INSTITUTE OF CLEAN AIR COMPANIES

September 10, 2015

EPA Docket Center
WJC West Building
Environmental Protection Agency
Mailcode 28221T
1200 Pennsylvania Ave., NW
Washington, DC 20460

RE: Docket ID No. EPA–HQ–OAR–2015-0341, Notice of Availability of the Environmental Protection Agency's Update of Two Chapters in the EPA Air Pollution Control Cost Manual (80 *Fed. Reg.* 33515 (June 12, 2015))

The Institute of Clean Air Companies (ICAC) is submitting comments on the proposed updates to the chapter on Selective Non-Catalytic Reduction (SNCR) in EPA's Air Pollution Control Cost Manual (80 Fed. Reg. 33515 (June 12, 2015)). ICAC member companies have engineered, supplied and installed hundreds of SNCR systems on combustion units, and that experience should be factored in the evaluation of controls using EPA's Air Pollution Control Cost Manual. As this manual is used by both regulators and industry to evaluate pollution control strategies, it is imperative that the updates to these chapters include the most recent, best available information on the applicability, performance, and cost of these technologies for industrial combustion applications. It is important to note that almost all of the systems provided by ICAC member companies have included performance guarantees which are defined prior to a project being awarded.

Thank you for your consideration of these comments. Please feel free to contact me at (571) 858-3707 if you have questions or need more information.

Sincerely,

Betsy M. Natz

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I. Executive Summary

EPA has issued draft revisions of the first two chapters of Section 4 of the Air Pollution Control Cost Manual for comment. The chapters cover two technologies that are used to control emissions of oxides of nitrogen (NOx): Selective Non-Catalytic Reduction (SNCR) and Selective Catalytic Reduction (SCR). The purpose of the Control Cost Manual is to provide an estimate of the cost to implement air pollution controls that can be applied consistently to a wide array of industries and source types. The Control Cost Manual is used by the EPA for estimating the impacts of rulemakings, and serves as a basis for industry to estimate costs of controls that are Best Available Control Technology (BACT) under the New Source Review (NSR), Best Available Retrofit Technology (BART) under the Regional Haze Program, and for other programs (e.g., Reasonably Available Control Technology (RACT)). EPA, states, and industry need to have the most up-to-date technical and economic information as they are evaluating strategies for NOx emissions reductions that are feasible and cost effective for compliance with a lower ozone standard, for example. ICAC members rely on the Control Cost Manual since plant owners and operators prepare BACT analyses for permit applications and evaluating whether it is feasible to install controls under programs such as BART and RACT.

Because of the heavy influence that the Control Cost Manual has on air pollution control and regulatory decisions made by EPA, permitting authorities, and industry, it is important that the performance and cost information contained in the manual is of the highest quality possible so that decisions will be equitable, sound, and will identify control strategies that are effective and economically feasible. Much work has been done to understand the mechanisms that influence the control of NOx emissions since these chapters were first published in October 2000 and entire technical conferences have recently been devoted to the control of NOx emissions. EPA should make sure to review the most recent information available and update its list of technical references.

II. Comments on the Draft SNCR Chapter

A. SNCR Application and Performance

The Introduction to Chapter 1 discusses the expected performance of SNCR on various types and sizes of units.

SNCR as a process is highly dependent on various operating conditions including baseline NOx, temperature, furnace CO, residence time, furnace geometry and corresponding injector coverage and allowable ammonia slip. These are major factors and lead to a wide range of potential removal efficiencies. The performance of the SNCR systems are more defined by the NOx reduction needs of the units and the allowable ammonia slip for a given process and boiler type.

Table 1.2 should be modified to have the categories properly aligned. As an example, utility and coal fired boilers should not be considered separate categories, nor should MSW Incinerators vs. MW Combustors. The comparisons in Table 1.2 could be misleading.

If Figures 1.1a and 1.1b represent a variety of projects, then the coverage and distribution issues are part of the individual performance levels. Large units typically have less than optimal coverage, which can reduce performance compared to smaller units.

The variety of data points in Figures 1.1a and 1.1b most likely include different ammonia slip values for the various projects. It s very unlikely that all performance for the various cases use the same allowable ammonia slip, and this is a critical parameter to define when comparing SNCR performance on different sized units. Industrial applications often allow a minimum of 10ppmv slip, with many installations having slip limitations of 20ppm or higher. For the curve to be more meaningful, the data should be grouped according to ammonia slip levels. In addition, the characterization that ammonia as a reagent performs better than urea has more to do with the performance of ammonia based systems on fluidized bed boilers, which often have higher ammonia slip limits. Ammonia applicability is limited based on furnace coverage and temperature window limitations, and urea reagent provides maximum reagent flexibility. It is also important to note that urea has a higher effective temperature window and a higher allowable urea release point, and that there are no ammonia SNCR systems on utility boilers.

There is a misperception about SNCR and the ability to perform over a wide boiler range. SNCR systems are designed using multiple levels of injection to accommodate quick changes in boiler load. The SNCR systems are designed to allow for injection in the optimal temperature window, which changes based on boiler load. Systems can accommodate 25% to 100% MCR load, and the control systems typically use boiler load as the feed forward signal. The proper injection locations can be designed into a system based on boiler load and temperatures. Systems need to be operated in automatic mode with multiple levels of injectors. Several customers in the early 1990s installed systems without automatic load following capability and cutback on the number of injectors. The systems were designed to manually change injectors from one level to another as a basis for operation. The resulting performance was not indicative of SNCR technology and its capabilities.

On page 1-12, the statement that the primary byproduct formed in SNCR systems is nitrous oxide (N_2O) is not accurate. The data referenced were published in 1993 prior to the understanding that elevated N_2O levels in flue gas samples were an artifact of the sampling and analytical methodology in use at the time. These results were later disproven after the advent of continuous N_2O emissions analyzers, which showed that N_2O formation in SNCR systems was not significant.

On Page 1-13, Section 1.2.2,19% ammonia solution is the most common concentration used when it comes to aqueous ammonia. Concentrations higher than 19% often have Department of Transportation restrictions.

Section 1.2.3 discusses the design factors and their impact on SNCR performance. CO and O2 levels should be added to the list based on their impact on performance. High CO levels will lower the temperature range in which SNCR is effective.

Section 1.2.4, is very outdated and should be rewritten. ICAC can provide input upon request. In addition, Section 1.4 references NOxOUT, which is one specific type of SNCR technology. A more generic reference should be utilized.

On Page 1-19, there is a discussion on ammonia slip from SNCR. Utility units typically have ammonia slip limits of 5 to 10 ppmv. The fuel sulfur content can be the limitation, with 5ppm being the limit required for higher sulfur fuel applications. Industrial units have historically been given much wider allowable range, with some applications having permit limits of 20ppmv or larger.

Section 1.2.4 on Page 1-20 refers to ammonia as being injected as a vapor. While that is true for anhydrous ammonia based systems, most aqueous ammonia based systems inject a liquid into the flue gas.

On Page 1-24, last 2nd paragraph at bottom, 3rd sentence. Authors state "Wall injectors are used in smaller boilers and urea based systems." This is not completely accurate, since wall injectors have been used in both smaller and large boilers.

On Page 1-26, the Statement in Section 1.2.5 conflicts with Page 1-7. The only real area of costs savings for a new unit would only include boiler penetrations being built into a new unit, compared to the additional cost to retrofit boilers to install ports in the field. The equipment installation and fabrication are largely unaffected when evaluating new unit installations compared to retrofits.

On Page 1-26, the last paragraph states that Rotamix has to be installed together with Rotating Over-Fire Air (ROFA). This is not true since Rotamix can be installed as a standalone technology. On Page 1-29, the Rotamix costs in this section are outdated. Recent installations show capital costs of $15-$20/kw for a 250 MW boiler and $10-$15/kw for a 350 MW boiler and larger.

Page 1-27 includes references NOxSTAR as an SNCR technology. However, since there are no commercial installations of this technology, the reference should be deleted.

On Page 1-36, Figure 1.10 presents data showing dramatic increases in predicted Normalized Stoichiometric Ratio (NSR) to achieve a desired NOx reduction as the uncontrolled NOx emissions decrease, and would appear to suggest that ammonia slip levels will become prohibitive at inlet NOx concentrations below 0.5 lb/MMBtu. This is not accurate based on recent practical experience; the reference for this figure is dated 1998. ICAC can offer more recent data upon request.

On Page 1-39, the comment discussing which parameters are needed to define an ammonia slip guarantee should include the location of where the ammonia slip will be measured is also required, typically at the stack, or at the economizer outlet.

B. SNCR Cost

On Page 1-41, additional information is required as to the reason for an elevation factor. The unit size and the operating range factor are the primary factors that affect system costs, and the elevation factor as stated is not accurate.

On Page 1-41, the 2nd paragraph states that “Thus, the procedure described in this document assumes the costs for industrial boilers are essentially the same as for utility boilers for the same design heat input.” The costs of SNCR applied to industrial boiler are often less than for the same size utility boiler. This is based on lower equipment costs due to a narrower boiler load operating range which results in the need for fewer injectors and also from a higher allowable ammonia slip which can reduce the complexity of the system controls.

In Section 1.4.1.1.1 and throughout the section that contains the SNCR cost formulas, the 1.3 factor is used with no stated reason for the factor. ICAC strongly disagrees with the overall cost model approach given the standardized nature of the approach, and the lack of definition of the 1.3 factor. The IPM cost model previously used by EPA, defines specific contingency factors, and a similar justification seems to be in order for this Manual.

ICAC believes that the following excerpt from Page 1-7 is a much more accurate indication of SNCR technology costs:

> Based on applications in operation, capital costs for SNCR installations are generally low due to the small amount of capital equipment required, and the cost per unit of output decreases as the size of the source increases. For example, Figure 1.2 shows the installed capital cost of SNCR technology for industrial boilers, on a $/MMBtu/hr basis, decreases as the size of the boiler (and therefore the gross heat input in MMBtu/hr) increases. In addition, the installed capital cost of SNCR applications ranged from $5–20/kWe (kilowatt) in $2008 for power generation units. The installed cost represents the cost of the capital equipment plus the associated installation expenses, but does not include the operation, maintenance, or reagent costs. Table 1.3 contains a summary of average capital costs for SNCR applications on various size units in several source categories.

The above reference appears to be ignored using the proposed cost model. The example in Section 1.5.2 calculates SNCR plus Balance of Plant (BOP) costs at $38/kWe for a 120MW unit, with the undefined 1.3 factor driving the cost to $49/kWe. For industrial units, Figure 1.2 is a much more accurate representation for the stated size range than the proposed cost formula.

In addition, Figure 1.2 for industrial units below 250 MMBtu/hr should be used as the basis for the technology cost evaluation. EPA has not proposed any sort of new cost formula for industrial units in that size range.

It is important to note that SNCR system costs are closely related to the boiler load range over which the SNCR system will operate. A wide load range of 25 or 30%MCR to 100%MCR may require multiple levels of injectors which affects the size and system capacity of the overall SNCR systems.

Balance of Plant Costs

The Balance of Plant (BOP) cost factor is based on a formula, however, no data to correlate the formula is provided. ICAC believes that the formula produces an extremely high value for BOP costs. Unless actual data can be referenced, the BOP calculation should be adjusted. The BOP values are significantly higher than the curve in Figure 1.2, where actual installation data is provided to establish the curve.

Reference 27 on Page 1-47 provides a link to a Safety Data Sheet. In the section where Reference 27 is cited, the implication that BOP costs include fans and chimneys are not correct for SNCR. That type of equipment has no relevance to SNCR technology.

Air Heater Modifications

The costing equations include the possibility for air preheater modifications for SO_3 control when high-sulfur coal is burned. On page 1-44, equation 1.25, the air heater factor (AHF) is defined as 1 if “the SO_2 content of the coal is ≥ 3 lb/MMBtu” and zero if below. The coal does not contain SO_2; it contains sulfur, which is oxidized to form SO_2 and SO_3. It is not clear whether the factor is to be based on the sulfur content of the coal or the maximum SO_2 emission rate expected. Air heater corrosion is a function of the flue gas SO_3 concentration and the air heater outlet temperature. Air heater deposition is related to the concentration of SO_3 and the amount of ammonia slip that is present in the flue gas. The threshold provided is arbitrary and does not accurately capture the potential for either air heater corrosion or deposition of ammonium bisulfate on the air heater baskets. In addition, the cost equations do not include APH costs for other types of combustion units, but high-sulfur fuel oils can also result in elevated flue gas SO_3 concentrations that lead to air heater deposition in the presence of ammonia slip.

The equations for air heater cost modifications are based on the assumption that air heater modifications to manage corrosion and deposition associated with the presence of SO_3 will be accomplished by replacing baskets with ceramic coated material. This is only applicable to units equipped with Ljungstrom rotating-type air heaters, and is not appropriate for other gas-to-gas air heater designs.

The basic idea that a given sulfur level, which in turn becomes an SO_2 and ultimately an SO_3 issue, will result in additional system costs must be questioned. Most high sulfur applications do not require air heater modifications since ammonia slip is limited to 5ppmv at the economizer outlet in most SNCR installations. High sulfur fuel conditions can minimize operating costs through reduced ammonia injection levels, and the lower ammonia slip will affect SNCR performance. Most $SO_2$and SO_3 related issues are mitigated through tight controls on ammonia slip.

Where air heater issues are present due to ammonia slip and SO_3, the addition of sonic horns can mitigate potential issues through improved cleaning. This option combined with sootblowers should also be considered as a separate option for high sulfur applications. These items are typically low in capital cost and a single cost model that also includes air heater changes will dominate the cost calculation.

<u>Operating Costs</u>

The maintenance costs as a percentage of the Total Capital Investment (TCI) are overstated due to an extremely high TCI calculation. With a more representative TCI, the calculated value for maintenance costs would be reasonable.

<u>Examples</u>

On Page 1-56, 2nd equation. There is a mistake in this equation. The constant 0.35 should not be in this equation. This mistake made the reagent flow very low and the correct value should be 438 lb/hr, instead of 154.

On Page 1-56, 3rd equation. Due to above-mentioned mistake, the solution flow calculated from this equation should be 877 lb/hr, instead of 307 lb/hr. As such, all solutions flow, tank size and operating cost calculated in this EXAMPLE should be updated.

C. SNCR Equipment Life

A number of SNCR systems have been in operation since before 1995. When SNCR system components and piping systems are constructed using stainless steel, a 20 year design life has been demonstrated, and a design life range of 15-25 years is often specified and is also the expected life.

III. Conclusion

We appreciate the opportunity to submit these comments on the proposed updates to the Control Cost Manual SNCR chapters. We urge EPA to carefully review the most up to date information as these revisions are being finalized and to properly characterize the proven effectiveness of SNCR technology and the cost algorithms within the chapters. If you have any questions about these comments or need additional information or clarification, please do not hesitate to contact Betsy Natz, ICAC Executive Director at (571) 858-3707.