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STATE AND LOCAL AIR POLLUTION CONTROL OFFICIALS RECOMMENDATIONS FOR UTILITY MACT STANDARDS (DISCUSSED AT SEPTEMBER 9, 2002 AND OCTOBER 17, 2002 UTILITY MACT WORKGROUP MEETINGS AND AMENDED OCTOBER 22, 2002)

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A. BACKGROUND AND INTRODUCTION

The state and local agency representatives on this working group would like to thank EPA for convening the group and providing the opportunity to meet and discuss this important MACT standard. We sincerely appreciate the time, effort, and resources that EPA has devoted to this process. We would also like to thank our fellow working group members and acknowledge the dedication of many to the process. Those that participated in the “mini” work groups to address specific issues, and those that authored and presented various special reports throughout the process are deserving of special thanks. We believe this has been a useful process and we trust EPA feels the time spent in our discussions will be helpful in its writing of the Utility MACT standard.

State and local agency participation in the working group was somewhat limited by the size of the committee. Some Western states have recently indicated an interest in evaluating the utility MACT workgroup recommendations and may present alternative or supplemental recommendations. We recommend that EPA consider this Western States submission, as well as any other state or local agency opinions which may be submitted on this topic. Those of us that have been on the working group have taken steps to incorporate STAPPA/ALAPCO membership positions into our report,and we have communicated with our membership on the process throughout the past year.

Regarding the incorporation of STAPPA/ALAPCO positions, cited below from STAPPA/ALAPCO documents are three references to non-mercury HAPs from utility boilers.

On June 5, 1998, STAPPA toxics committee chair Bliss Higgins of Louisiana sent a letter to EPA regarding the U.S. Environmental Protection Agency's (EPA) proposed Information Collection Request (ICR) related to coal-fired electric utilities proposed in the Federal Register on April 9, 1998 (63 FR 17406). In that letter a number of recommendations were made, including one that EPA “should seriously consider also requiring the analysis of other chemicals of concern in the coal, ash, and flue gases. Most of the cost of stack testing is related to the labor of obtaining the samples and the supporting measurements, not the analysis of the mercury. To add the analysis of arsenic and other chemicals of concern would add insignificantly to the overall cost. The collection of these samples represents an opportunity for obtaining statistically representative data on other chemicals very cost-effectively."

On June 12, 2000 STAPPA/ALAPCO sent a letter to Administrator Carol Browner regarding the pending regulatory determination to regulate hazardous air pollutants from electric utility steam generating units (Public Docket No. A92-55). Quoting from that letter, "STAPPA and ALAPCO believe a regulation is warranted and strongly recommend that the U.S. Environmental Protection Agency (EPA) establish standards to control emissions of HAPs from electric utilities, including, but not limited to, mercury. Other pollutants you may wish to consider addressing include dioxin, arsenic, nickel and acid gases."

In May, 2002 the STAPPA/ALAPCO membership adopted a set of "Principles for a Multi-Pollutant Strategy for Power Plants." Quoting from that document, "Power plants also emit substantial quantities of hazardous air pollutants. EPA's *Study of Hazardous Air Pollutant Emissions from Electric Utility Generating Units – Final Report to Congress* (1998) concludes that electric utility steam generating units emit 67 hazardous air pollutants (HAPs), including mercury, arsenic, nickel, hydrogen chloride and dioxins. In fact, electric generating units are the major emitter of hydrochloric acid, which is the HAP emitted in the greatest quantity in the U.S….. Given the significant contribution of power plant emissions to public health and environmental problems in the U.S., the State and Territorial Air Pollution Program Administrators (STAPPA) and the Association of Local Air Pollution Control Officials (ALAPCO) believe that, if properly structured, a comprehensive, integrated control strategy for electric utilities is an appropriate approach that will offer multiple important benefits."

Clearly, it can be seen in these documents that state and local agencies desire that EPA consider carefully the control of all HAPs emitted by utilities.

In addition to the written documentation on this issue, we also considered an electric utilities MACT project stakeholder meeting EPA held with 17 state and local representatives on March 12, 2001. At that meeting, the

State/local/tribal representatives indicated that their preferred outcome would be a rule that provided for:

– minimal subcategorization of the industry;

– the most stringent levels of mercury control possible;

– a multi-pollutant approach;

– limited flexibility by the sources so as to enhance the States ability to implement the standards;

– early compliance encouraged through the use of incentives; and

– no trading of toxics.

The recommendations included in this report reflect the historical positions taken by STAPPA/ALAPCO, our personal knowledge, and our observations gleaned from the working group meetings. Our general views were presented to the STAPPA/ALAPCO Board of Directors on July 27th and to the STAPPA/ALAPCO toxics committee on September 6th. Also, an overview of our recommendations was provided to the STAPPA/ALAPCO membership on September 29, 2002, along with copies of the presentation for the September 9 workgroup meeting. The authors of this paper are Praveen Amar (NESCAUM), Bill O'Sullivan (N.J.) and John Paul (Dayton, Ohio). This paper does not reflect the views of the Hg MACT workgroup member, Dave Schanbacher (Texas) who has provided separate recommendations.

B. SUMMARY

A good summary of the recommendations contained in this white paper are included in the Workgroup's Final Report to the CAAAC. Within that report the States and Local's column in the Table entitled "Summary of Stakeholder's Positions on Key Issues" gives a thumbnail sketch of recommendations in this white paper.

C. COAL MACT RECOMMENDATIONS

1. COAL HAPS TO BE REGULATED

In addition to mercury, which has been identified as the hazardous air pollutant (HAP) of "greatest potential concern," many other HAPs are emitted by coal-fired power plants in significant amounts and also are of potential concern. In EPA's electric utility study, specific concerns were identified for arsenic, dioxin, and radionuclides. Additionally, coal-fired utilities are the largest source category of hydrochloric acid and hydrofluoric acid emissions in the US. Coal-fired utilities are also the largest, or among the largest, emitters of many other HAPs.

On December 2000, the EPA made the "Regulatory Finding" that regulation of HAP emissions from coal-fired and oil-fired electric steam generating units under section 112 is appropriate and necessary (Federal Register Volume 65, p. 79825-79831). The "Regulatory Finding" stated the following: "With regard to the other HAPs, arsenic and a few other metals (e.g., chromium, nickel, cadmium) are of potential concern for carcinogenic effects. Although the results of the risk assessment indicate that cancer risks are not high, they are not low enough to eliminate those metals as a potential concern for public health. Dioxins, hydrogen chloride, and hydrogen fluoride are three additional HAP that are of potential concern and may be evaluated further during the regulatory development process. The other HAPs studied in the risk assessment do not appear to be a concern for public health based on the available information. However, because of data gaps and uncertainties, it is possible that future data collection efforts or analyses may identify other HAPs of potential concern."

This same "Regulatory Finding" estimated HAP emissions from coal as follows:

Arsenic	61 tons/year
Chromium	73 tons/year
Lead	75 tons/year
Manganese	164 tons/year
Mercury	46 tons/year
Hydrogen chloride	143,000 tons/year
Hydrogen fluoride	19,500 tons/year

In keeping with precedents to regulate all significant HAPs when a MACT rule is developed for a source category, EPA's MACT rules for coal-fired utilities must include HAP emission limits which address the majority of HAPs emitted by coal-fired power plants. The technology-based MACT program under the Clean Air Act (CAA)is designed to ensure that all significant sources of HAPs implement controls to reduce emissions to the maximum extent achievable. High stacks, which are common to coal-fired power plants, should not be relied upon to limit high local risk from HAPs and are not an acceptable substitute for MACT. Power plants contribute to the nationwide soup of toxic air pollutants, which need to be minimized consistent with the MACT mandate of the Clean Air Act.

a. Coal HAP Groupings

Coal HAPs can be grouped by chemical and physical properties relevant to air pollution control measures for the purpose of developing MACT limits. The following groups of HAPs from coal-fired power plants cover most of the HAPs emitted from coal-fired power plants.

i. Mercury - Mercury and its compounds require a separate grouping for MACT limitation because of the unique chemical and physical properties of mercury with respect to air pollution control.

ii. Fine-particulate HAPs – Fine-particulate HAPs include the heavy metals, including but not limited to arsenic, cadmium, and chromium; radionuclides; and polycyclic organic matter (POM). Some of the adverse health effects of fine particulates (PM 2.5) are certain to be related to these HAPs, which are components of PM 2.5 in the ambient air. For the purpose of MACT standards for heavy metals, it may be appropriate to have a subgroup of HAP particulates which are semi-volatile at temperatures present in boilers.

iii. Acid-Gas HAPs - These are primarily hydrochloric acid (HCl) and hydrofluoric acid (HF). These acid-gas HAPs are the bulk of the 784 million pounds of HAP emissions reported by utilities in the 1998 Toxic Release Inventory

(TRI) and account for over 1/3 of the entire TRI inventory.

iv. Organic HAPs – Coal-fired power plants are a major emitter of polycyclic organic matter (POM) and other products of incomplete combustion (PICs). Dioxin is a PIC of potential concern where combustion is inefficient.

b. Surrogates

One practical way to address the large number of non-mercury HAPs emitted by coal-fired boilers is through the use of surrogates. Surrogates may be non-HAPs (for example, CO or PM2.5 mass) or a single HAP that is representative of many HAPs. This approach is useful to efficiently and effectively address the majority of HAPs emitted by coal-fired power plants.

A surrogate is useful if efforts to minimize the surrogate also result in the minimization of a group of HAPs which have common air pollution control properties. Under section 112(d) of the CAA, the Administrator is directed to use emission information to set MACT limits. The Administrator is not limited to using only HAP emission information, and it is reasonable to conclude the Administrator may also use information on other emissions which are associated with HAP emissions. A surrogate is particularly useful if it can be continuously monitored and serve as a continuous indicator of HAP emissions.

A representative HAP is a HAP within a group of HAPs where its emission minimization indicates the emissions of other HAPs in the group are also being minimized.

Using the above (C.1.a.) HAP groupings for coal- fired power plants, the following surrogates or representative HAPs are reasonable choices to regulate the majority of HAPs from coal-fired power plants:

i. Fine-particulate HAPs - Fine particulate mass emissions may be an adequate surrogate. Alternatively, representative HAPs such as arsenic (semi-volatile) and chromium (non-volatile) could have MACT limits. POM control is best achieved by good combustion, and consequently, the CO surrogate discussed in C.1.b.iii. below is most relevant to POM.

ii. Acid-Gas HAPs - Hydrochloric acid is the HAP emitted in greatest amounts from coal-fired power plants. An HCl limit may be adequate for all acid-gas HAPs, but there are insufficient data on HF emissions to confirm that an HCl limit would be adequate for the control of HF. Additional testing of HF should be required to show that HCl minimization also minimizes HF emissions, or that a separate MACT standard for HF may be more appropriate. Alternatively, sulfur dioxide limits may be an appropriate surrogate for acid-gas HAPs since scrubbers used to control SO2 have been shown to control HCl at even higher efficiencies. Using SO2 as a surrogate for acid-gas HAPs has the added advantage of continuous emission monitoring for SO2.

iii. Organic HAPs - These HAPs are products of incomplete combustion (PICs), which can be largely avoided with good combustion control. The traditional and most common indicator of good combustion is a low concentration of carbon monoxide (CO), which is generally monitored continuously in large fossil-fuel-fired boilers. Hence, a reasonable surrogate for limiting organic HAP emissions is setting a MACT limit for carbon monoxide. Additional testing is needed to confirm that the CO MACT limit results in negligible amounts of all organic HAP emissions. Special emphasis needs to be placed during this testing on evaluating the relationship between combustion temperatures and the concentrations of CO and organic HAPs.

2. COAL SUBCATEGORIES

Depending on the design of the MACT mercury standard for coal-fired power plants, subcategorization may not be necessary or useful, especially subcategorization based on the use of bituminous and subbituminous coals. However, a subcategory for lignite may be acceptable for reasons described below.

a. Lignite

Lignite is burned in relatively few plants, and therefore, such subcategorization has relatively low impact on overall mercury emissions from coal-fired power plants as a group. If separate MACT limits are set for lignite, the limits should not be so different from MACT limits for bituminous/subbituminous coals that existing lignite fired boilers remain uncontrolled for mercury or the construction of new high mercury emitting lignite plants is encouraged over much lower emitting power plants burning other fuels.

b. Bituminous and Subbituminous

The majority of the coal-fired plants in the USA are fired with bituminous or subbituminous coals, or a combination of these. The increasing use of bituminous and subbituminous blends argues against different standards for each of these coals. Also, the use of an emission rate standard as the primary limit for both bituminous and subbituminous coal can address the different properties of these coals. The generally lower mercury content of subbituminous coal is offset by the greater proportion of elemental mercury emitted, as compared to bituminous coal. These properties tend to offset each other with respect to resultant mercury emissions after control. Also, EPA analysis of potential floors for bituminous and subbituminous coal showed little difference. The minor potential difference in limits and the difficulty in applying separate standards to mixtures of bituminous and subbituminous coal makes it unnecessary to differentiate between these two most commonly used coals. Therefore,we recommend that a single standard should be developed for both bituminous and subbituminous coal. We do note that Texas supported a separate subcategory for subbituminous coal, and some Western states are considering this issue further.

c. Small Power Plants

EPA should not subcategorize or exempt coal-fired power plants based on the size of the power plant or units. Relative to other sources of HAP emissions, even the smallest coal-fired power plants are a significant source of HAP emissions.

d. Stack Gas Parameters

EPA should not subcategorize based on flue gas temperature or moisture content related to the air pollution control system in place. This may inappropriately exempt currently poorly controlled power plants from any further HAP reductions or inappropriately limit the extent and the effect of MACT application.

e. FBC and IGCC

Fluidized bed combustors (FBCs) do not need a separate category because their emissions characteristics are similar to either bituminous/subbituminous coals or lignite coal for other types of coal combustors. Integrated gasification combined cycle (IGCC) electric generating units might also be included with “all other coal fired units.” However, these units were not thoroughly evaluated by the working group, and we have no specific recommendation on whether or not they be a separate subcategory.

3. MERCURY LIMITS FOR COAL COMBUSTION

a. Format of Hg MACT Limit for Coal

The primary MACT emission limit should be based on useful energy output to reward higher efficiency plants and encourage higher efficiency (and lower emissions) in new and modified power plants. For example, emission limits in units of milligrams per MWhr are appropriate for an output-based standard. Conversion of useful heat output from a cogeneration facility to MWhr units would be necessary to provide credit for more efficient energy use from such facilities.

A percentage reduction component to the emission limit can be added to the primary emission rate limit to form a “combination standard.” Precedents for combination standards include the mercury limits for municipal solid waste incinerators and the NSPS for sulfur dioxide from coal-fired power plants. In the case of mercury from coal-fired power plants, the percent reduction component of a combination standard could provide a reasonable alternative limit for those coal-fired units that burn high mercury content coal.

The percent reduction option, however, needs to be developed in such a manner that it does not result in a less stringent alternative for “average” mercury content coal. Rather, the output based emission limit standard should be applicable to most units because emission limits based on useful output are economically and environmentally preferable to a percent reduction limit. Also, an important benefit of an emission rate standard is the relative ease of determining compliance since it does not rely on simultaneous testing of “before and after” emission controls. The corollary of this, however, is that one must develop an effective compliance strategy for those units that choose the percentage reduction option since it requires the clear determination of baseline, e.g. the determination of “what” in the “percentage reduction of WHAT”. Rather than attempt to simultaneously test the mercury in the coal being burned, it would be more appropriate to test the outlet of the boiler, prior to the air pollution control system, to obtain the uncontrolled mercury emission rate for determining the percent emission reduction.

The format of the combination standard could be "X mg of mercury per MWhr or Y percentage reduction of mercury, whichever is less stringent. " An alternative, but less desirable, combination standard could be input based in the form of "A lbs per trillion Btu or B percentage reduction of mercury, whichever is less stringent."

As discussed in C.3.b. below, when a combination standard is developed, the specific numerical values of emission rates and percentage reduction need to be chosen in such a way that they result in a national, controlled mercury emission level (in TPY) that is as stringent as the ones that will be achieved through MACT floor levels determined for a percentage reduction standard alone or an emission rate standard alone. Appendix 3 estimates the national tons per year of resultant mercury emissions for various combinations of emission rates and percentage reductions. Appendix 4 is the same as Appendix 3 but focuses on mercury emission rate limits below 1.00 lb per trillion Btu. These graphs demonstrate a combination standard achieves an equivalent degree of emission reductions as a standard based on percent reduction alone or emission rate alone.

b. Floor for Hg MACT Limit for Coal

This section relates to setting a mercury MACT limit for all coal-fired power plants without subcategorization. See the discussion in section 2 above for potential subcategories, which could result in different limits for lignite. If higher limits are set for lignite, then the floor for bituminous/subbituminous may be lower than indicated below.

The floor for mercury must be no higher than the mercury emission levels achieved by the best performing 12% of the power plants for which there are emission data. Emission data should consider all the estimated HAP emission rates that EPA derived from application of stack test and plant specific data to the approximately 450 coal-fired power plants in the USA.

The floor level depends on the format of the standard discussed in C.3.a. above. The recommended combination standard (output emission rate level or percent reduction level, whichever is less stringent) should be evaluated holistically and not rely on separate evaluations of the “12% best emission rate performers” or the “12% best percent reduction performers.” Instead, evaluation of each of these two parameters can be done to set boundaries for each of the two parameters for the combination standard. The “12% best combination standard” logically results in a lower mercury emission rate component and a higher percent reduction component than the best 12% of each of these levels when evaluated individually.

Mercury emission rate estimates can be evaluated for 411 out of 452 coal-fired power plants in the US EPA Utility Air Toxics Study data. USEPA plant by plant emissions estimates were obtained from the wpd file, “plant by plant emissions estimates”, downloaded from www.epa.gov/ttn/atw/combust/utiltox/utoxpg.html, 3/26/02. These data were compared with data on mercury concentrations in coal purchased by power plants obtained from the 1st, 2nd, 3rd, and 4th quarter coal data, downloaded from the same source. There were 411 plants for which both coal data and EPA plant emissions estimates existed for mercury. Subsequent analyses of emissions rates and percentage reductions were limited to these 411 plants.

Appendix 1 groups power plants by levels of emissions based on heat input, in units of lbs of mercury emitted per trillion Btu. Output rates can be derived by approximating the heat rate at 10,000 Btu per KWhr. This graph indicates that approximately 50 of the 411 plants in the database have emissions of less than 1 lb per trillion Btu. These 50 plants constitute just over 12% of the 411 plants. Hence, the baseline for an input heat rate based mercury MACT emission limit where there are no subcategories should be no higher than 1 lb per trillion Btu, and should be lower when the average of the best 12% is considered.

Appendix 2 is a similar evaluation of “percentage reduction” estimates in the US EPA Utility Air Toxics Study data. The percentage reductions are based on the emissions of mercury estimated from the stacks compared to the mercury in the coal. Appendix 2 includes 411 plants for which removal efficiency data could be estimated. This evaluation of data indicates that approximately 55 of the 411 plants had mercury removal efficiencies of greater than 80%. 55 out of 411 is about 13.4% of the plants. Therefore, a MACT floor based solely on the percentage control efficiency of mercury removal from the coal being burned should be no lower than 80%, and should be higher than 80% when the average of the “best 12%” is considered.

A combined MACT limit in terms of lbs per trillion Btu or percentage reduction should be more stringent than combining the best 12% derived from the components individually. Therefore, a combined limit floor should have components which require an emission rate limit more stringent than 1 lb. per trillion Btu and a percentage reduction greater than 80% if based on heat input.

As discussed in C.3.a. above, the preferable standard is output based. Conversion to an output based limit using a heat rate of 10,000 Btu per kWh gives an upper floor level of 4.54 mg/MWhr. Increasing the stringency of both the efficiency and the output based limit, to account for the ability to choose the less stringent component of a combined standard, gives a MACT floor of about "4.00 mg/MWhr or 85 percent reduction (0.0800 lb per trillion Btu or 85%). This standard would result in about 10.5 TPY of national mercury emissions from coal-fired power plants, based on data from USEPA's Utility Air Toxics Study. (See Appendix 4, which evaluates combination standards using this data.)

Also, as discussed in 3.a. above, the purpose of including a percentage reduction component in a combined standard is to provide a "safety valve" for coals with very high mercury content, rather than being a less stringent choice for "average mercury" content coal. Hence, the percentage reduction component should be reflective of the best removal efficiencies achieved with the best control systems possible. While control efficiencies of up to about 98% have been demonstrated for some plants, the efficiency component would more reasonably be in the range of 90 to 95%.

Choosing a higher control efficiency component allows a higher emission rate component, while still maintaining equivalent national emission reductions. Following are examples of "combination standard" which would result in estimated USA mercury emissions between 8.5 and 11.5 tons per year. Similar alternatives can be developed for the MACT floor recommendation of about 7 tons per year.

Combination Standard Floor	Hg (TPY)
1.0 or 85%	11.5
1.1 or 90%	11
0.9 or 85%	11
0.8 or 85%	10.5
1.0 or 90%	10

0.9 or 90%	9.0
0.8 or 90%	8.5

Based on discussion at the September 9, 2002, Utility MACT Working Group meeting, we reevaluated the recommendations made in our white paper for that meeting. The September 9, 2002, white paper used the “worst” of the “Best 12 percent” of the test data and extrapolated the 80 tests to 411 plants to determine a generous MACT floor which also considered variability beyond the averaging procedure specified in section 112(d). We have reevaluated the MACT floor based on the literal reading of section 112(d) which specifies the “average emission limitation” for the best 12 percent of the sources for which there is emission information. We have averaged the test results of the “Best 12 percent” for the 80 ICR stack tests, as well as the extrapolated emissions information for 411 plants.

Following are results of this reevaluation. It compares the average performance of the best 12 percent in two ways, with the test data (80 tests), as well as with the extrapolated test data (411 plants), based on EPA’s estimates of emissions from each of these plants. The best “percent reductions” were determined independently of the best “rate-based limits,” and do not represent stand-alone alternative limits to a “combined rate or percent reduction standard.”

1. Average of best 12 percent of 411 plants – 0.3 lb/Tbtu (1.5 mg/MWh); 94 percent control.

2. Average of best 12 percent of 80 tests – 0.2 lb/Tbtu (1.0 mg/MWh); 93 percent control.

We believe that consideration of the variability of the data is appropriate. Although our primary recommendation is to deal with variability by averaging quarterly tests in a year (3 test runs per quarter), adding a compliance margin to the average of the best 12 percent of the actual emission level is also reasonable when determining an appropriate emission limitation. We recommend a factor of 2 times the actual tested average as a reasonable compliance margin when an annual average of quarterly tests is used or a 30-day or greater average of continuous emission monitor (CEM) data is used.

We also recommend that a percent reduction alternative be part of the MACT standard to enable any plant the opportunity to continue to burn the same coal if best available control technology (BACT) is employed. Our estimated range for the percent reduction alternative for bituminous/subbituminous coal is 90 to 95 percent. This range is consistent with the average control efficiencies for the best 12 percent of the test data (93 percent control) and the 411-plant evaluation (94 percent control) without activated carbon injection. Hence, this MACT floor does not depend on the use of activated carbon injection (ACI). Rather, ACI and baghouse control are available as an option to comply with the 90 percent alternative limit. A 90 percent alternative limit is recommended to provide a reasonable assurance of compliance if the percent reduction option is chosen.

Our recommendation for a MACT floor for bituminous and subbituminous coals would be 0.4 lb/Tbtu (2 mg/MWh) or 90 percent control, based on the data from the 80 tests. The 0.2 lb/Tbtu emisison limit (1 mg/MWh) would be a literal reading of section 112(d) if applied to the test data with no further consideration of variability. The 0.4 lb/Tbtu emission limit includes the factor of 2 compliance margin to further address variability beyond the averaging of 12 tests or long-term CEM data.

We also believe that consideration of information on the total population of coal plants in the US is appropriate. If the extrapolation of the average tests data to the 411 coal plants is used to develop the MACT floor, the MACT standard would be 0.6 lb/Tbtu (3 mg/MWh) or 90 percent control based on the same consideration of variability. Looking at Appendix 4 we conclude that when a 90 percent alternative limit is used, the 0.6 lb/Tbtu rate-based option is the preferred rate level for a combination standard. This is because there is little difference in the overall amount of mercury control between these two combination standards, and the 0.6 or 90% standard provides more flexibility and an higher incentive to use the simpler component (e.g. rate based component) of the combination standard. In conclusion, we recommend that the MACT floor be in the range of 0.40 to 0.60 lb/Tbtu (2 to 3 mg/MWh) or 90% control, with a preference for the 0.60 lb/Tbtu level.

c. Beyond-the-Floor for Mercury from Coal

Beyond-the-floor refers to setting a MACT standard which is more stringent than the floor level (best 12%). EPA should establish “beyond-the-floor” limits for mercury emissions from coal by considering:

i. Emissions data for control of the criteria pollutants (particulates, sulfur dioxide, volatile organic substances, nitrogen oxides, and carbon monoxide), including BACT/LAER determinations, as discussed in section E.3;

ii. The additional mercury emissions reduction benefits of control systems which minimize other HAPs, including fine-particulate HAPs and acid-gas HAPs;

iii. Technology transfer of air pollution control technologies used on other mercury source categories, especially carbon injection and fabric-filter control of municipal solid waste incinerators;

iv. Pilot and full scale demonstration programs for mercury control technology for coal-fired power plants, especially carbon injection along with fabric-filter control;

v. The well-documented history of the role of environmental regulation as a strong driver of technology innovation and implementation for the electricity-generating sector in the US. (For example, see the September 2000 NESCAUM report “Environmental Regulation and Technology Innovation: Controlling Mercury Emissions from Coal-Fired Boilers”). The major advances in the development of control technologies and substantial reductions in costs will occur only after (and not before) EPA adopts performance-based emission standards and clear time schedules; and

vi. The fact that coal combustion is the single greatest source category for mercury and other HAP emissions in the US.

In going beyond the floor, EPA should not put significant emphasis on estimates of control technology costs, which will certainly decrease significantly in the future as a result of technology innovation that will occur in response to well-defined environmental regulation. Instead, EPA needs to put more emphasis on the latest information on the technical feasibility of meeting the maximum achievable emission reductions. This includes the recent results from full-scale field tests completed at the three power plants in Alabama, Wisconsin, and Massachusetts.

d. Averaging Method and Monitoring Requirements for Hg from Coal

Selection of reasonable averaging time periods is appropriate and necessary to address the issue of variability of mercury concentrations in coal and flue streams. Until such time as mercury continuous emission monitors(CEMs) are proven(which appears likely), annual averaging of quarterly emission rates, determined by averaging 3 test runs per quarter, is appropriate. Compliance determination with a percent reduction limit is usually based on simultaneous boiler outlet and stack testing, but simultaneous testing of coal and stack may be feasible with representative testing of the coal as fired. This periodic testing should be replaced with monthly or annual averages of CEM data when Hg CEMs become commercially available. Averages might be weighted by the amount of coal burned or electricity generated. The CEM averaging could be a 12-month moving average, calculated each month, or a monthly average. The interim quarterly periodic testing should be a 12-month moving average, calculated each quarter. EPA method 29 is most appropriate in order to obtain data on mercury and other metals.

e. Types of Mercury Control Expected

The mercury MACT standard for coal-fired power plants should reflect the following best control measures:

i. Fabric filtration

ii. Wet or dry scrubbing

iii. Activated carbon injection

We note that a large electrostatic precipitator (ESP) may approach a fabric filter in control efficiency for TSPs or total particulates (99 to 99.7% for cold-side ESPs, 99 to 99.9% for fabric filters), but is inferior to a fabric filter for both the fine particulate control (less than PM2.5, the fraction where most of the trace metal HAPs are expected to accumulate) and mercury control. For example, EPA ORD's April 2002 report, "Control of Mercury Emissions from Coal-Fired Electric Utility Boilers" notes that cold-side ESPs are only 80 to 95% efficient in controlling PM less than 0.3 micron compared to 99 to 99.8% control efficiency of baghouses for the same size fraction. Also, experience with ESPs and fabric filters on MSW incinerators has shown fabric filters to have about 5 times lower mercury emissions with the same carbon injection rate. In some cases large ESPs, along with scrubbers and carbon injection, may result in low mercury emissions and achieve the eventual MACT standard, but the MACT standard should not be designed with the intent of not requiring existing ESPs to be supplemented with or replaced by fabric filters. For plants with existing ESPs, the most cost-effective mercury control measure to achieve significant mercury reductions is likely to be the addition of a polishing fabric filter (similar to EPRI's COHPAC system) with carbon injection.

Scrubbers can be wet or wet/dry. They will assist with minimizing mercury emissions, as well as provide effective control of acid-gas HAPs. In addition, EPA should evaluate the most recent data on the effectiveness of the joint SCR-FGD/SDA systems in controlling emissions for units burning either bituminous or subbituminous coals.

Activated carbon injection with fabric-filter control should be able to consistently reduce mercury emissions by over 90%. For MSW incinerators with baghouses, initial testing of activated carbon injection showed over 90% mercury control of the flue gas, and the technology subsequently proved out at over 98% control. While use of activated carbon for control of Hg from coal is also expected to show improvement as the technology is applied, 98% is not likely to be routinely achieved because of lower mercury inlet concentrations in coal. The 90% or better expected control efficiency is based on pilot and full scale demonstration tests indicating that 90% control is reachable and the expected refinement of the technology as it is applied to coal.

f. New Coal Electric Generating Units

An emission rate limit for new coal-fired boilers should be set to reflect the lowest mercury limits being met, and the presumptive MACT limit should be based on the application of the following technologies: fabric filters, activated carbon injection and wet/dry scrubbing. The mercury limit for new units should be near the lower end of the range recommended in C.3.b. above.

4. RECOMMENDATIONS ON OTHER HAPS FROM COAL

See section C above on the coal HAPs to be regulated. This section will address MACT emission limits for these groups of HAPs, other than mercury.

a. Floors and “Beyond-the-Floors” for Other HAPs from Coal

i. Particulate HAPs - We believe there is sufficient information to calculate floors for individual heavy metal HAPs. However, use of a fine particulate (PM2.5) emission mass limit as a surrogate for particulate HAPs emitted by coal combustion may eliminate the need for floor calculations for individual heavy metal

HAPs, other than mercury. If there are sufficient data, EPA might use the best 12% of the criteria pollutant fine particulate emission data from coal firing to develop a surrogate particulate HAP floor. Using the reasoning in section E.3., the particulate HAP floor should be no higher than the 0.030 lb. per million Btu New Source Performance Standard (NSPS) for particulate emissions adjusted to incorporate the fine fraction since the 0.030 limit is for total PM. BACT and LAER limits for particulate emissions should be considered in determining a "beyond-the-floor" particulate emission limit. BACT limits for total particulate emissions have been set and achieved at the 0.0150 lb. per million Btu level, which may be an appropriate "beyond-the-floor" surrogate limit for particulate HAPs. A particulate MACT limit based on fine particulate emissions(PM-2.5) is preferable, since heavy metals are found mostly in the fine fraction. EPA may be able to establish a MACT limit based on the available total or PM10 emissions data with appropriate adjustment to estimate the PM2.5 fraction.

If test data for fine particulates (PM2.5 or Pm10) are insufficient for developing a particulate HAP surrogate standard, and if converting total particulate test data to estimate fine particulate levels is not reasonable, then total particulate test data should be used to develop a total particulate HAP surrogate at this time. Subsequently, additional testing should be done to determine if the adopted total particulate MACT standard is sufficient to minimize the emissions of particulate HAPs.

ii. Acid-Gas HAPs - The floor for acid-gas HAPs should be in the range of 90% to 95% control of sulfur dioxide (non-HAP surrogate) or hydrochloric acid (representative HAP surrogate). The number of coal plants with scrubbers and the general knowledge that these are routinely over 90% efficient, and typically greater than 95% efficient, at removing acid gases, should be sufficient emission information to set a floor for acid-gas HAPs which requires such wet or wet/dry scrubbing. Utility emission factors and estimates of hydrochloric acid emissions when reporting emissions pursuant to “Right to Know” are other useful pieces of emission information which are relevant in establishing the MACT floor for acid-gas HAPs. Also, NSPS limits for sulfur dioxide could be the basis for an acid-gas HAP floor, and the more recent BACT/LAER decisions for sulfur dioxide could be the basis for a “beyond the floor” acid-gas HAP limit if sulfur dioxide is used as a surrogate for acid-gas HAPs.

iii. Organic HAPs - Since organic HAP emissions are products of incomplete combustion, carbon monoxide (CO), which is the most common product of incomplete combustion, could be used as a surrogate for setting the MACT floor for organic HAPs and ensuring efficient combustion. New Jersey has a 100 ppm (corrected to 7% oxygen) RACT emission limitation for CO, and this level may be a potential highest floor for organic HAPs. More recent BACT and LAER decisions for carbon monoxide should be considered in a “beyond-the-floor” determination. Oxidation catalysts also should be considered in the “beyond-the-floor” determination.

b. Format of Standards for Other HAPs from Coal

If a fine particulate limit is used as a surrogate for particulate HAPs, then EPA's adopted test methods for fine particulate concentrations in lb. per million Btu should be used. If representative HAPs are selected for particulate HAP MACT limits, then there should be quarterly testing of those HAPs (along with quarterly testing for mercury), and the format of the limits should be the same as for mercury.

Where continuous emission monitors are used to determine compliance, as should be the case if

SO_2 and CO are selected as surrogates for acid gas and organic HAPs, then the emission limit should be a concentration limit in the form of ppmv with a correction factor for oxygen.

For the acid gases, a “combination standard” of the form "ppmv or % reduction, less stringent of the two" is reasonable to address high chlorine coal.

c. Averaging and Monitoring Methods for Other HAPs from Coal

Where criteria pollutant surrogates are selected as surrogate MACT limits, the traditional testing and monitoring methods for criteria pollutant limitations should be used. Averaging times may be different and should reflect the probability of short-term unusually high emissions and whether there are adverse health effects associated with these short-term peak values. EPA method 29 would be appropriate to obtain data on multiple metals, even if a surrogate limit for one metal is adopted.

i. For particulate limits, the average of 3 test runs is traditional and should be retained. Annual particulate testing would be appropriate. If representative HAPs are selected for particulate HAP MACT limits, then quarterly testing and the same averaging procedure as recommended for periodic testing of mercury could be used to address variability of metal emission levels.

ii. If SO_2 is used as an acid-gas HAP surrogate, daily limits with compliance determined by CEMs is appropriate. If HCl is used as a representative acid-gas HAP, then annual testing and averaging 3 test runs (similar to particulate testing) is appropriate.

iii. For products of incomplete combustion, a short-term (hourly to daily) limit for CO and the requirement of a CO CEM are appropriate.

d. New Coal-Fired Electric Generating Units

Future BACT and LAER determinations for criteria pollutants emitted by new coal units should provide for equal or lower emissions than MACT limits which are consistent with today's BACT and LAER technology, which should be applied to existing plants. Hence, setting separate MACT emission limits for other than mercury from new coal-fired power units may not be necessary, provided New Source Review (NSR) technology requirements remain for new units.

e. Additional HAP Testing of Coal Combustion

Where a surrogate criteria pollutant or a representative HAP is used as a MACT performance standard for a group of similar HAPs, the MACT rule should include testing for some or all of those HAPs to confirm effective control. This is especially prudent for the organic HAPs for which there are little test data at this time.

D. OIL MACT RECOMMENDATIONS

MACT standards should be developed for electric generating units which combust other than light oil. Effective particulate control and good combustion should be the goal of the MACT for heavy-oil combustion.

1. OIL HAPS TO BE REGULATED

MACT requirements should be set for particulate HAPs and organic HAPs emitted by heavy oil combustion. Nickel may be appropriate as a representative HAP for the heavy metals in oil. Alternatively, a limit on fine particulate emissions may be an appropriate surrogate for both heavy metals and particulate organic matter emissions which contain HAPs. Carbon monoxide would be an appropriate surrogate for organic HAPs which are products of incomplete combustion.

2. OIL SUBCATEGORIES

There should be no subcategories for power generating units burning heavy oil. All oil heavier than number 2 oil should be subject to the same MACT requirements.

3. OIL MACT LIMITS AND FORMAT

a. Particulate HAPs

We have not determined a MACT limit for nickel. An output-based standard is preferred in the form of milligrams per megawatt hour. An input standard in the units of lb. per million Btu is also useful, but less desirable. If a fine particulate emission rate is used as a surrogate, the MACT floor should be no higher than the floor for coal, i.e., no higher than 0.030 lb. per million Btu. A "beyond-the- floor" level should also be considered at the 0.015 lb. per million Btu level. These total particulate limits should be adjusted, if possible, to reflect the fact that metals in oil, like trace metals in coal, accumulate in the fine fraction of PM (see the earlier section 4.a.i)

b. Organic HAPs

The carbon monoxide floor should be no higher than 100 ppm (at 7% oxygen) averaged daily, which is the New Jersey RACT limit for both coal and oil fired boilers.

An averaging period between 1 and 24 hours should be considered. BACT and LAER determinations should be considered for a "beyond-the-floor" MACT limit. Oxidation catalysts should be considered, but good combustion control should be sufficient in most cases.

4. OIL HAP AVERAGING AND MONITORING METHODS

a. Particulate HAPs

If nickel is used as a surrogate for metal HAP emission from heavy oil combustion, then the nickel in a monthly composite oil sample should be tested monthly, and the efficiency of the fine particulate air pollution control should be tested annually. A weighted annual average of the nickel emissions per MWhr can be determined based on the monthly amount of electricity produced, and the rate of nickel emitted can be adjusted by the efficiency of the particulate air pollution control. If fine particulates are used as a MACT surrogate, then an annual particulate test would be appropriate, using standard EPA methods and averaging 3 test runs.

b. Organic HAPs

Carbon monoxide CEMs should be used to determine short-term (hourly to daily) average emission concentrations.

5. NEW OIL ELECTRIC GENERATING UNITS

Future BACT and LAER determinations for particulate and carbon monoxide emissions from new oil fired electric generating units should be sufficient to reduce HAP levels from new units to lower levels than for existing units, provided New Source Review (NSR) technology requirements remain for new major units.

E. OTHER CONSIDERATIONS

1. DATA SUFFICIENCY

There are a wealth of data for setting MACT limits for mercury emitted by coal combustion. EPA’s testing of many electric generating units during the 1999 ICR (Information Collection Request), and the application of those test data to similar units that were not tested is appropriate and sufficient to set a mercury emission limit for coal combustion.

For other HAPs emitted by coal, there are less emission data, and for some HAPs the data is not sufficient for setting a MACT emission limit specific to that HAP. There are, however, sufficient data for setting HAP-specific MACT emission limits for most heavy metals. There are not sufficient data to set HAP specific limits for organic HAPs.

Emission data other than HAP emission data should also be used in determining MACT limits for coal and oil fired power plants. Criteria pollutant emission data for particulates (including data on fine particulate mass), sulfur dioxide, carbon monoxide, and volatile organic substances are relevant to HAP emissions, which are mostly fine particulates, acid gases and products of incomplete combustion. For example, emission data on the effectiveness of SO2 control should be used to help determine a MACT emission limit for HCl.

Data on criteria pollutant emissions are particularly relevant when they are used as surrogates for groups of HAPs with similar properties relevant to controlling their emissions. Continuous emission monitoring data for sulfur dioxide and carbon monoxide would be useful for setting surrogate HAP standards, as well as determining compliance with those standards.

Emission data provided by utilities in response to “Right to Know” surveys are of lower quality than stack test data, but nonetheless also relevant and useful in determining MACT emission limits. All emission data which are available and related to HAP emissions should be considered holistically in developing MACT emission limits.

2. VARIABILITY OF DATA

Variability of emission data is not new to HAPs. For mercury and other heavy metals which have a wide range of concentrations in coal and oil, this variability is best addressed through the optimum design of the magnitude and form of the standard and through the selection of averaging time period and procedures. Equally important, the numerical value, form, and averaging time period of the standard should be based not on the variability of the incoming Hg concentrations in coal or the flue gases, but on the best evaluation of how control technologies are capable of handling and “damping” the incoming variability through equipment and operating design (for example, activated carbon injection based systems should be able to meet a fixed output limit by injecting more or less carbon; feedback control systems can be used for wet scrubber-based systems).

Statistical manipulation of the coal or test data to generate unreasonably high emission limits is inappropriate. To reasonably address variability in the system (monitoring, sampling, mercury content of coal,etc.), we recommend using the combination of these three components: 1. the average of emissions from the "best 12%" of the units, 2. a factor-of-2 compliance margin, and 3. the use of long term averaging of compliance data for mercury or other individual HAPs.

For periodic testing of mercury, quarterly testing and averaging 3 test runs each quarter and the 4 quarters each year should be sufficient to provide a reasonable determination of average annual emission rate. Similar procedures have been successfully used for municipal solid waste incineration which has more mercury variability than coal.

When CEMs are used for mercury emission determination, there are many ways to average the data to address variability and obtain a reasonable determination of average emission rates. A moving 12-month average of the average emission rate for each month is a common procedure. A monthly average should also be sufficient to address variability of mercury.

Where criteria pollutants are used as surrogates for HAP emissions, there is also sufficient experience to develop appropriate averaging procedures.

3. SPECIAL CONCERN ABOUT VARIABILITY OF HAP PRODUCTS OF INCOMPLETE COMBUSTION

The variability of carbon monoxide (and HAP products of incomplete combustion) is not directly related to coal or oil properties, but rather is related to operation of the unit. Very high carbon monoxide and other products of incomplete combustion (including HAP organics) can result from poor combustion practices over a relatively short period of time. Therefore, the MACT standards for HAPs which are products of incomplete combustion should be of sufficiently short averaging time to promote good combustion practice at all times and not enable poor combustion practices to be lost in long averaging time. The MACT standard for HAP products of incomplete combustion should catch bad combustion practice and cause corrective actions to be taken immediately. The use of continuous emission monitors for carbon monoxide is appropriate to instantaneously determine a poor combustion problem and enable timely corrective action. To encourage timely corrective action, the averaging time for carbon monoxide should be no greater than 24 hours and could be as low as 1 hour.

4. RELATIONSHIP OF MACT TO RACT, NSPS, BACT AND LAER

MACT is an emission limit based on maximum achievable control technology, including pollution prevention measures. Section 112(d) of the Clean Air Act requires that beyond-the-floor MACT standards "require the maximum degree of reduction in emissions of the hazardous air pollutants.... taking into consideration the cost of achieving such emission reduction, and any non-air quality health and environmental impacts and energy requirements.....achievable for new or existing sources..." Other technology based emission limits required by the Clean Air Act include, in order of least stringent to most stringent: Reasonably Available Control Technology (RACT); New Source Performance Standards (NSPS); Best Available Control Technology (BACT); and Lowest Achievable Emission Rate (LAER). These 4 technology-based emission standards are applied to the criteria pollutants and their precursors, including fine particulates (PM2.5 and PM10), sulfur dioxide, oxides of nitrogen, volatile organic substances, carbon monoxide, and lead. These criteria pollutant emission limits are also relevant to HAPs from coal-fired power plants which emit significant amounts of HAP particulates, HAP acid gases and HAP products of incomplete combustion; all of which can be controlled by the same air pollution control technologies as used for the more encompassing criteria pollutant category.

Comparing the definition of MACT for HAPs with RACT, NSPS, BACT and LAER for criteria pollutants shows similar language for MACT, BACT and LAER. Therefore, BACT and LAER technology for criteria pollutants is equally relevant for HAPs which are also within the same criteria pollutant category. In addition, HAPs should be minimized to an even greater degree than criteria pollutants in view of their higher toxicity. Hence, MACT standards for fine-particulate HAPs, acid-gas HAPs, and products-of-incomplete-combustion HAPs should result in more stringent air pollution control technology requirements (including pollution prevention) than RACT and NSPS standards for criteria-pollutant requirements for particulates, sulfur dioxide, volatile organic substances and carbon monoxide. MACT standards should be consistent with BACT and LAER determinations for the analogous criteria pollutants.

Current BACT limits for coal-fired power plants require baghouse control or the equivalent, wet or dry scrubbers, and good combustion. These technologies and measures are also directly relevant to minimizing HAPs from coal-fired power plants. BACT limits have been set for many power plants to control particulates, acid gases, and products of incomplete combustion (CO and VOC). BACT/LAER limit should be considered for "beyond-the-floor" MACT limits for all coal-fired power plants.

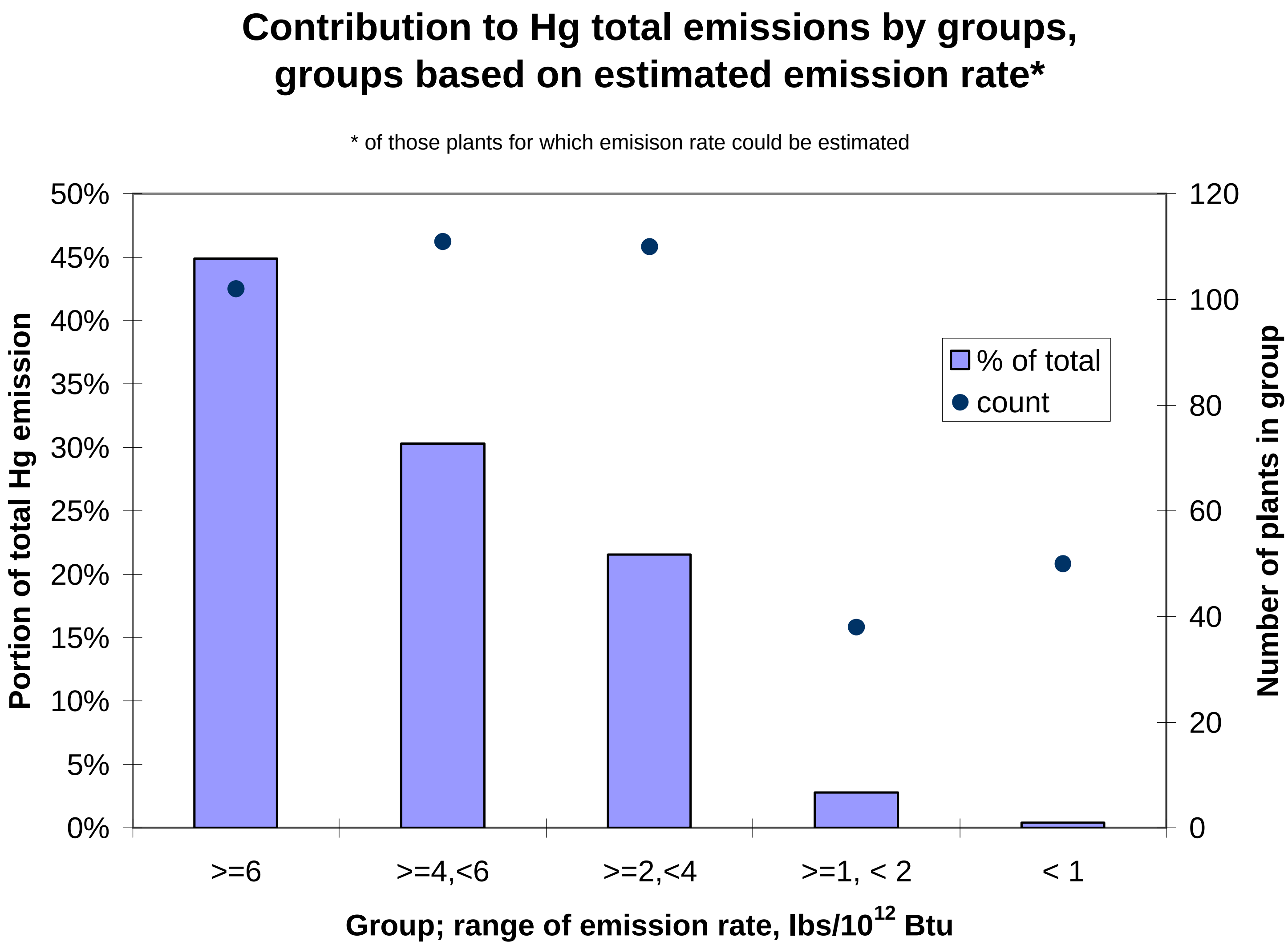
RACT and NSPS are generally less stringent than MACT, but can be considered as highest MACT floors where criteria pollutants are used as surrogates for HAPs.

5. AIR POLLUTION CONTROL TECHNOLOGY: INNOVATION, IMPLEMENTATION AND TECHNOLOGY TRANSFER

It is important for EPA to recognize the important role the EPA MACT determination ("environmental driver") will play in the near-term future innovation in alternative technologies and strategies for controlling mercury emissions. In the long-term, the full-scale field implementation of different technologies and strategies will result in even more innovation and substantial cost reduction through the optimum selection of combination of technologies, operating methods, and fuels. These are expected to include: pollution prevention, coal cleaning, fuel blending and switching, injection of carbon or other sorbents, enhanced wet scrubbing, catalysts to oxidize mercury in flue streams before its capture in wet or dry scrubbers, SCR-FGD/SDA combinations to capture Hg besides controlling NOx and SO2. In addition, there are a number of emerging technologies including electro-catalytic oxidation (ECO) that may find commercial application once the MACT standards are established. The historical fact that more effective control technologies have always appeared in the marketplace after (and not before) the performance standards are set is of particular importance when EPA establishes "beyond-the floor" MACT limits as it takes into account not only the current status of technology, but its realistic future potential.

The technology-transfer capability from other sources also needs to be taken into consideration by the EPA. The successful use of carbon injection and baghouse control on municipal solid waste (MSW) incinerators should be considered in developing the MACT standard for mercury from coal-fired power plants. While uncontrolled mercury concentrations in the flue gas of MSW incinerators are much higher than for coal combustion, pilot and full-scale testing of carbon injection on coal shows the same relationships as for MSW incineration. The more carbon injected, the better the mercury control, up to a point. The MSW experience has shown that baghouses are far superior for mercury control than ESPs and can be used to avoid high carbon use and the associated costs, as well as to effectively control fine-particulate HAPs. Thus, while the working experience with other sources such as waste combustors may not be directly transferable to large coal-fired boilers because of their different flue-gas characteristics, it is nevertheless helpful in informing the MACT determination for the coal-fired boilers.

Appendix 1

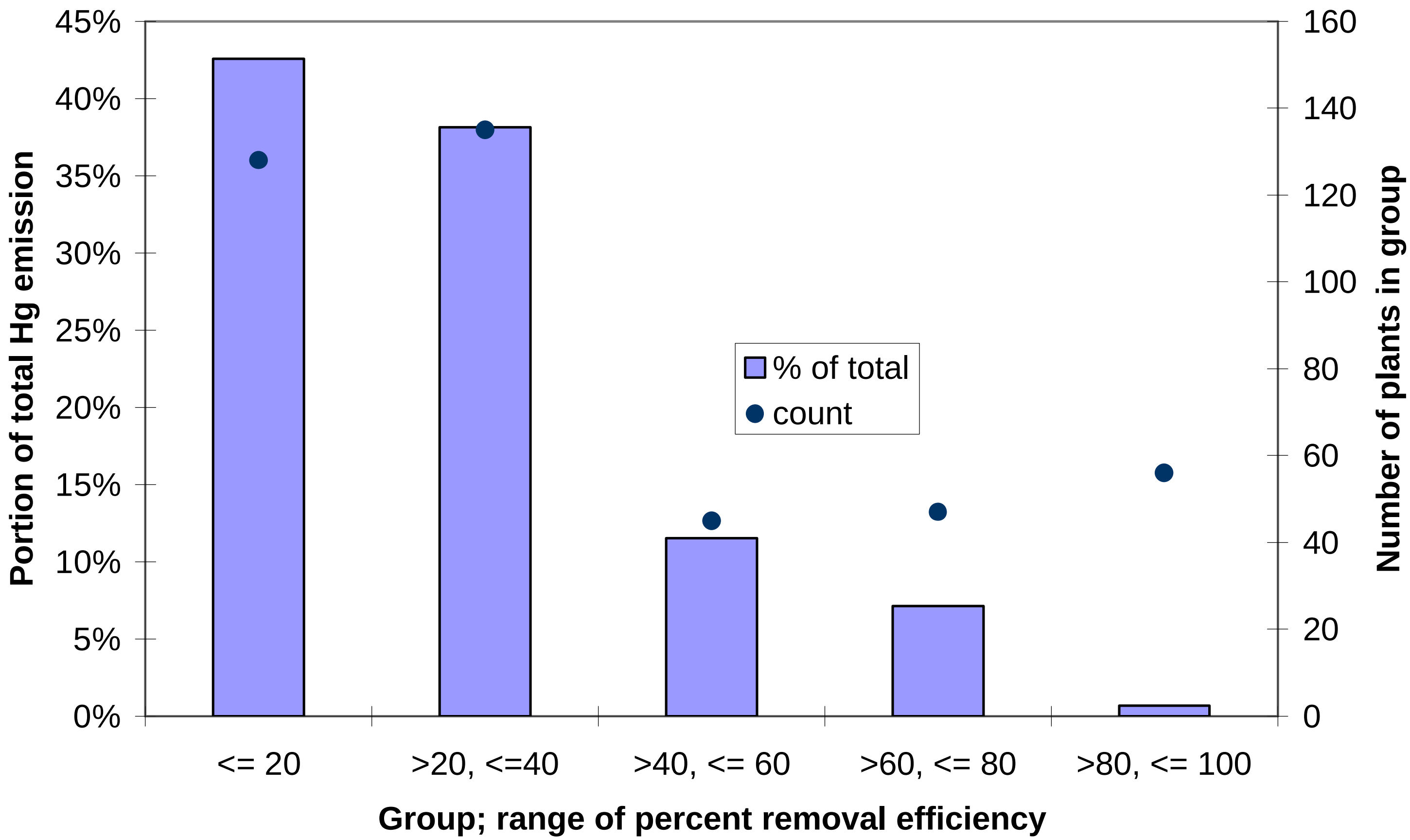


Note: Estimates are based on data for 411 coal-burning power plants for which plant by plant emissions data and coal analysis data were both available. Emission rates are based on pounds per year per plant as estimated by USEPA in the file "plant by plant emissions estimates" divided by total Btu content of coal purchased by that plant obtained from the 1st, 2nd, 3rd, and 4th quarter coal data. All files were dated June, 2001, and were downloaded from www.epa.gov/ttn/atw/combust/utiltox/utoxpg.html, 3/26/02.

Appendix 2

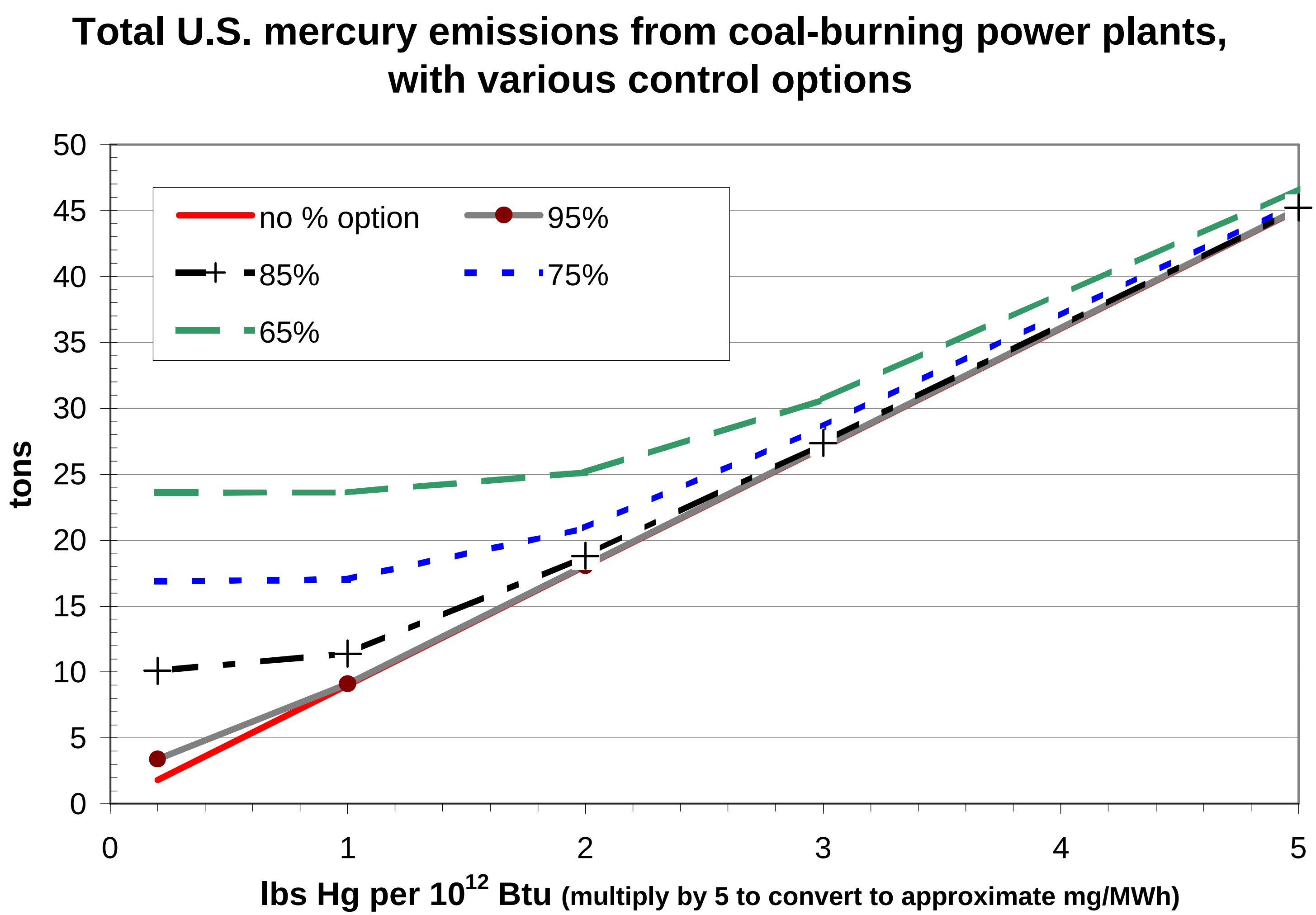
Contribution to Hg total emissions by groups, groups based on estimated percent removal efficiency*

* of those plants for which removal efficiency data could be estimated



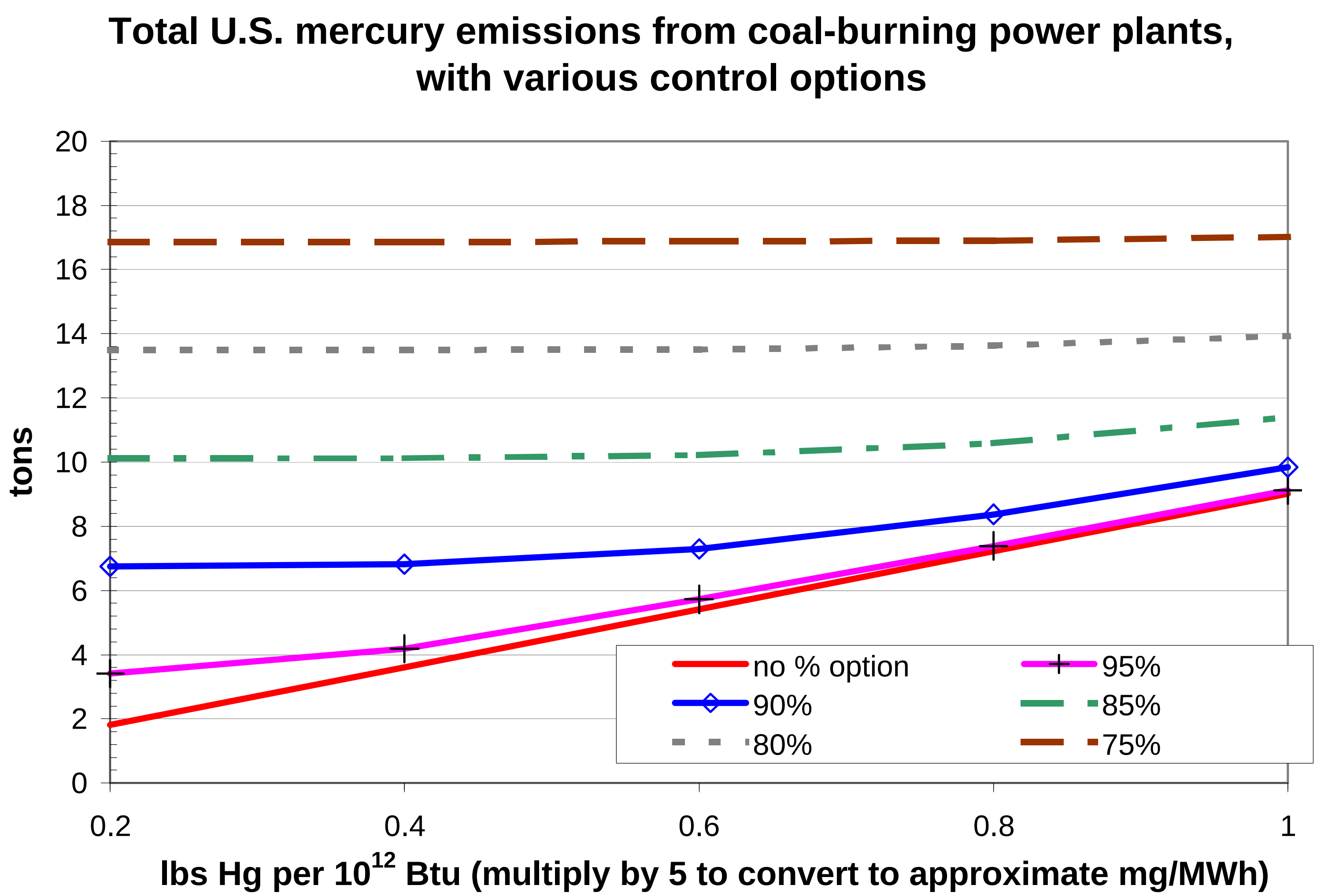
Note: Data source is the same as Appendix 1. Percent removal efficiency was based on comparison of USEPA estimated plant by plant emissions compared with total mercury content of coal purchased by that plant, as estimated from the quarterly coal data files.

Appendix 3



Note: Plant by plant emissions were estimated for various combination standards in the form of A lbs. per trillion Btu or B percentage reduction of mercury (based on coal mercury content), whichever is less stringent, with the assumption that a plant's emissions will reflect the less stringent applicable standard. Estimated emissions for all plants were totaled. Data source is the same as Appendix 1.

Appendix 4



Note: This graph is identical to graph in Appendix 3, except that the lbs. per trillion Btu scale (x-axis) extends only to 1 lb. per trillion Btu, 80% and 90% reduction options have been added, and the 65% option is not included. Data source is the same as Appendix 1.