Practical Constraints and Limitations That Discourage States From Attaining Total Compliance With Federal Guidance and Requirements for Emission Inventory Data

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ABSTRACT

Federal specifications, guidance and tools for states are developed as the result of federal needs and requirements/edicts established by Congress. At times, these specifications are difficult or impossible to meet in every detail, even though an honest effort is made. For example, the timing of an inventory submittal may not be compatible with the needs of EPA due to resource constraints. The pollutants involved or the data systems used, for example, may introduce practical limits and short circuits that may compromise the total data quality as required for the purpose intended. These and other limitations must be recognized and taken into consideration when utilizing resulting databases and when planning future emission inventory preparations.

This paper attempts to identify several such limitations and constraints as experienced in North Carolina and other jurisdictions, and provide some evaluation of their impact. The paper will also explore potential remedies and policies that might alleviate some of the related problems. Many such problems are schedule oriented; many are educational based; and others relate to technical issues and computer system issues.

INTRODUCTION

A new federal administration is in place with changes in ideology and politics. The history-making Clean Air Act Amendments of 1990,[1] that we continue to try to understand, and implement, are now past a decade old. Numerous complexities and failings of these amendments and pursuant regulations have limited progress and frustrated government at many levels, environmental interest groups and private industry sectors alike. Signs of the "winds of change" are beginning to appear on the horizon. Now is the time for the technicians, engineers and scientists to reflect on their experiences, formulate their views and articulate solutions based on the various laws of physics, chemistry and biology that will remain absolute, even after attempts by Congress to take on new efforts to modify or strike them down. This paper is intended primarily to stimulate some reflection and thinking on how this can most constructively and productively be done, primarily with regard to those portions of this iceberg that relate to the emission inventory. Results of such efforts may best then be provided to the policy and lawmakers in time to help them formulate intelligent revisions, encourage simplicity-with-results and to intercept changes and revisions that would be foolish, unproductive and technically unsound.

Emission inventories have long been recognized as cornerstones of air quality management.[2 3] Emission inventories are required in order to establish the sources and relative insults on the ambient air quality and to develop mitigation strategies for the management of these emissions. The emission inventory, though fundamental to the process, is often overlooked.[4] Without a clear realization of the importance, the strengths and limitations of this tool, it is difficult to make intelligent decisions on the overall air quality strategies to be employed. Fundamental flaws in the organization of thought and approaches come together in the emission inventory and it can often become the lowest common

denominator of communication. This is key to its importance and its use as a tool for analysis of the larger picture.

The experiences and situations described in this paper are in no way intended to be "non-constructively" critical of the existing situation, but to be a means of drawing attention to some of these areas so that they can be recognized and isolated for mitigation as warranted. The comments are also not intended as an official position of the North Carolina Division of Air Quality, but reflections of the author on events and situations that have recognized and/or experienced over the past several years.

Title V and Emission Inventories

One of the important new programs that came into existence due to the Clean Air Act (CAA) Amendments of 1990 is the Title V permits program. While many states, such as North Carolina, already had an active and functional permit program prior to the 1990 Amendments, other states had no such program at all. The Title V program has required the states to issue a (new) category of permits that target the most major of facilities. These are those facilities with ***potential*** emissions in excess of 100 tons/year of a single criteria pollutant, over 10 tons of *one* of the (now) 188 Hazardous Air Pollutants (HAPs) or 25 tons of the summation of any HAPs that are emitted by a facility. Emission fees are also prescribed and defined by this program. To make determination as to whether a facility falls under the Title V program, emissions of these potential emissions must be made. The estimation of potential and/or actual emissions is also required for the determination of the annual emission fees. Estimation procedures and actual data available for these purposes are usually limited, unless expensive and sometimes burdensome testing is done. Even reliable testing may not be possible in many situations. Thus, classifications and fees are often based upon data from those mythical "typical or average" facilities for which the only practical tools exist. The tools available are usually those used for emission inventory purposes that are somewhat limited in applicability to a single source.

Since the title of this paper indicates that it is aimed at the limitations of compliance with emission inventory guidelines or standards, the question may be asked how the background above on Title V is relevant. The relevance is traced to the legal implications and context that results from the emission estimation process and the resulting sanctity of the estimates generated. Of course, a state has the authority to challenge and require correction of errors in an inventory or emission estimate that is in error, whether due to negligence, ignorance or fraud. However, because the inventory serves many purposes and must meet many tests, the complexity and inertia may tend to suppress the ability or willingness for make adjustments or refinements to that inventory without a process of notification and agreement to be carried out within and outside such an agency to properly take care of legal constraints and implications. For example, if the CAA-required and authorized Title V emissions fee is based upon the actual emissions from normal operations (excluding malfunctions and start up emissions), then there is a likely and real programmatic resistance to artificially "adding in" emissions for such abnormal but real, events to the inventory. However, when atmospheric simulation modeling is done, adjustments for such differences may be readily made to make the model input conform more closely to the real world. Going one step further, however, the results of such modeling (based on "adjusted" emissions – not consistent with those legally reported by the facility) will then be used to develop new rules and regulations for the facility. Such rules and regulations may be inadequate or inappropriate if some recognition is not made of the differences in the reported and modeled emissions.

Many legally oriented considerations and constraints apply to Title V facilities and their emission estimates, as indicated above. For example, there are cases where some sources within a facility, or entire facility types may be exempted. If steps are considered to bring the inventory requirements and procedures more into compliance with permit requirements, then the situation becomes more complicated and considerable resistance may be encountered from the regulatory side

and especially from the facility side of the arguments because such changes will likely be more stringent on the facility in some way. Even if the change is not toward increased stringency, there may be resistances to change that preclude making such differing requirements more compatible. The education process for facility and agency personnel may be significant to achieve understanding and compliance with what may seem trivial changes in process and procedures. There is a real or perceived need to have absolute agreement between data in systems and legally required data from facilities. This may result in changes in processes and procedures meeting resistance if may not be possible at all without complications.

Title V has been a boon to refinements in emission estimation in that it has increased the visibility and scrutiny of results and thus the level of requirements for attention to detail. Errors can also result in monetary penalties. The integration of permits and Title V with the inventory process also means that facilities (i.e., the *Responsible Official*) are legally responsible for the estimates (Emission Reports) and states are accountable to US EPA, environmental interests, the public, other facilities, etc. to verify that emissions are correctly quantified. You just don't lightly go into these estimates and start making changes. The down side is that such "hardening" of the estimates may suppress efforts to make improvements in them that could make the results more representative and accurately reflective of the real world.

Rule Effectiveness may have add a level of confusion to emission estimates. Rule effectiveness is a concept and process whereby emissions are artificially adjusted to account for an expected less-than-100 percentage compliance with a rule or regulation, due to technical, economic, practical or even divisive or fraudulent reasons. The facility often has no part in (and perhaps no knowledge of) such determinations and revisions. Resulting adjustments in emissions are usually made to the inventory during air quality simulation modeling used for State Implementation Plan (SIP) development. A result of such adjustments, however, rules that are developed may affect the facility in question and others that are in the same status or category as far as potential targets for additional emission reductions. Hence, the newly developed rule is based on information different from that submitted in a legal context by the facility. In this situation, incorporation of rule effectiveness into an inventory and planning process can become an impediment to getting facilities to report emissions accurately and properly as they may anticipate such a percentage being added later. It is inherently better for emissions to be accounted for more accurately at the facility level, by the primary inventory submittal than for emissions to be artificially added in later due to a general expectation or knowledge that the rules may not be executed fully as applicable rules state.

The *One Inventory* Concept

There is only one finite set of air pollutant sources, i.e. "THE INVENTORY." However, common references are often made to a "haze inventory," a "PM2.5 inventory," an "ozone modeling inventory", an hourly inventory, etc. In the most fundamental terms, there is only one inventory, whether it is for a single facility or some broad jurisdictional designation. The inventory may have many attributes and be described in many different ways, all having different sets of temporal, spatial, pollutant and other specifications as well as levels of detail. However, as new programs come along, the US EPA has the tendency to undertake more narrowly scoped efforts to tackle a specific problem in a short-term basis without keeping the context of the broader picture of what is required and is happening at a facility and/or state/local agency as part of an integrated whole. This is usually as the result of some upper management decisions to have emphasis on this or that and accomplish a set of goals during a given time frame, usually without taking a holistic view. As new programs are initiated or evolve, other existing needs and requirements do not usually go away, nor does these jurisdictional staff normally expand to provide more resources for the chore. Integration of inventories and inventory requirements is a necessity for efficient development and submittal by state and local agencies on a continuing basis.

Other federally required inventory programs include the National Acid Rain Program[5] that is aimed at SO_2 and NOx reductions, and the SARA 313 (or Toxics Reporting Inventory – TRI). These efforts result in data generated on a different scale or level of detail, and somewhat redundantly.. The Acid Rain data for example are hourly and result from instrumentation installed and operating as part of a required continuous emissions monitoring (CEM) program. It does not seem to be very realistic to estimate emissions using gross and uncertain emission factor methods when accurate and comprehensive data are available from a real time basis. Such continuous data are highly accurate and should be summarized in the same manner for reporting to the states, with the same annual statistics as the data reported to the Acid Rain Program. The SARA 313 data are much less detailed than the information required of EPA as part of the legislation to provide the public with fundamental information on releases into the air and water, etc. If the data used and reported for TRI submittals differ from data submitted to states for their requirements, then this can quickly become basis for disputes and confusion. Once two different numbers are compared, the integrity of both becomes suspect.

Timing and Scheduling Considerations and Realities

States do not generally go to a facility with a request for raw data to enable the state to estimate emissions. Especially with the advent of Title V and other permit programs and their requirements, an important part of the estimate is that it is made by the facility and is a legal statement by the facility which can have formal enforcement actions taken because it does not exist or was prepared incorrectly. Therefore, the commonplace situation in most states seems to be similar to that in North Carolina where the facilities report their estimates of actual emissions annually, for major/Title V facilities. The remaining facilities are categorized as Smalls and Synthetic Minors and they report on a third year cycle.

A facility cannot properly estimate or report actual emissions for a calendar year (CY) until that calendar year is over. A simple facility with few simple processes with acceptable emission factors could possibly complete its emission inventory within a matter of days if it managed its production information and other data in an efficient manner. However, a more complex facility may have many levels of records that must be assessed, analyzed and organized in proper fashion to be able to tally their production efforts and the raw materials used or finished products produced. In addition, environmental or emission inventory staff are often not able to devote their full attention to the annual inventory as an immediate priority. This has become even more of a reality with the tendency within industry to have less and less staff devoted to a wider variety of environmental and occupational health and safety reports, regulations and rules. The inventory preparation staff may have other reports and responsibilities related to air, water, hazardous waste, toxic substances, Superfund, community health and safety, employee health and safety, fire and building code regulations, etc. Thus, their time may not be as flexible as it could be, or perhaps once was. In addition, the SARA 313 or Toxics Release Inventory (TRI) reports are well established in law to be due to US EPA and to state emergency management officials by July 1 of the CY following the end of the CY of the inventory. Though there are important differences, the basic data used are much the same and it is usually most efficient to compile and report such data at the same time. This helps to identify and resolve any differences in estimates if they are worked on and due at the same time. In North Carolina, the existence of this TRI federal reporting requirement has established a strong precedence and any movement to evolve toward another date has met with significant resistance from industry even though they may concede that they really don't need a full six months to complete the reports.

Following the reporting of the data, state and local agencies need time to enter the data and to review and quality assure the information provided by the facilities. This will vary with the level of sophistication and integration of electronic reporting capability that is utilized with a given organization. If there are numerous facilities of relative high complexity, and the database used requires substantial manual entry, the process of data entry can likely take several months. In North Carolina, the

inventories due from the approximately 600 TV or major facilities on June 30 of CY +1 are not usually completely reviewed and entered into the database until the end of the CY +1. North Carolina completes an inventory each third year of all approximately 3,200 permitted and registered facilities in the state. On these occasions, the time required to get these data entered may extend even further. If the reporting requirements or formats have changed, the overhead and other resources required to make such changes may delay the completion of this effort even further.

Agencies may be organized according to jurisdictional and/or work effort categories. For example, in North Carolina, there are seven regions of the state in addition to the three local agencies. The data collected from the annual inventory starts to come in early in the calendar year, but is mostly submitted during the month of June, the deadline being June 30. The regional staff, being most familiar with the facilities is assigned the responsibility for reviewing and entering the inventory data that comes in. This period is usually at the time of the year when inspections are more possible and needed due to weather considerations. Thus, the inventory is not as high a priority it could be at other times of the year when inspections and various other reports are due that require attention. There can be considerable other reasons for delay in the data entry process due to such practical situations. Staff is never adequate nor sufficiently trained to accomplish all that is needed in the timeliest manner and with the highest degree of efficiency and integrity of data.

If there is a change in what US EPA expects to be reported in the inventory for a given CY, then this process and its limitations must be recognized and taken into consideration. A facility cannot be expected to report data to the state that it has not been asked to collect in advance. Therefore, it will be necessary to notify the facility of any changes that will be included in their CY year-end inventory prior to the beginning of the CY of the inventory to be collected. A ninety-day lead-time for the facility to raise questions and other stakeholder issues is a minimum. It will also take the state or local agency at least three to six months to evaluate the impact of any new requirements and to prepare information to provide to the facilities to be able to tell them what is needed and how they may meet the requirements. They likely will have to remind and convince them <u>again,</u> as to why they have to provide the information at all. When there are significant changes, rule revisions may be necessary. Such changes may take months to years. In the normal case, however, changes in the inventory requirements can likely be accommodated with a minimum total of six months notice of final changes prior to the CY of the inventory. US EPA guidance, then is needed in final form within a minimum of six months to one year prior to the beginning of the inventory (CY) year if there is to be any realistic expectation that the targeted data can be provided by the state or local authorities. Adding a major new pollutant or other significant “structural” changes may take several months longer. Bottom line is that changes needed for CY 2002 inventory cycle should be well developed at this point.

<u>Pollutant Definitions and Conventions</u>

Many disagreements and miscommunications exist regarding what is included or meant for a given Hazardous Air Pollutant (HAP), and even sometimes for criteria pollutants which are much more commonly dealt with historically in air quality management programs. Recently, for example, there was a guidance memorandum from OAQPS[6] to spell out the definition of various HAPs for purposes of determining whether a facility met the 10 and 25 tons per year of potential emissions for classification as Title V. This grouping is generally similar but not identical with the list of pollutants and codes required to submit emissions data to US EPA using the National Emissions Trends (NET) Input Format (NIF). Any data that are to be submitted to US EPA must be in this format, so it is very important, though there has been no database system or translators provided by US EPA to make this universally possible for those who were previous submitters to AIRS and other systems.

In addition, Congress did not do a good job of defining chemicals or substances and groups that always make sense. They were trying to rectify a situation whereby there was sluggishness on the part

of US EPA and much confusion and impatience with determination of what were appropriate pollutants to be established for the National Standards for Hazardous Air Pollutants (NESHAPs), which was the former effort in this area. Therefore, Congress, in their wisdom and power, established a list of 189 (now 188) pollutants that they felt should be addressed; not forsaking all others, but effectively taking the focus away from others. For example, the list of HAPs in the CAA specifically states "2, 3, 7, 8 – Tetrachlorodibenzo-p-dioxin (TCDD)" which is a specific dioxin isomer/compound. Yet, in reality many isomers of dioxin could easily be technically classed as HAPs (There are over 70 'tetrachloro' isomers that are suspect, not to mention the hundreds of others). The permit aspects of the CAA add a very legalistic view which surfaces here and many other places. The industry successfully argues that the specific isomer is stated in the Act. This, they argue, is the one that determines the HAP and permit limits. Though 2,3,7,8- TCDD will never (yes, *never* - final answer!) trigger the 10/25-tons/year *potential* emissions criteria for Title V classification for a single facility, the situation illustrates a point. Because the specific isomer is stated in the CAA list, facilities reporting emissions will not likely be inclined to voluntarily report the toxic equivalent emissions. Nor will one will be successful in requiring them to include the Toxic Equivalency for the dioxin emissions based on "2,3,7,8" without changes in the wording in the Act or federal rulemaking. Differences such as this may often seem minor, but in the real world can cause many practical problems to implement and enforce.

The definition of glycol ethers, a HAP group, is very complex. There are thousands of compounds that meet the definition in the Act. It takes someone very versed in organic chemistry to even interpret the definition of glycol ethers. In addition, many of the compounds that are defined by the CAA definition are not manufactured or practically existent in the normal "real world" situations. To make this example even more complex, US EPA recently determined that many of the glycol ether compounds defined in the Act are not properly classified as hazardous and consequently de-listed part of the list.[7] (De-listing (or listing) of compounds is allowed under Section 112 of the Act as a means of taking compounds off the list -or adding others- after meeting specific criteria. Several proposals have been made, but few substances have actually been removed, and none added). More recently, proposal has been made to de-list other additional compounds from this definition. This adds further to the complexity, confusion of what the requirement is to meet, and how everyone must be kept informed. Facility personnel often tend to wish for, hope for, or expect definitions and requirements to remain stable and tend to get more difficult to deal with when the rules keep changing, even if sometimes to their advantage.

Another pollutant-oriented issue that makes it difficult to be compliant with all inventory guidance relates to criteria pollutants. "VOC" is defined[8], for regulatory purposes, to exclude a number of specific compounds, including methane, ethane, acetone and other compounds with low photochemical reactivity. This effectively excludes them from record-keeping requirements at the facility level and the states do not generally ask for reporting of these compounds separately. However, when inventory input to photochemical models is generated, the fact that most or all of these compounds eventually have some reactivity somewhere, sometime, down stream, is recognized. This is then reflected in the reintroduction of large quantities of these compounds to the modeling inventory, based on speciation profiles or other secondary information. Consequently, the modeling is then done with a different set of emissions than submitted by the facility. As stated earlier, this generates a "disconnect" in the train of data legally provided by facilities. The resulting modeling version of the inventory is then utilized to analyze ozone development in the atmosphere. While being more scientifically defensible, it does create some questions on the purpose of the exclusion of the compounds in question from the VOC definition in the first place. It introduces a double inventory standard that could cause challenges to be raised to resulting regulations, especially if those regulations are expensive and degree of projected attainment is not convincing. Again, hardening of the data because of legal constraints can become an issue.

Mass of emissions of groups of compounds or substances is often a confusing issue and thus likely to be reported incorrectly. For example, the list in the Act defines chromium compounds (and others). The mass of these compounds is to be reported. That is to say if the emissions to be reported are zinc chromate, for example, the reported quantity should be the entire mass. However, many risk assessment exercises depend upon risk information that is based on effects of the chromium ion. If you know the weight or mass of each individual compound, and what the compounds are, one can readily determine the mass attributable to the chromium ion. However, in many real world cases, there may be a mixture with several compounds, for which the specific identity of all the cat ions and anions may be unknown. Also, the Act says that in this example, the chromium metal, which is un-reacted should be included in the total. This is not likely to be a problem in many practical situations. Yet, if the emissions were significantly composed of un-reacted metal, the risk assessment would be additionally in error as metallic chromium is very un-reactive and less likely to be risk causal than a compound. In manufacturing operations where a single or a number of known compounds are being manufactured, it may be easy for the company to determine the exact compounds emitted. For others, such as combustion or for complex reactions, it may be unknown as to what those exact quantities are. Even testing and analysis, if there is a method, may be somewhat crude due to uncertainties. Fortunately, the chromium ion, in such an example, will normally be a large portion of the atomic weight of the compound such that such an introduction of error may not be of much consequence.

Training and Communication

The growing trend in most facilities in the past few years has been to consolidate all environmental and occupational health duties into one position or office. There continues to be more and more volumes of regulations and rules that apply to air quality, water quality, solid waste, hazardous waste, toxic substances, emergency preparedness, employee protection, etc. Each regulation that has been passed has tended to be more complex than previously and often very convoluted and detailed. The single person who many times has the responsibility for these activities and operations must operate virtually as a living computer to know about them and understand them. These regulations often have different definitions for the same substances or the terms that apply in one situation are not the same as apply under another situation in another regulation.

Training and communication are key to any successful information gathering and interpretation program. Many times the federal level may fail to see the problems and real world situations that exist at the state and local level. Also, manufacturing and other facilities are concentrated on producing a product and making a profit and the reporting of information may inhibit either or both of these aspects. A facility “environmental” manager, for example, may not have a clue as to what a dioxin is or appreciate the nuances of isomers and relative toxicity. The “simplest” thing may be so foreign to the facility person that it causes immense concern and grief. For these reasons, it is imperative that communications between various levels be clear, simple, detailed and unambiguous. This standard should carry through for emission inventory forms instructions, reporting requirements. The designer should keep in mind that, for example, the same person at the facility may also be reporting to SARA 313 (Toxics Reporting) and may be easily confused by something that may sound similar, unless they are “hit over the head with a two by four,” figuratively speaking.

CONCLUSIONS

The Clean Air Act is a monumental piece of legislation and has had significant positive impact on the air quality of the United States. However, there are many places in the Clean Air Act (and its implementing regulations) that are inherently confusing, difficult to apply, or lacking in harmony with other regulations and reality. An effort to simplify, reduce confusion and complexity of implementation is warranted. Often extra steps are needed to train and educate the agency and facility staffs so that the

often-confusing regulations and terms are well understood and acted upon properly. Now is a good time to be reflecting on those such items that could be improved for purposes of revisions and fine-tuning of the Act that is likely to occur in the next session or two of the US Congress. It is better for informed scientists and engineers to provide factual and logical information and alternatives to the formulators of any changes than to suffer the consequences.

This author has presented several related evolving and related treatises[9] [10] [11] on this topic at emission inventory conferences in the past few years. They were not intended to be fully developed authorities on the topics discussed but a means to stimulate original and innovative thought and to encourage the reader to evaluate the practical aspects of the related issues. If others are so inspired, they should feel free to contact me at the e-mail address above for comments and agreement or disagreement with the issues. If there is an interest, I can supply the reader with the names of senior staff officials in Congress who are interested in listening to constructive comments on revisions that may be needed to the Act. This sort of enlightenment can only lead to improved legislation.

KEYWORDS

Emission Inventories
Air Quality Management
Clean Air Act
Practical Applications
State/Federal

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