CK	50th Percentile	21.65	23.42	27.15
		75th Percentile	39.32	42.54	49.31
		90th Percentile	67.28	72.80	84.38
		95th Percentile	92.79	100.40	116.38

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Mercury (µg/dscm)	INC	50th Percentile	8.05	9.87	14.45
		75th Percentile	28.37	34.77	50.91
		90th Percentile	88.13	108.00	158.12
		95th Percentile	173.67	212.81	311.58

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Mercury (µg/dscm)	LWAK	50th Percentile	13.20	16.21	23.82
		75th Percentile	34.56	42.42	62.34
		90th Percentile	82.15	100.86	148.20
		95th Percentile	137.94	169.35	248.84
Particulate Matter (gr/dscf)	CK	50th Percentile	0.019	0.023	0.033
		75th Percentile	0.051	0.062	0.091
		90th Percentile	0.124	0.152	0.222
		95th Percentile	0.213	0.260	0.379
Particulate Matter (gr/dscf)	INC	50th Percentile	0.006	0.007	0.011
		75th Percentile	0.011	0.014	0.022
		90th Percentile	0.021	0.026	0.041
		95th Percentile	0.030	0.038	0.059
Particulate Matter (gr/dscf)	LWAK	50th Percentile	0.009	0.011	0.016
		75th Percentile	0.020	0.024	0.036
		90th Percentile	0.040	0.049	0.074
		95th Percentile	0.061	0.076	0.113
SVM (µg/dscm)	CK	50th Percentile	16.88	19.31	24.87
		75th Percentile	33.51	38.34	49.38
		90th Percentile	62.12	71.09	91.55
		95th Percentile	89.88	102.86	132.47
SVM (µg/dscm)	INC	50th Percentile	39.09	48.00	70.56
		75th Percentile	88.48	108.64	159.69
		90th Percentile	184.55	226.61	333.07
		95th Percentile	286.54	351.84	517.14

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
SVM (µg/dscm)	LWAK	50th Percentile	2.57	2.75	3.12
		75th Percentile	4.84	5.17	5.87
		90th Percentile	8.55	9.14	10.37
		95th Percentile	12.02	12.85	14.57

Table 23b.

Percentile Estimates Based on Percentile Devices from New Sources in the Full-MTEC Data (Based on 3-Run Averages)

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	INC	50th Percentile	3.22	3.94	5.77
		75th Percentile	12.58	15.42	22.58
		90th Percentile	42.92	52.60	77.03
		95th Percentile	89.46	109.63	160.55
LVM (µg/dscm)	CK	50th Percentile	16.31	17.83	21.05
		75th Percentile	26.56	29.02	34.27
		90th Percentile	41.19	45.01	53.15
		95th Percentile	53.57	58.53	69.11
LVM (µg/dscm)	INC	50th Percentile	35.75	41.06	53.26
		75th Percentile	97.38	111.86	145.08
		90th Percentile	239.98	275.67	357.55
		95th Percentile	411.73	472.96	613.44
LVM (µg/dscm)	LWAK	50th Percentile	56.75	60.34	67.69
		75th Percentile	123.34	131.13	147.12
		90th Percentile	248.04	263.72	295.86
		95th Percentile	376.79	400.62	449.45
Mercury (µg/dscm)	CK	50th Percentile	19.58	20.49	22.33
		75th Percentile	35.56	37.22	40.56
		90th Percentile	60.84	63.70	69.41
		95th Percentile	83.91	87.85	95.73

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Mercury (µg/dscm)	INC	50th Percentile	6.71	7.59	9.57
		75th Percentile	23.64	26.75	33.72
		90th Percentile	73.42	83.08	104.73
		95th Percentile	144.68	163.70	206.38

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
Mercury (µg/dscm)	LWAK	50th Percentile	10.99	12.45	15.74
		75th Percentile	28.78	32.60	41.20
		90th Percentile	68.41	77.50	97.94
		95th Percentile	114.87	130.13	164.45
Particulate Matter (gr/dscf)	CK	50th Percentile	0.016	0.018	0.022
		75th Percentile	0.042	0.048	0.060
		90th Percentile	0.104	0.117	0.147
		95th Percentile	0.177	0.200	0.252
Particulate Matter (gr/dscf)	INC	50th Percentile	0.005	0.015	0.007
		75th Percentile	0.009	0.011	0.014
		90th Percentile	0.017	0.020	0.026
		95th Percentile	0.025	0.029	0.038
Particulate Matter (gr/dscf)	LWAK	50th Percentile	0.007	0.008	0.011
		75th Percentile	0.016	0.019	0.024
		90th Percentile	0.033	0.038	0.048
		95th Percentile	0.051	0.058	0.074
SVM (µg/dscm)	CK	50th Percentile	14.53	15.73	18.27
		75th Percentile	28.84	31.23	36.27
		90th Percentile	53.47	57.90	67.24
		95th Percentile	77.37	83.78	97.29
SVM (µg/dscm)	INC	50th Percentile	32.55	36.88	46.62
		75th Percentile	73.67	83.47	105.51
		90th Percentile	153.67	174.11	220.07
		95th Percentile	238.59	270.33	341.68

HAP	Source	Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
SVM (µg/dscm)	LWAK	50th Percentile	2.35	2.45	2.63
		75th Percentile	4.43	4.60	4.95
		90th Percentile	7.83	8.14	8.75
		95th Percentile	11.00	11.44	12.31

4.5 Average-Based Analysis of 6% HW-MTEC Data

Tables 24a and 24b present estimated percentiles for emissions from the 6% HW-MTEC database, based on 3-run average data. The analyses are similar to those performed for the 12% HW-MTEC database in Section 3.2. The estimated 90th, 95th, and 99th percentiles are based on the average emission concentrations. The estimated mean represents the emission level at which facilities should operate in order to meet the standard a given percentage of the time, corresponding to the percentile used for the emission standard. That is, if the 99th percentile estimate is used to establish the emission standard, then the estimated mean is the level at which facilities should operate in order to meet the standard 99 percent of the time. The estimated percentiles that are presented in Table 24a are based on grab samples (or single run data). The estimated percentiles that are presented in Table 24b are based on 3-run average data.

Table 24a.

Percentile Estimates Based on Average Emissions from Existing Sources in 6% HW-MTEC Data (Based on Grab Samples)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	25	34	117	95.7	7.31	14.02	17.83	27.97
HCl (ppmv)	LWAK	6	6	30	100.0	1116.94	1757.88	2050.66	2737.76
LVM (µg/dscm)	CK	16	23	77	74.0	17.27	29.07	39.39	68.69
LVM (µg/dscm)	LWAK	7	7	21	100.0	35.57	50.11	55.94	68.77
Mercury (µg/dscm)	CK	14	20	72	84.7	31.97	44.60	47.69	53.98
Mercury (µg/dscm)	LWAK	8	9	24	75.0	13.72	21.31	23.43	27.87
SVM (µg/dscm)	CK	6	11	36	58.3	15.80	15.05	17.45	22.74
SVM (µg/dscm)	LWAK	3	4	13	100.0	4.19	6.09	6.88	8.64

* Estimated from a modified delta-lognormal distribution.

NOTE: Test conditions from device 307 were collapsed into a single test condition.

Table 24b.

Percentile Estimates Based on Average Emissions from Existing Sources in 6% HW-MTEC Data (Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	25	34	117	95.7	7.31	11.54	13.47	18.02
HCl (ppmv)	LWAK	6	6	30	100.0	1116.94	1494.78	1638.19	1945.38
LVM (µg/dscm)	CK	16	23	77	74.0	17.27	27.12	31.71	42.51
LVM (µg/dscm)	LWAK	7	7	21	100.0	35.57	43.97	46.90	52.94
Mercury (µg/dscm)	CK	14	20	72	84.7	31.97	41.57	45.07	52.43
Mercury (µg/dscm)	LWAK	8	9	24	75.0	13.72	18.78	20.70	24.83
SVM (µg/dscm)	CK	6	11	36	58.3	15.80	21.34	23.89	29.49
SVM (µg/dscm)	LWAK	3	4	13	100.0	4.19	5.29	5.69	6.50

* Estimated from a modified delta-lognormal distribution.

NOTE: Test conditions from device 307 were collapsed into a single test condition.

4.6 Analysis of 6% HW-MTEC Data at Breakpoint Facility

The following tables present the expected mean emission levels based on the 99th percentile of the breakpoint facility in the 6% HW-MTEC database. The expected mean emission level is the level at which the facilities should operate at in order to pass the limit 99 percent of the time. Table 25 presents the estimated mean levels from the exiting sources in the 6% HW-MTEC data. Table 26 presents the estimated mean levels from the new sources in the HW-MTEC data. The expected mean levels were estimated based on the assumption that the limitation on 3-run averages was set equal to the 99th percentile of the breakpoint facility.

Table 25.

Expected Mean Levels Based on the 99th Percentile of the Breakpoint Facility from Existing Sources in the 6% HW-MTEC Data (Based on 3-Run Averages)

HAP	Source	Breakpoint Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
LVM	CK	202C2 (Option 1) 319C1 (Option 2)	53.524 128.804	31.767 66.778
LVM	LWAK	311C1	62.770	42.553
SVM	CK	306C1 (Option 1) 303C3 (Option 2)	32.626 57.491	17.619 34.118
SVM	LWAK	307C2	11.550	7.445

Table 26.

Expected Mean Levels Based on the 99th Percentile of the Breakpoint Facility from New Sources in the HW-MTEC Data (Based on 3-Run Averages)

HAP	Source	Breakpoint Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
LVM	CK	303C1	44.29	25.87
LVM	LWAK	312C1	54.80	36.49
SVM	CK	303C3	53.71	33.60

SVM	LWAK	224C1	5.15	4.03

4.7 Analysis of 6% HW-MTEC Data at Percentile Facilities

Tables 27a and 27b present estimated emission percentiles based on percentile devices, using existing sources in the 6% HW-MTEC database. The 50th, 75th, 90th, and 95th percentile devices were estimated from the emission concentration means from each of the devices in the expanded MACT pool. The estimated percentiles that are presented in Table 27a are based on grab samples (or single run data). The estimated percentiles that are presented in Table 27b are based on 3-run average data.

Table 27a.

Percentile Estimates Based on Percentile Devices from Existing Sources in the 6% HW-MTEC Data (Based on Grab Samples)

HAP	Source	Breakpoint Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	50th Percentile	16.41	20.75	32.23
		75th Percentile	64.54	81.63	126.80
		90th Percentile	221.42	280.02	434.97
		95th Percentile	463.03	585.56	909.60
HCl (ppmv)	LWAK	50th Percentile	284.61	321.36	403.56
		75th Percentile	1088.49	1229.03	1543.42
		90th Percentile	3640.46	4110.47	5161.95
		95th Percentile	7498.04	8466.08	10631.75
LVM (µg/dscm)	CK	50th Percentile	30.00	38.16	59.95
		75th Percentile	49.08	62.44	98.08
		90th Percentile	76.45	97.26	152.77
		95th Percentile	99.67	126.79	199.17
LVM (µg/dscm)	LWAK	50th Percentile	50.25	56.09	68.97
		75th Percentile	95.41	106.51	130.95
		90th Percentile	169.91	189.69	233.21
		95th Percentile	240.00	267.94	329.41
Mercury (µg/dscm)	CK	50th Percentile	32.59	35.15	40.15
		75th Percentile	58.50	63.09	72.71

HAP	Source	Breakpoint Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
		90th Percentile	99.02	106.81	123.09
		95th Percentile	135.70	146.36	168.67
Mercury (µg/dscm)	LWAK	50th Percentile	38.35	46.10	65.08
		75th Percentile	179.32	215.52	304.29
		90th Percentile	718.64	863.70	1219.44
		95th Percentile	1649.31	1982.25	2798.68

HAP	Source	Breakpoint Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
SVM (µg/dscm)	CK	50th Percentile	21.25	24.57	32.24
		75th Percentile	35.47	41.00	53.80
		90th Percentile	56.24	65.01	85.31
		95th Percentile	74.11	85.66	112.41
SVM (µg/dscm)	LWAK	50th Percentile	4.90	5.54	6.96
		75th Percentile	8.58	9.69	12.17
		90th Percentile	14.18	16.02	20.13
		95th Percentile	19.17	21.65	27.20

Table 27b.

Percentile Estimates Based on Percentile Devices from Existing Sources in the 6% HW-MTEC Data (Based on 3-Run Averages)

HAP	Source	Breakpoint Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	50th Percentile	13.60	15.73	20.64
		75th Percentile	53.51	61.87	81.21
		90th Percentile	183.57	212.23	278.59
		95th Percentile	383.88	443.81	582.58
HCl (ppmv)	LWAK	50th Percentile	247.46	265.78	303.88
		75th Percentile	946.40	1016.46	1162.17
		90th Percentile	3165.24	3399.55	3886.87
		95th Percentile	6519.24	7001.84	8005.54
LVM (µg/dscm)	CK	50th Percentile	24.87	28.87	38.19
		75th Percentile	40.68	47.23	62.49
		90th Percentile	63.37	73.57	97.33
		95th Percentile	82.62	95.91	126.89
LVM (µg/dscm)	LWAK	50th Percentile	44.10	47.04	53.09
		75th Percentile	83.73	89.31	100.81
		90th Percentile	149.11	159.05	179.52
		95th Percentile	210.62	224.66	253.58
Mercury (µg/dscm)	CK	50th Percentile	29.57	30.90	33.56
		75th Percentile	53.07	55.46	60.23

HAP	Source	Breakpoint Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
		90th Percentile	89.84	93.88	101.96
		95th Percentile	123.11	128.65	139.71
Mercury (µg/dscm)	LWAK	50th Percentile	32.15	35.91	44.20
		75th Percentile	150.32	167.92	206.68
		90th Percentile	602.41	672.93	828.26
		95th Percentile	1382.55	1544.42	1900.90

HAP	Source	Breakpoint Device/Test Condition	Emission Concentrations		
			Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
SVM (µg/dscm)	CK	50th Percentile	18.17	19.80	23.26
		75th Percentile	30.33	33.05	38.83
		90th Percentile	48.09	52.40	61.56
		95th Percentile	63.37	69.05	81.12
SVM (µg/dscm)	LWAK	50th Percentile	4.26	4.58	5.24
		75th Percentile	7.45	8.01	9.16
		90th Percentile	12.33	13.24	15.15
		95th Percentile	16.66	17.90	20.47

4.8 Analysis of 12% Full-MTEC Data Below Breakpoint

Tables 28a and 28b present estimated percentiles for emissions from existing sources in the 12% Full-MTEC database that have average emission levels below the breakpoint. The analyses are similar to those performed for the 12% Full-MTEC database in Section 3.1, except that only test conditions with emissions below the engineering-based breakpoint are included in this analysis. The estimated mean represents the emission level at which facilities should operate in order to meet the standard a given percentage of the time, corresponding to the percentile used for the emission standard. That is, if the 99th percentile estimate is used to establish the emission standard, then the estimated mean is the level at which facilities should operate in order to meet the standard 99 percent of the time. The estimated percentiles that are presented in Table 28a are based on grab samples (or single run data). The estimated percentiles that are presented in Table 28b are based on 3-run average data.

Estimates for semi-volatile metals (SVM) and HCl from light weight aggregate kilns (LWAKs) were calculated twice; once using all test conditions, and a second time with test conditions 307C1, 307C2, 307C3, and 307C4 combined as a single test condition. Additional estimates were calculated for SVM from LWAKs to incorporate two potential breakpoints.

Table 28a.

Estimated Percentiles from Existing Sources in the 12% Full-MTEC Data Using Data Below the Breakpoint (Based on Grab Samples)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	28	38	133	96.2	11.06	20.63	25.85	39.42
HCl (ppmv)	INC	31	65	210	91.4	4.21	8.55	11.24	18.73
HCl (ppmv)	LWAK	7	10	33	100.0	1256.76	1801.72	2024.84	2520.61
HCl (ppmv)**	LWAK	7	7	33	100.0	1297.51	2015.32	2337.98	3089.08
LVM (µg/dscm)	CK	19	26	86	76.7	20.05	35.32	46.62	77.62
LVM (µg/dscm)	INC	9	20	58	82.8	20.83	35.72	42.57	58.85
LVM (µg/dscm)	LWAK	7	7	21	100.0	36.01	52.59	59.53	75.09
Mercury (µg/dscm)	CK	24	31	111	79.3	36.55	53.80	58.63	68.70
Mercury (µg/dscm)	INC	15	27	76	57.9	5.05	6.79	8.99	14.81
Mercury (µg/dscm)	LWAK	7	7	21	57.1	12.50	19.73	22.21	27.44
Particulate Matter (gr/dscf)	CK	18	30	109	100.0	0.023	0.034	0.039	0.050
Particulate Matter (gr/dscf)	INC	53	126	397	99.7	0.010	0.018	0.021	0.031
Particulate Matter (gr/dscf)	LWAK	10	12	37	100.0	0.005	0.009	0.010	0.014
SVM (µg/dscm)	CK	14	21	74	62.2	25.79	31.07	35.94	46.69
SVM (µg/dscm)	INC	8	14	45	71.1	12.38	16.21	20.68	32.27

SVM (µg/dscm) (Breakpoint = 227C1)	LWAK	5	8	27	100.0	5.62	8.85	10.33	13.80
SVM (µg/dscm)** (Breakpoint = 227C1)	LWAK	5	5	27	100.0	5.89	10.04	12.14	17.35
SVM (µg/dscm) (Breakpoint = 313C1)	LWAK	8	11	36	100.0	17.36	29.83	36.21	52.09
SVM (µg/dscm)** (Breakpoint = 313C1)	LWAK	8	8	36	100.0	18.01	32.20	39.89	59.59
D/F TEQ (ng/dscm)	INC	17	26	77	92.2	0.08	0.13	0.15	0.21
D/F TEQ (ng/dscm)	KILNS	10	15	45	95.6	0.05	0.08	0.09	0.12

* Estimated from a modified delta-lognormal distribution.
** Test conditions 307C1, 307C2, 307C3, and 307C4 collapsed into a single test condition.

Table 28b.

Estimated Percentiles from Existing Sources in the 12% Full-MTEC Data Using Data Below the Breakpoint (Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	28	38	133	96.2	11.06	17.02	19.66	25.78
HCl (ppmv)	INC	31	65	210	91.4	4.21	7.03	8.42	11.80
HCl (ppmv)	LWAK	7	10	33	100.0	1256.76	1572.40	1684.00	1915.16
HCl (ppmv)**	LWAK	7	7	33	100.0	1297.51	1719.33	1877.76	2215.36
LVM (µg/dscm)	CK	19	26	86	76.7	20.05	31.12	36.14	47.84
LVM (µg/dscm)	INC	9	20	58	82.8	20.83	29.57	33.09	40.87
LVM (µg/dscm)	LWAK	7	7	21	100.0	36.01	45.64	49.09	56.28
Mercury (µg/dscm)	CK	24	31	111	79.3	36.55	48.38	52.74	62.00
Mercury (µg/dscm)	INC	15	27	76	57.9	5.05	8.34	10.13	14.58
Mercury (µg/dscm)	LWAK	7	7	21	57.1	12.50	17.49	19.41	23.55
Particulate Matter (gr/dscf)	CK	18	30	109	100.0	0.023	0.029	0.032	0.037
Particulate Matter (gr/dscf)	INC	53	126	397	99.7	0.010	0.015	0.017	0.021
Particulate Matter (gr/dscf)	LWAK	10	12	37	100.0	0.005	0.007	0.008	0.010
SVM (µg/dscm)	CK	14	21	74	62.2	25.79	34.82	38.58	46.73
SVM (µg/dscm)	INC	8	14	45	71.1	12.38	18.79	21.75	28.62

SVM (µg/dscm) (Breakpoint = 227C1)	LWAK	5	8	27	100.0	5.62	7.52	8.25	9.80
SVM (µg/dscm)** (Breakpoint = 227C1)	LWAK	5	5	27	100.0	5.89	8.40	9.42	11.68
SVM (µg/dscm) (Breakpoint = 313C1)	LWAK	8	11	36	100.0	17.36	24.92	28.02	34.91
SVM (µg/dscm)** (Breakpoint = 313C1)	LWAK	8	8	36	100.0	18.01	26.76	30.50	38.98
D/F TEQ (ng/dscm)	INC	17	26	77	92.2	0.08	0.11	0.12	0.15
D/F TEQ (ng/dscm)	KILNS	10	15	45	95.6	0.05	0.07	0.07	0.09

* Estimated from a modified delta-lognormal distribution.
** Test conditions 307C1, 307C2, 307C3, and 307C4 collapsed into a single test condition.

4.9 Analysis of 12% HW-MTEC Data Below Breakpoint

Tables 29a and 29b present estimated percentiles for emissions from existing sources in the 12% HW-MTEC database that have average emission levels below the breakpoint. The analyses are similar to those performed for the 12% HW-MTEC database in Section 3.2, except that only test conditions with emissions below the engineering-based breakpoint are included in this analysis. The estimated mean represents the emission level at which facilities should operate in order to meet the standard a given percentage of the time, corresponding to the percentile used for the emission standard. That is, if the 99th percentile estimate is used to establish the emission standard, then the estimated mean is the level at which facilities should operate in order to meet the standard 99 percent of the time. The estimated percentiles that are presented in Table 29a are based on grab samples (or single run data). The estimated percentiles that are presented in Table 29b are based on 3-run average data.

Estimates for semi-volatile metals (SVM) and HCl from light weight aggregate kilns (LWAKs) were calculated twice; once using all test conditions, and a second time with test conditions 307C1, 307C2, 307C3, and 307C4 combined as a single test condition. Additional estimates were calculated for Mercury from cement kilns and LWAKs and for SVM from LWAKs to incorporate two potential breakpoints.

Table 29a.

Estimated Percentiles from Existing Sources in the 12% HW-MTEC Data Using Data Below the Breakpoint (Based on Grab Samples)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	26	37	129	96.1	8.97	16.84	21.18	32.54
HCl (ppmv)	LWAK	7	10	33	100.0	1256.76	1801.72	2024.84	2520.61
HCl (ppmv)**	LWAK	7	7	33	100.0	1297.51	2015.32	2337.98	3089.08
LVM (µg/dscm)	CK	20	27	89	77.5	19.12	33.50	44.37	74.35
LVM (µg/dscm)	LWAK	7	7	21	100.0	36.01	52.59	59.53	75.09
Mercury (µg/dscm) (Breakpoint = 308C1)	CK	24	30	105	82.9	37.23	55.65	61.30	73.28
Mercury (µg/dscm) (Breakpoint = 321C1)	CK	25	31	108	83.3	37.62	55.85	61.42	73.21
Mercury (µg/dscm) (Breakpoint = 223C1)	LWAK	8	8	24	62.5	13.10	20.05	22.25	26.85
Mercury (µg/dscm) (Breakpoint = 336C1)	LWAK	9	10	27	66.7	13.89	20.93	23.08	27.56
SVM (µg/dscm)	CK	16	23	83	66.3	28.20	38.69	45.89	62.50
SVM (µg/dscm) (Breakpoint = 227C1)	LWAK	5	8	27	100.0	5.62	8.85	10.33	13.80

SVM (µg/dscm)** (Breakpoint = 227C1)	LWAK	5	5	27	100.0	5.89	10.04	12.14	17.35
SVM (µg/dscm) (Breakpoint = 313C1)	LWAK	8	11	36	100.0	17.36	29.83	36.21	52.09
SVM (µg/dscm)** (Breakpoint = 313C1)	LWAK	8	8	36	100.0	18.01	32.20	39.89	59.59

* Estimated from a modified delta-lognormal distribution.
** Test conditions 307C1, 307C2, 307C3, and 307C4 collapsed into a single test condition.

Table 29b.

Estimated Percentiles from Existing Sources in the 12% HW-MTEC Data Using Data Below the Breakpoint (Based on 3-Run Averages)

HAP	Source	Number of Devices	Number of Test Conditions	Number of Runs	Percent Detect	Estimated Mean*	Estimated 90th Percentile	Estimated 95th Percentile	Estimated 99th Percentile
HCl (ppmv)	CK	26	37	129	96.1	8.97	13.88	16.08	21.19
HCl (ppmv)	LWAK	7	10	33	100.0	1256.76	1572.40	1684.00	1915.16
HCl (ppmv)**	LWAK	7	7	33	100.0	1297.51	1719.33	1877.76	2215.36
LVM (µg/dscm)	CK	20	27	89	77.5	19.12	29.76	34.60	45.91
LVM (µg/dscm)	LWAK	7	7	21	100.0	36.01	45.64	49.09	56.28
Mercury (µg/dscm) (Breakpoint = 308C1)	CK	24	30	105	82.9	37.23	49.65	54.29	64.20
Mercury (µg/dscm) (Breakpoint = 321C1)	CK	25	31	108	83.3	37.62	49.97	54.57	64.38
Mercury (µg/dscm) (Breakpoint = 223C1)	LWAK	8	8	24	62.5	13.10	17.96	19.78	23.70
Mercury (µg/dscm) (Breakpoint = 336C1)	LWAK	9	10	27	66.7	13.89	18.78	20.61	24.50
SVM (µg/dscm)	CK	16	23	83	66.3	28.20	38.53	42.71	51.79
SVM (µg/dscm) (Breakpoint = 227C1)	LWAK	5	8	27	100.0	5.62	7.52	8.25	9.80

SVM (µg/dscm)** (Breakpoint = 227C1)	LWAK	5	5	27	100.0	5.89	8.40	9.42	11.68
SVM (µg/dscm) (Breakpoint = 313C1)	LWAK	8	11	36	100.0	17.36	24.92	28.02	34.91
SVM (µg/dscm)** (Breakpoint = 313C1)	LWAK	8	8	36	100.0	18.01	26.76	30.50	38.98

* Estimated from a modified delta-lognormal distribution.
** Test conditions 307C1, 307C2, 307C3, and 307C4 collapsed into a single test condition.

4.10 Analysis of Carbon Monoxide and Total Hydrocarbon Data at Breakpoint Facility

Table 30 presents the expected mean emission levels based on the 99th percentile of the breakpoint facility for carbon monoxide (CO) and total hydrocarbon (HC). These analyses are similar to analyses performed on the breakpoint facility from the 6% database in Section 3.3. Estimates are presented for each averaging method (run average and maximum hourly rolling average). The expected mean emission level is the level at which the facilities should operate in order to pass the limit 99 percent of the time. The expected mean levels were estimated based on the assumption that the limitation on 3-run averages was set equal to the 99th percentile of the breakpoint facility. The estimation assumed a lognormal distribution of emission concentrations and uses a within condition variation pooled across facilities.

Table 30.

Expected Mean Levels Based on the 99th Percentile of the Breakpoint Facility for Carbon Monoxide and Hydrocarbon (Based on 3-Run Averages)

HAP	Source	Averaging Technique	Breakpoint Device/Test Condition	Estimated 99th Percentile	Estimated Mean Emission Level
Carbon Monoxide	INC	RA	351C1	116.29	51.81
Carbon Monoxide	INC	MHRA	341C1	3292.57	373.01
Carbon Monoxide	LWAK	RA	310C1	137.04	88.43
Carbon Monoxide	LWAK	MHRA	310C1	269.45	124.27
Hydrocarbon	CK (bypass stack)	RA	301C2	32.86	9.98
Hydrocarbon	CK (bypass stack)	MHRA	316C2	6.70	5.07

Hydrocarbon	INC	RA	706C3	11.73	6.14
Hydrocarbon	LWAK	RA	312C1	7.91	5.02
Hydrocarbon	LWAK	MHRA	312C1	14.34	6.38

RA = Run Average
MHRA = Maximum Hourly Rolling Average

APPENDIX A
STATISTICAL METHODOLOGY DETAILS

This appendix provides details regarding the three potential statistical methodologies discussed in Section 2 for generating percentile estimates from pollutant concentration data. These methodologies are: generation of estimates from the modified delta-lognormal distribution, the censored maximum likelihood estimation procedure, and regression on order statistics.

Modified Delta Lognormal

The EPA has used two reasonably simple modifications to the lognormal density model for several years. In the first modification, the classical delta-lognormal model, the lognormal density is expanded to include zero amounts. To do this, all positive amounts are fit to a lognormal density. All zero amounts represent a discrete distributional "spike" at zero. The resulting mixed distributional model combines a continuous density portion with a discrete-valued spike. The delta in the name refers to the percentage of the overall distribution contained in the spike at zero, that is, the percentage of zero amounts.

Researchers at the EPA (Kahn and Rubin, 1989) further adapted the classical delta-lognormal model ("adapted model") to account for non-detect measurements in the same fashion that zero measurements were handled in the original delta-lognormal model. Instead of zero amounts and non-zero positive amounts, the data consisted of non-detects and detects. Rather than assuming that non-detects represented a spike of zero concentrations, these samples were allowed to have a single positive value, usually equal to the Method Detection Limit. Since each non-detect was assigned the same positive value, the distributional "spike" in this adapted model was located not at zero, but at the detection limit. This adapted model was used in developing limitations for several EPA rulemaking efforts.

While the standard adaptation to the delta-lognormal model has been used successfully for years by EPA in a variety of settings, the model assumes that the discrete spike portion of the adapted delta-lognormal model is a fixed, single-valued probability mass associated with all the non-detect measurements. If all non-detect samples have roughly the same reported detection limit, this assumption would be adequately satisfied. However, reported detection limits in this study vary from sample to sample. Because of variation in detection limits, a single-valued discrete spike will not adequately represent the set of non-detect measurements observed in the database and a modification to the model must be considered. The discrete, single-valued spike representing non-detect measurements was replaced in the delta-lognormal model by a discrete distribution made up of multiple spikes.

Once each non-detect has been associated its reported detection limit, the discrete "delta" portion of the modified model can be estimated in a way similar to the adapted delta-lognormal distribution, only now multiple spikes are constructed, linked to the distinct detection limits observed in the data set. In the adapted model, the delta parameter, designated as d, is estimated by computing the proportion of non-detects. In the modified model, d again represents the proportion of non-detects, but is divided into the sum of smaller fractions, d_i, each representing the proportion of non-detects associated with a distinct detection limit.

The mean and variance of this discrete distribution (unlike the adapted delta-lognormal, the variance of the modified spike is non-zero) is computed using the modified but tractable formulas for the modified delta-lognormal model.

While replacing the single discrete spike in the adapted delta-lognormal distribution with a more general discrete distribution of multiple spikes increases the complexity of the model, the discrete portion plays a role in limitations development identically parallel to the single spike case and offers flexibility for handling multiple observed detection limits.

The modified delta-lognormal random variable U is mathematically expressed as a combination of three other independent variables, such that,

$$U = I_u X_D + (1 - I_u) X_C$$

where X_D represents a random non-detect from the discrete portion of the model, X_C represents a random detected measurement from the continuous lognormal portion, and I_u is an indicator variable designating whether a particular random measurement is detected or not. The expected value and variance of U have forms somewhat similar to the standard delta-lognormal model. These are expressed as

$$E(U) = \sum_i \delta_i D_i + (1-\delta)\exp(\mu + .5\sigma^2)$$

$$\mathrm{Var}(U) = \frac{1}{2\delta}\sum_i \sum_j \delta_i \delta_j (D_i - D_j)^2 + (1-\delta)\exp(2\mu + \sigma^2)\left[\exp(\sigma^2) - 1\right] + \delta(1-\delta)\left[\frac{\sum_i \delta_i D_i}{\delta} - \exp(\mu + .5\sigma^2)\right]^2$$

where D_i equals the individual detection limits for the non-detects, the δ_i are the corresponding proportions of not detected values with detection limit D_i, $\delta = \Sigma\delta_i$, μ is the log-mean of the detected values, and σ^2 is the log-variance of the detected values.

The daily maximum limitation depends on estimates of the upper 99th percentile, which in the modified delta-lognormal model, is an upper quantile from the lognormal portion where the specific quantile depends on the proportion of nondetects.

Cohen's Censored Maximum Likelihood Method

Cohen's censored maximum likelihood method is the most closely related of the alternative methodologies to the modified delta-lognormal. Cohen's method explicitly accounts for and incorporates censored data into the model, and it is adaptable to a variety of distributional models, not just the lognormal distribution.

Using an underlying lognormal model, the basic premise of Cohen's method is that all of the observed measurements in a given data set, whether censored or non-censored, are generated according to a single underlying, continuous distribution, in this case, the lognormal. Thus, not only do the known, non-censored values follow a lognormal pattern, but also the censored observations whose values are not known explicitly. Under Cohen's model, these censored measurements would be seen to follow the same lognormal distribution if only their true values were known.

To find the specific parameters and lognormal density most consistent with a particular set of censored and non-censored values, the approach taken is identical to that used in fitting censored and non-censored detected measurements to the continuous lognormal portion of the modified delta-lognormal model. In particular, the maximum likelihood estimation scheme for censored data is used to find the best-fitting parameters m and s. Then the overall likelihood function is computed as in the following general expression:

$$\mathrm{L.F.} = \left(\prod_{i:\mathrm{Detect}} \frac{1}{x_i \sigma} \phi\left(\frac{\log x_i - \mu}{\sigma} \right) \right) \times \left(\prod_{i:\mathrm{ND}} \Phi\left(\frac{\log U_i - \mu}{\sigma} \right) \right)$$

where $\phi(x)$ and $\Phi(x)$ denote the standard normal density and standard normal cumulative distribution functions, respectively.

Once the MLEs for the model parameters have been determined, estimates of the mean, variance, and upper percentiles can be computed from the estimated best-fitting distribution. Non-detects under Cohen's model are treated merely as one type of censored sample, namely left-censored. Thus, it is assumed that non-detects, if the true concentration or mass amounts were measurable, would follow the same lognormal pattern as the rest of the data set.

Regression on Order Statistics

Another estimation method that will be considered in developing the final statistical methodology is the regression on order statistics (ROS) approach. This method of fitting partially censored data to an underlying distributional model has been formally developed by a number of researchers at the USGS.

The ROS technique can be described by first considering the case with no censored measurements (for instance, a set of detected and precisely known observations). If it is assumed that the data were generated by an underlying lognormal distribution, we would expect that the natural logarithm transformed data would plot on a probability plot in roughly a linear pattern when graphed against ordered quantiles from a standard normal distribution. In fact, it would be possible in this case to fit a linear regression to the points on the probability plot and determine the slope and intercept of the regression equation.

From the slope and intercept of this regression equation, an "optimal" set of parameters for fitting a specific lognormal density to the observed data can be estimated. The optimality in this case is not one in which the overall likelihood function is maximized, as in the MLE method, but rather relies on the fact that the standard linear regression minimizes the sum of squared distances or "residuals" between the observed points on the probability plot and the regression line drawn through these points.

To derive the actual parameters of the optimal lognormal density, the natural logarithm transformed data are plotted against quantiles from a standard normal density. Thus the linear regression equation with slope and intercept parameter b and a, respectively, can be written in the form

$$\log(X)_\alpha = a + bZ_\alpha$$

where each quantile z_α of a standard normal variable Z is equated to the corresponding alpha-quantile of a normally-distributed variable log(X), log(X) being normally distributed since it is assumed that the underlying distribution of the original data is lognormal. Writing this relationship in terms of the random variables Z and log(X) instead of the alpha-quantiles, the relationship is expressed as log(X) = a + b Z. Since log(X) is normal in distribution, the first and second moments of both sides of the latter equation are calculated to derive expressions for the parameters m and s in terms of the regression coefficients a and b. Specifically, parameter m is set equal to the expected value of log(X), and so, since Z has a mean of zero, the resulting relationship is estimated as m=a. Similarly, the variance of log(X) is set equal to b^2 times the variance of Z, and s is estimated by the slope, b, of the regression line.

The basic advantages of using the ROS approach instead of a maximum likelihood scheme to estimate the underlying model parameters are twofold. First, if censored data are present, the MLE method must be computed using an iterative, nonlinear search algorithm. The ROS method only requires construction of a probability plot and a regression fit to the points on the plot. In this sense, the ROS estimates can be somewhat easier to compute and verify than the MLE estimates. Second, the ROS estimates tend to be more stable and accurate than comparable maximum likelihood estimates (Gilliom and Helsel, 1986).

In the more general case, some, but not all, of the measurements are assumed to be censored values, where the exact concentration or mass amount is unknown. The key to constructing any probability plot is the ability to list the observed data in order, so that the appropriate quantiles from (typically) the normal distribution can be matched against these ordered values. With censored data, however, it is generally not possible to construct an exact ordering of the observations. In fact, the censored values cannot even be graphed on the probability plot, since the measurements are not known. Thus a partial ordering of the data, one in which the non-censored, detected values can be ordered precisely, once the relative positions of the censored data have been established is generated. Such a partial ordering is sufficient to construct the linear regression, since it is only these detected values that can be graphed on the probability plot anyway.

If the only censored data are non-detects and the largest reported detection limit is no greater than the smallest detected value, the desired partial ordering is easy to construct. In that case, all of the detects are presumably larger than any of the non-detects, and so it is possible to order each detected value precisely, even though none of the non-detects can be so ordered. As a simple example, suppose a data set contains 5 non-detects with the largest detection limit equal to 10 ppq and 15 detects with smallest value equal to 12 ppq. The detected measurements would occupy ordered ranks 6 through 20, or in terms of quantiles, from a = 0.29 to 0.95, and would be matched against normal quantiles of corresponding probabilities.

When the censored data are non-detects exhibiting multiple detection limits, and the set of detection limits overlaps the set of detected values, the desired partial ordering of the data is more difficult to construct. Such is the situation with many typical effluent analytical data sets. However, Gilliom and Helsel (1987) have attempted to adapt the simpler ROS method with a single detection limit to the more general case of multiple detection limits and overlapping data by developing the partial ordering in terms of cumulative probabilities. These authors in fact adapted the work of Hirsch and Stedinger (1987) on the partial ordering of historical flood levels, in which the censored observations were right-censored, to the partial ordering of concentration measurements, in which the censored values are left-censored.

Unfortunately, careful examination of the Gilliom and Helsel paper shows that the algorithm they suggest for constructing the partial ordering is logically flawed. While the algorithm works fine for historical flood levels, the same procedure cannot be directly adapted to the ordering of non-detect concentration values without making assumptions that may not be warranted. To illustrate the problem, consider the difference between historical flood levels and non-detect measurements with multiple detection limits. Suppose the actual crest levels of two historical floods are not known, but it is known that one level was at least 50 feet and the other was at least 75 feet. As Hirsch and Stedinger point out, with the way flood records are kept (with emphasis upon noteworthy flood levels and whether or not the crest was higher than previous floods), the first flood could not have been more than 75 feet. Thus, it is possible to impose a relative ordering on these two floods without knowing the exact crest levels.

On the other hand, suppose, as in the example of Gilliom and Helsel's paper, some non-detects with detection limit equal to 1 and some non-detects with detection limit equal to 10. Just because certain non-detects have a higher detection limit does not mean that all of the exact concentration levels associated with these samples are greater than 1. Indeed, the picture in Gilliom and Helsel's paper seems to illustrate just this possibility, namely that the non-detects with detection limit of 10 are uniformly distributed in a probabilistic sense between the values of 0 and 10, not between 1 and 10. However, the explicit calculation of the partial ordering in fact assumes that the non-detects behave like historical flood levels, in that any non-detect with detection limit equal to 10 must have a true concentration level greater than 1.

Because of this flaw in the algorithm for constructing the partial ordering, SAIC has begun to investigate the practical impact of the logical flaw on estimation results from the ROS algorithm in the presence of multiple detection limits. Preliminary work suggests that the ROS method may still be adequate in many cases, leading to performance no worse than situations where the exact ordering of the data is known.

One important caveat to this discussion is that the ROS method, like Cohen's method above, assumes implicitly that all non-detects come from the same distribution as the detects. When this is not the case, the modified delta-lognormal method should still provide more accurate estimates than either the ROS or Cohen's methods.

APPENDIX B
PROBABILITY PLOTS OF EMISSION CONCENTRATIONS

This appendix contains the probability plots of emission concentration data from the existing sources in the 12% Full-MTEC database. These probability plots were used to assess the distribution of the HAP emission concentrations in Section 1.1. These plots are contained in Appendix B. The first set of probability plots (Figures B-1-x) compare the normal and lognormal distributions. The second set of plots (Figures B-2-x) are similar to the first set, but the concentration data have been adjusted to remove test condition effects by subtracting the test condition mean from each run. The third set of probability plots (Figures B-3-x) display all of the data with the nondetects set equal to one-half of the detection limit fit to the lognormal distribution and only the detected concentrations fit to the lognormal distribution. These plots are used to assess whether the nondetected samples follow the same distribution as the detected samples.

APPENDIX D

AIR POLLUTION CONTROL DEVICE ACRONYM LIST

AIR POLLUTION CONTROL DEVICE ACRONYMS

AB	Afterburner
ACS	Acid Scrubber
APCD	Air Pollution Control Device
APCS	Air Pollution Control System
AS	Absorber
AT	Ash Trap
C	Cyclone
CA	Carbon Absorber
CB	Carbon Bed
CCS	Counter Current Scrubber
CLS	Chlorine Scrubber
CS	Caustic Scrubber
CT	Chimney Tray
DA	Dilution Air
DI	Dry Injection
DM	Demister
DS	Dry Scrubber
dscf	Dry Standard Cubic Foot
dscm	Dry Standard Cubic Meter
ES	Entrainment Separator
ESP	Electrostatic Precipitator
FF	Fabric Filter
FN	Fog Nozzel
GC	Gas Cooler
H	Humidifier
HCA	Hydrogen Chloride Absorber
HCS	Hydrogen Chloride Scrubber
HE	Heat Exchanger
HEPA	High Efficiency Particulate Air Filter
HES	High Energy Scrubber
HS	Hydrosonic Edctor Scrubber
HTHE	High Temperature Heat Exchanger
IWS	Ionizing Wet Scrubber
KOV	Knock Out Vessel
LTHE	Low Temperature Heat Exchanger

APPENDIX E

FACILITY NAME AND LOCATION LIST CORRESPONDING TO THREE DIGIT EPA ID CODES

LIST OF FACILITY NAME AND LOCATIONS CORRESPONDING TO THREE DIGIT ID NUMBER

EPA ID	System Type	Company	City	State	Unit
200	CEMENT KILN	GIANT CEMENT COMPANY	HARLEYVILLE	SC	KILN NO. 4
201	CEMENT KILN	GIANT CEMENT COMPANY	HARLEYVILLE	SC	KILN NO. 5
202	CEMENT KILN	HEARTLAND CEMENT COMPANY	INDEPENDENCE	KS	KILN NO. 1
203	CEMENT KILN	HOLNAM INC.	ARTESIA	MS	KILN NO. 1
204	CEMENT KILN	HOLNAM INC.	CLARKSVILLE	MO	KILN NO. 1
205	CEMENT KILN	HOLNAM INC.	HOLLY HILL	SC	KILN NO. 1
206	CEMENT KILN	HOLNAM INC.	HOLLY HILL	SC	KILN NO. 2
207	CEMENT KILN	KEYSTONE CEMENT COMPANY	BATH	PA	KILN NO. 1
208	CEMENT KILN	KEYSTONE CEMENT COMPANY	BATH	PA	KILN NO. 2
228	CEMENT KILN	ASH GROVE CEMENT COMPANY	FOREMAN	AR	KILN NO. 2
300	CEMENT KILN	ESSROC CORPORATION	LOGANSPORT	IN	KILN NO. 1
301	CEMENT KILN	ESSROC CORPORATION	DORADO	PR	KILN NO. 1
302	CEMENT KILN	LAFARGE	PAULDING	OH	KILN NO. 2
303	CEMENT KILN	LONE STAR INDUSTRIES, INC.	CAPE GIRARDEAU	MO	KILN NO. 1
304	CEMENT KILN	LONE STAR INDUSTRIES, INC.	GREENCASTLE	IN	KILN NO. 1
305	CEMENT KILN	MEDUSA CEMENT COMPANY	WAMPUM	PA	KILN NO. 1,2
306	CEMENT KILN	NATIONAL CEMENT PLANT	LEBEC	CA	KILN NO. 1
308	CEMENT KILN	NORTH TEXAS CEMENT COMPANY	MIDLOTHIAN	TX	KILN NO. 2
309	CEMENT KILN	RIVER CEMENT	FESTUS	MO	KILN NO. 1,2
315	CEMENT KILN	SOUTHDOWN	FAIRBORN	OH	KILN NO. 1
316	CEMENT KILN	SOUTHDOWN	KNOXVILLE	TN	KILN NO. 1
317	CEMENT KILN	SOUTHDOWN	KOSMOSDALE	KY	KILN NO. 1
318	CEMENT KILN	TEXAS INDUSTRIES	MIDLOTHIAN	TX	KILN NO. 1
319	CEMENT KILN	CONTINENTAL CEMENT COMPANY	HANNIBAL	MO	KILN NO. 1
320	CEMENT KILN	LAFARGE	ALPENA	MI	KILN NO. 23
321	CEMENT KILN	LAFARGE	DEMOPOLIS	AL	KILN NO. 1
322	CEMENT KILN	LAFARGE	FREDONIA	KS	KILN NO. 1
323	CEMENT KILN	LAFARGE	FREDONIA	KS	KILN NO. 2
335	CEMENT KILN	MEDUSA CEMENT COMPANY	WAMPUM	PA	KILN NO. 3
401	CEMENT KILN	ASH GROVE CEMENT COMPANY	CHANUTE	KS	KILN NO. 1
402	CEMENT KILN	ASH GROVE CEMENT COMPANY	CHANUTE	KS	KILN NO. 2

LIST OF FACILITY NAME AND LOCATIONS CORRESPONDING TO THREE DIGIT ID NUMBER

EPA ID	System Type	Company	City	State	Unit
403	CEMENT KILN	ASH GROVE CEMENT COMPANY	FOREMAN	AR	KILN NO. 1
404	CEMENT KILN	ASH GROVE CEMENT COMPANY	FOREMAN	AR	KILN NO. 3
405	CEMENT KILN	ASH GROVE CEMENT COMPANY	LOUISVILLE	NE	KILN NO. 1
406	CEMENT KILN	ASH GROVE CEMENT COMPANY	LOUISVILLE	NE	KILN NO. 2
209	COMM. INCINERATOR	LAIDLAW ENVIR SERVICES	ROEBUCK	SC	
210	COMM. INCINERATOR	LWD, INC.	CALVERT CITY	KY	UNIT NO. 3
211	COMM. INCINERATOR	LWD, INC.	CALVERT CITY	KY	UNIT NO. 1
212	COMM. INCINERATOR	LWD, INC.	CALVERT CITY	KY	UNIT NO. 2
214	COMM. INCINERATOR	ROLLINS ENVIRONMENTAL SERVICES	BATON ROUGE	LA	
216	COMM. INCINERATOR	ROLLINS ENVIRONMENTAL SERVICES	BRIDGEPORT	NJ	
221	COMM. INCINERATOR	ROLLINS ENVIRONMENTAL SERVICES	DEER PARK	TX	RES (TX) INCINERATOR
222	COMM. INCINERATOR	WASTE TECHNOLOGIES INDUSTRIES	EAST LIVERPOOL	OH	
324	COMM. INCINERATOR	ALLIED CORPORATION	BIRMINGHAM	AL	
325	COMM. INCINERATOR	APTUS	COFFEYVILLE	KS	
327	COMM. INCINERATOR	APTUS	ARAGONITE	UT	
329	COMM. INCINERATOR	CHEMICAL WASTE MANAGEMENT	CHICAGO	IL	
330	COMM. INCINERATOR	GENERAL ELECTRIC CO.	PITTSFIELD	MA	
331	COMM. INCINERATOR	ROSS INCINERATION SERVICES	GRAFTON	OH	
332	COMM. INCINERATOR	THERMALKEM	ROCK HILL	SC	
333	COMM. INCINERATOR	TRADE WASTE INCINERATION	SAUGET	IL	UNIT NO. 4
359	COMM. INCINERATOR	ATOCHEM	CARROLLTON	KY	
400	COMM. INCINERATOR	MARINE SHALE PROCESSORS, INC.	MORGAN CITY	LA	
223	LWA KILN	SOLITE	NORWOOD	NC	KILN NO. 5
224	LWA KILN	SOLITE	NORWOOD	NC	KILN NO. 6
225	LWA KILN	SOLITE	NORWOOD	NC	KILN NO. 7
226	LWA KILN	SOLITE	NORWOOD	NC	KILN NO. 8
227	LWA KILN	SOLITE	GREEN COVE SPRINGS	FL	KILN NO. 5
307	LWA KILN	NORLITE	COHOES	NY	KILN NO. 1
310	LWA KILN	SOLITE	BROOKS	KY	KILN NO. 2
311	LWA KILN	SOLITE	CASCADE	VA	KILN NO. 2
312	LWA KILN	SOLITE	CASCADE	VA	KINL NO. 4

LIST OF FACILITY NAME AND LOCATIONS CORRESPONDING TO THREE DIGIT ID NUMBER

EPA ID	System Type	Company	City	State	Unit
313	LWA KILN	SOLITE	ARVONIA	VA	KILN NO. 7
314	LWA KILN	SOLITE	ARVONIA	VA	KILN NO. 8
336	LWA KILN	SOLITE	CASCADE	VA	KILN NO. 1
229	ONSITE INCINERATOR	VULCAN MATERIALS CO.	WICHITA	KS	
334	ONSITE INCINERATOR	3M	COTTAGE GROVE	MN	CHEMOLITE INCIN
337	ONSITE INCINERATOR	OLIN CHEMICALS	EAST ALTON	IL	UNIT NO. 2
338	ONSITE INCINERATOR	DUPONT	ORANGE	TX	
339	ONSITE INCINERATOR	DUPONT	DEEPWATER	NJ	
340	ONSITE INCINERATOR	MILES, INC.	NEW MARTINSVILLE	WV	
341	ONSITE INCINERATOR	GLAXO INC.	RES TRI PRK	NC	
342	ONSITE INCINERATOR	UPJOHN CO.	KALAMAZOO	MI	
344	ONSITE INCINERATOR	DEPARTMENT OF ARMY	JOHNSTON ATOLL	TT	LIC
346	ONSITE INCINERATOR	DEPARTMENT OF ARMY	JOHNSTON ATOLL	TT	DFS
347	ONSITE INCINERATOR	DEPARTMENT OF ARMY	TOOELE	UT	
348	ONSITE INCINERATOR	OCCIDENTAL CHEMICAL CORP.	NIAGARA FALLS	NY	
349	ONSITE INCINERATOR	RADFORD ARMY AMMO PLANT	RADFORD	VA	UNIT 6A
350	ONSITE INCINERATOR	DUPONT	LA PORTE	TX	VINYLS INCINERATOR
351	ONSITE INCINERATOR	IOWA ARMY AMMUNITION PLANT	MIDDLETOWN	IA	EWI AFTERBURNER
353	ONSITE INCINERATOR	DOW CHEMICAL CO.	MIDLAND	MI	UNIT 703
354	ONSITE INCINERATOR	DOW CHEMICAL CO.	MIDLAND	MI	UNIT 830
356	ONSITE INCINERATOR	DUPONT	LOUISVILLE	KY	
357	ONSITE INCINERATOR	DEPARTMENT OF ENERGY	OAK RIDGE	TN	K-25
358	ONSITE INCINERATOR	ELI LILLY AND COMPANY	LAFAYETTE	IN	
500	ONSITE INCINERATOR	CHEVRON CHEMICAL CO.	RICHMOND	CA	
502	ONSITE INCINERATOR	PFIZER, INC.	GROTON	CT	UNITS 101/102
503	ONSITE INCINERATOR	LAKE CITY ARMY AMMO PLANT	INDEPENDENCE	MO	BUILDING 97
504	ONSITE INCINERATOR	CHEVRON CHEMICAL CO.	PHILADELPHIA	PA	
600	ONSITE INCINERATOR	DOW CHEMICAL CO.	FREEPORT	TX	
700	ONSITE INCINERATOR	DUPONT	WILMINGTON	DE	INCINERATOR
701	ONSITE INCINERATOR	ELI LILLY AND COMPANY	CLINTON	IN	BARTLETT SNOW INCIN.
702	ONSITE INCINERATOR	DUPONT	LA PORTE	TX	THF INCINERATOR

LIST OF FACILITY NAME AND LOCATIONS CORRESPONDING TO THREE DIGIT ID NUMBER

EPA ID	System Type	Company	City	State	Unit
703	ONSITE INCINERATOR	ARISTECH CHEMICAL	COLTON	CA	INCINERATOR
704	ONSITE INCINERATOR	ASHLAND CHEMICAL COMPANY	LOS ANGELES	CA	INCINERATOR
705	ONSITE INCINERATOR	CIBA-GEIGY CORPORATION	McINTOSH	AL	MULTIPURPOSE INCINER
706	ONSITE INCINERATOR	CIBA-GEIGY CORPORATION	BATON ROUGE	LA	INCINERATOR
707	ONSITE INCINERATOR	DUPONT	LA PORTE	TX	CENTRAL SCRUBBED INC
708	ONSITE INCINERATOR	BURROUGHS WELLCOME	GREENVILLE	NC	McGILL NO 2 INCIN.
709	ONSITE INCINERATOR	CARGILL CHEM PRODUCTS DIV	LYNWOOD	CA	HIRT COMBUSTION ENG.
710	ONSITE INCINERATOR	DUPONT	LA PLACE	LA	INCINERATOR
711	ONSITE INCINERATOR	CHEVRON CHEMICAL CO.	BELL CHASSE	LA	INCINERATOR
712	ONSITE INCINERATOR	NEPERA	HARRIMAN	NY	INCINERATOR
713	ONSITE INCINERATOR	PFIZER, INC.	BARCELONETA	PR	INCINERATOR
714	ONSITE INCINERATOR	OLIN CHEMICALS	LAKE CHARLES	LA	INCINERATOR
725	ONSITE INCINERATOR	ZENECA	BAYONNE	NJ	LV-3 INCINERATOR
726	ONSITE INCINERATOR	SHELL OIL CO.	MARTINEZ	CA	RM-17 INCINERATOR
727	ONSITE INCINERATOR	IOWA ARMY AMMUNITION PLANT	MIDDLETOWN	IA	EWI NO AFTERBURNER
728	ONSITE INCINERATOR	ELI LILLY AND COMPANY	MAYAQUEZ	PR	BRULE
784	ONSITE INCINERATOR	COOK COMPOSITES	PORT WASHINGTON	WI	
805	ONSITE INCINERATOR	AMERICAN CYANAMID	HANNIBAL	MO	TRANE/BRULE
806	ONSITE INCINERATOR	AMOCO OIL CO.	WHITING	IN	FLUIDIZED BED
807	ONSITE INCINERATOR	BROS LAGOON AND CLEANUP SITE	BRIDGEPORT	NJ	MWP-2001
808	ONSITE INCINERATOR	DOW CHEMICAL CO.	PLAQUEMINE	LA	I-300
809	ONSITE INCINERATOR	TENNESSEE EASTMAN CO.	KINGSPORT	TN	NO. 1 ROTARY KILN
810	ONSITE INCINERATOR	TENNESSEE EASTMAN CO.	KINGSPORT	TN	LIQUID CHEMICAL DEST
824	ONSITE INCINERATOR	PENNWALT CORPORATION	THOROFARE	NJ	ISOTRON 142
825	ONSITE INCINERATOR	GENERAL ELECTRIC CO.	WATERFORD	NY	ROTARY KILN INCINER
902	ONSITE INCINERATOR	ROCKY MOUNTAIN ARSENAL	ADAMS COUNTY	CO	SQI
904	ONSITE INCINERATOR	FIRST CHEMICAL CORPORATION	PASCAGOULA	MS	
905	ONSITE INCINERATOR	VELSICOL CHEMICAL CORPORATION	MEMPHIS	TN	
906	ONSITE INCINERATOR	MONSANTO AGRICULTURAL CO	MUSCATINE	IA	CAC INCINERATOR
914	ONSITE INCINERATOR	VERTAC SUPERFUND SITE	JACKSONVILLE	AR	
915	ONSITE INCINERATOR	EASTMAN KODAK	ROCHESTER	NY	BUILDING 218 CHI

LIST OF FACILITY NAME AND LOCATIONS CORRESPONDING TO THREE DIGIT ID NUMBER

EPA ID	System Type	Company	City	State	Unit
903	ONSITE INCINERATOR	NEW BEDFORD HAR SUPERFUND SITE	NEW BEDFORD	MA	IRF

MC	Multiple Cyclones
OS	Orifice Scrubber
PBC	Packed Bed Condenser
PBS	Packed Bed Scrubber
PT	Packed Tower
Q	Quench
QC	Quench Column
QS	Quench Separator
QT	Quench Tower
RH	Reheat
RJS	Reverse Jet Scrubber
S	Scrubber
SD	Spray Dryer
SS	Spray Saturator
ST	Spray Tower
VQ	Venturi Quench
VS	Venturi Scrubber
WHB	Waste Heat Boiler
WS	Wet Scrubber