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# **EMISSIONS FACTORS PROGRAM IMPROVEMENT EFFORTS**

U.S. Environmental Protection Agency  
Office of Air Quality Planning and Standards  
Emissions Monitoring and Analysis Division  
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Research Triangle Park, NC 27711

September 2005

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# **Emissions Factors Program Improvement Efforts**

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**EPA Contract No. 68-D-01-003  
Work Assignment No. 5-01**

**September 2005**

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## EXECUTIVE SUMMARY

During fiscal year 2003, the Emissions Monitoring and Analysis Division (EMAD) recognized the need to reorganize and separate the Emissions Inventory and Emissions Factors programs in part to make the emissions factors program more responsive to the broad and diverse needs of emissions factors users. EMAD formed the Emissions Factors and Policy Applications Group (EFPAG) to be responsible for updating and improving the emissions factors and other emissions quantification programs.

EFPAG recognized the need to perform a complete evaluation of the emissions factors program to understand the emissions factors development process, the scope of the inventory and non inventory uses of emissions factors, and the perceived needs of emissions factors users. During fiscal year 2004, EFPAG initiated efforts to identify areas of the existing program that could be revised to make the program more responsive to the needs of the emissions factors user community. These efforts included distributing surveys to stakeholders, interviewing stakeholders, and organizing stakeholder workshops to identify existing uses of emissions factors and specific areas of the existing program that could be improved.

Through the information gathering and stakeholder engagement process, EFPAG recognized several broadly supported directions for the future emissions factors program. Stakeholder support exists to: (1) make the development of emissions factors more self supporting and open to fuller participation by external organizations, thereby making the program less reliant on Federal decisions, (2) increase the use of electronic means to standardize the development process, quantify the quality components, and streamline all aspects of emissions factors development and use, (3) make the emissions factors uncertainties and emissions quantification methodologies more transparent to users, and (4) provide direction on the proper application of emissions factors consistent with non-inventory program goals including clearer guidance and direction on use of more direct quantification tools (e.g., emissions monitoring) in lieu of emissions factors.

This report summarizes: (1) the emissions factors uses and program areas that were identified for improvement through these surveys, interviews, and workshops; (2) the options to improve the program that were presented to stakeholders during the workshops; and (3) the status of program improvement areas.

## **Initial Investigation of Emissions Factors Uses and Program Areas for Improvement**

One of the initial efforts that EFPAG undertook was to identify current uses of emissions factors and to identify areas of the emissions factors programs that users believed should be improved. EFPAG accomplished this effort by interviewing and surveying a variety of emissions factors users. The stakeholders interviewed/surveyed included 49 state, local, and tribal air pollution control agencies; 13 industries; 6 environmental advocacy groups; 25 EPA offices and regions; and 3 other federal agencies.

Although the emissions factors presented in AP-42 were originally intended for use during the development of regional emissions inventories, stakeholders indicated that they are currently used for many other purposes. The stakeholders identified the following current uses of emissions factors:

1. Developing regional emissions inventories.
2. Developing site-specific emissions inventories.
3. Identifying and evaluating control strategies.
4. Determining applicability of permit and regulatory requirements.
5. Conducting risk assessments.

In addition to identifying the current uses of emissions factors, the stakeholders identified the emissions factors program areas they wanted improved. The stakeholders major recommendations included:

1. EPA should establish a more open and less cumbersome process that allows interested parties to assist in the improvement and development of emissions factors.
2. EPA should update the format of AP-42 and the methods for accessing the factors and associated documentation.
3. EPA should provide guidance to help emissions factors users: (1) select the most appropriate factor; (2) understand how to consider uncertainties when using factors; and, (3) gather data to estimate emissions when a factor is not available. EPA should also provide guidance on applying emissions factors in permitting and enforcement applications.
4. EPA should update existing emissions factors and provide more factors where gaps currently exist. In many cases, the new emissions factors that stakeholders requested were related to more speciation (particle size for PM, specific chemicals for VOC). EPA should also provide more attention to developing regional factors and factors for unique events and circumstances.

Additional information regarding the interviews and surveys conducted as well as the input received from emissions factors users may be obtained at: <http://www.epa.gov/ttn/chief/efdocus/efimproverproject.pdf>.

EFPAG assessed all of the data collected from stakeholders and performed an internal assessment of the existing status of the emissions factors program. Based upon these assessments, EFPAG preliminarily identified the following four program elements as the primary areas where improvements will occur:

1. Assessing and documenting the quality of source tests.
2. Assessing and documenting the quality of emissions factors.
3. Automating components of the emissions factors development and delivery process.
4. Providing guidance regarding the use of emissions factors for purposes other than emissions inventories.

Improvements in these four emissions factors program areas would address the first three recommendations that EFPAG received from stakeholders. Although EFPAG understands that many individual emissions factors could be improved, EFPAG decided to expend current, limited resources on programmatic improvements rather than on the improvement of individual emissions factors. As a result, the fourth stakeholder recommendation has not been addressed.

### **Program Improvement Options Discussed at Stakeholder Workshops**

During the summer and fall of 2004, EFPAG held four workshops to engage stakeholders and identify the critical activities necessary for improving the emissions factors program. In preparation for the workshops, EFPAG developed several options that might be implemented to improve each of the program areas identified above. These options were intended to provide a basis for discussions with the stakeholders; they were not intended to restrict the options proposed by the stakeholders.

EFPAG identified and analyzed the advantages and disadvantages of implementing each option. Options ranged in scope from leaving the existing program in place to making substantial changes to the program. For example, options for assessing and documenting the quality of emissions factors ranged from continuing the existing labor intensive and subjective program to implementing an automated data collection and evaluation system that would use statistical analyses to quantify the uncertainty associated with uses of emissions factors. All of the options were made available to prospective stakeholders prior to workshops. Papers that describe the options developed as well as the advantages and disadvantages of each option are presented in Appendices A through D.

EFPAG endeavored to solicit workshop attendees from the entire range of emissions factors users, while simultaneously focusing the discussions during each workshop. Attendees at the first workshop primarily included EPA, State/local agency, regional planning organization, and industry personnel involved with

the development of regional and/or national emissions inventories. The second and third workshops involved a broad range of emissions factors users from EPA, State/local agencies, trade organizations, and industry. Attendance at the fourth workshop was limited to personnel from EPA offices and regions.

As part of the workshop sign up process, stakeholders were asked to select the top three topics that they wished to discuss during the workshops. The complete list of topics provided to the stakeholders included the following:

1. What changes to the emissions factors development protocol are needed to maximize the amount of data available for emissions factors development and insure the factors and data are acceptable to all stakeholders?
2. What criteria would you impose in assessing emissions data (e.g., compliance test reports) and how would you report the data quality in a process for establishing and publishing emissions factors?
3. What application guidance would you impose to ensure adequate consideration of emissions factors data quality issues (e.g., higher uncertainty in some emissions factors data has little effect on the resulting inventory but may have significant compliance implications when applied in a permit)?
4. What tools or changes to the emissions factors program would improve the effectiveness of the non-emissions inventory programs and the consistency among these programs?
5. What should be done in the emissions factors program to address perceived differences in emissions due to differences in feed material, climate, control measures, and other process parameters?
6. How should information on emissions factors uncertainty and the variability of source emissions be accommodated when used in inventory and non-inventory programs?
7. We envisage an emissions factors' development process where the source testing data are collected and submitted electronically - first to the state or local program for their normal review and then to EPA for updating AP-42. Under what conditions could this be accomplished? What EPA and non-EPA actions are needed to produce this situation?
8. Although emissions factors represent an average, they are used for many programs (emissions limitations, PTE determinations, compliance assessments, fee calculations, penalty calculations, etc.) where other values may be more appropriate. What information and guidance is required to develop and support the use of these more appropriate values? What would be needed to achieve some congruity between the different emissions values?
9. Factors based emissions estimates are use in some trading programs. What emissions factors information and guidance would be necessary to allow for trading across broader situations and

accommodate potential differences between actual emissions and an emissions estimate based upon emissions factors information?

EFPAG tallied results from the stakeholders and identified four topics for detailed discussion at each workshop.

During each workshop, EFPAG presented background information regarding the emissions factors program, program status, results from the initial stakeholder interviews and surveys, and current and proposed emissions factors development activities. Following these presentations, the stakeholders broke into between three and five groups to discuss the topics chosen for the workshop and to develop specific recommendations. At the conclusion of each workshop, the workgroups briefed all workshop participants on the focus of their discussions as well as their recommendations.

A total of 14 workgroups met over the course of the four workshops. The most common recommendations that the workgroups made to EFPAG were:

1. Standardize source test plans and reports and associated QA procedures.
2. Develop an automated mechanism for the submission of source test plans and reports.
3. Develop a web-based clearinghouse of source test reports including emissions factors developed, operating parameters tested, uncertainty associated with the test, and QA steps conducted.
4. Quantify the uncertainty associated with emissions factors.
5. Provide guidance regarding the use of emissions factors in non-emissions inventory applications.
6. Streamline the process of developing new emissions factors.

Additional information regarding the stakeholder involvement meetings conducted as well as the input received from the stakeholders is presented in Appendices E through H.

### **Status of Program Improvement Areas**

EFPAG has initiated four projects to address the stakeholder recommendations identified above. These projects will lead to the development of reports or other products that will be submitted to stakeholders for review and input.

In the first project, EFPAG is assessing the quality of source tests by characterizing and quantifying the uncertainties associated with several stack testing methodologies. In addition, EFPAG is evaluating the

uncertainties that result when stack tests deviate from the prescribed methods. Results from this project will be incorporated into the second project, as described below.

Second, EFPAG is in the process of developing an automated mechanism to standardize the development and submission of source test plans and reports, as well as to standardize test plan and test report QA procedures. The Electronic Reporting Tool (ERT) is a Microsoft Access program that is intended for use by both source testers and review agencies. Source testers will use the ERT to develop standardized test plans and test reports that include facility information, operating parameters, test procedures, test data, and analytical data. Review agencies will use the ERT to perform quality assurance checks and to quantify the uncertainty associated with the source test results. Electronic data contained in a comprehensive Access database could subsequently be used to develop new emissions factors.

Third, EFPAG has initiated a project to understand and quantify the uncertainties associated with the development of emissions factors and the application of emissions factors to achieve various program objectives. In this context, uncertainty is a combination of the bias in selection of an emissions factor, imprecision of the emissions factor itself, and in source variability. During the course of this project, several series of “A” rated emissions factors will be evaluated to characterize the underlying statistical distributions of the data as well as to quantify the uncertainty associated with each factor.

Fourth, EFPAG is evaluating the use of emissions factors for non-emissions inventory purposes. EFPAG has identified numerous uses of emissions factors, ranging from applicability determinations to permitting to regulatory development. EFPAG is assessing the implications that incorporating uncertainty estimates into the emissions factors program will have on the many programs that currently rely on emissions factors.

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## 1.0 INTRODUCTION

Quantifying air emissions is a vital aspect of all air pollution programs. Regulatory authorities and others use emissions values in developing emissions inventories, identifying and evaluating control strategies, determining applicability of permit and regulatory requirements, assessing risks, and a variety of other applications. In an ideal situation, all emissions data users would derive values from emissions tests, continuous emissions monitoring data, or mass balances or other detailed engineering calculations. These methods are time- and resource-intensive, so users often do not have data sufficient to allow detailed site-specific emissions determinations. Without such data, emissions factors, which are representative annual average values that relate the quantity of a pollutant emitted with an activity associated with the release of that pollutant, are frequently the best or only method available for emissions determinations.

EPA's Office of Air Quality Planning and Standards (OAQPS) has long recognized the importance of emissions factors in implementing the air program. OAQPS has devoted energy and resources on developing and documenting emissions factors for use in applications focused almost entirely on emissions inventories and modeling. The primary emissions factors tool is EPA's *Compilation of Air Pollutant Emissions Factors*, or AP-42. There are two volumes of AP-42: Volume I contains emissions factors for stationary point and area sources and Volume II contains emissions factors for mobile sources. The former Emission Factor and Inventory Group (EFIG) of OAQPS's Emissions Monitoring and Analysis Division (EMAD) has historically been responsible for Volume I.

In 2003, EMAD undertook an assessment of groups and associated responsibilities. As a result of this assessment, EMAD formed the Emissions Factors and Policy Application Group (EFPAG) to undertake the challenge of revamping the emissions factors and other emissions quantification programs. EFPAG formed a team to take a fresh look at the emissions factors program and the direction for its future.

EFPAG recognized the need to perform a complete evaluation of the emissions factors program to understand the emissions factors development process, the scope of the inventory and non-inventory uses of emissions factors, and the perceived needs of emissions factors users. EFPAG also intended to:

- (1) identify methods that would expand the capabilities for improving the number and quality of available emissions factors;
- (2) provide science-based recommendations on appropriate adaptations to achieve different program goals through the use of emissions factors;
- (3) characterize the deficiencies of using emissions factors through quantification of the uncertainties associated with using emissions factors;
- (4) provide users with alternative methods of quantifying emissions;
- (5) reduce the levels of uncertainties;
- and (6) increase the accountability of stakeholders for improvements in the emissions factors program.

During fiscal year 2004, efforts were initiated to identify areas of the existing program that could be revised to make the program more responsive to the needs of the emissions factors user community. These efforts included distributing surveys to stakeholders, interviewing stakeholders, and organizing stakeholder workshops to identify existing uses of emissions factors and specific areas of the existing program that could be improved.

This report summarizes the emissions factors uses and program areas that were identified for improvement through these surveys, interviews, and workshops; the options to improve the program that were presented to stakeholders during the workshops; and the status of program improvement areas. Section 2 describes the initial investigation of emissions factors uses and program areas for improvement. Section 3 summarizes the preliminary options to improve the emissions factors program that EFPAG developed to support stakeholder workshops. The stakeholder workshops are described in Section 4 and Section 5 summarizes the status of EFPAG's current projects to improve the emissions factors program.

## **2.0 INITIAL INVESTIGATION OF EMISSIONS FACTORS USES AND PROGRAM AREAS FOR IMPROVEMENT**

One of the initial efforts that EFPAG undertook was to identify current uses of emissions factors, identify areas of the emissions factors programs that users believed should be improved, and identify potential stakeholders who may be interested in participating in emissions factors program improvement projects. EFPAG accomplished this effort by interviewing and surveying a variety of emissions factors users. The stakeholders interviewed/surveyed included 49 state, local, and tribal air pollution control agencies; 13 industries; 6 environmental advocacy groups; 25 EPA offices and regions; and 3 other federal agencies.

This section provides an overview of the emissions factors survey project. Additional information regarding the interviews and surveys conducted as well as the input received from emissions factors users may be obtained at: <http://www.epa.gov/ttn/chief/efddocs/efimproverproject.pdf>.

### **2.1 Information Gathering Efforts**

EFPAG decided to gather information from AP-42 users to help focus efforts to improve the program. The goal of the information gathering effort was to learn the following from users of AP-42 and other emissions factors:

- How emissions factors are used generally.
- What's working and what's not working in using emissions factors.
- Major areas for further exploration.
- Who the major stakeholders are and what their issues are.
- The user community's view of the emissions factors development process.
- How the military and other government facilities' needs in permitting and source monitoring are being met by the emissions factors program.
- What interest there is in improving and developing new emissions factors or developing alternative emissions quantification procedures.

EFPAG desired to obtain input from as many different types of emissions factors users as possible. The team identified the following types of people and organizations from whom they wished to solicit input:

- Individuals or groups who actively use emissions factors and care about improving the program.
- Individuals or groups with whom the team already had relationships.
- Individuals or groups who were frustrated with the program and no longer use emissions factors.

- Individuals or groups who have gone above and beyond using emissions factors.
- Individuals on the management level.

They also wanted to ensure that the individuals or groups represented a broad cross-section of types of emissions factors users (e.g., the factors are used for permitting, emissions inventories, enforcement).

Using the criteria defined, the team created a list of groups and individuals from whom they wanted to obtain information. In general, this list included representatives from other EMAD groups, the three other OAQPS divisions, EPA Regional offices, other (non-OAQPS) EPA offices, other Federal agencies, State agencies, local agencies, regional planning and other state/local organizations, industry and industry trade organizations, and environmental advocacy groups. In total, 94 interviews and surveys were conducted by EFPAG in this effort.

These interviews primarily consisted of face-to-face meetings and telephone conference calls. Specific questions were used to start the conversation and engage the interviewees. The specific questions were the following:

1. How do you or your constituents use emissions factors (e.g., inventories, permit applicability, compliance)?
2. Are the emissions factors you or your constituents use derived from EPA's AP-42 or other data sources? What are those other sources?
3. Do you use emissions factors from sources other than AP-42 because AP-42 does not provide factors for your source type or for other reasons?
4. To what extent does the use of emissions factors satisfy the needs of the military or other government facilities in your area or constituency in obtaining and complying with operating, NSR, or other permits and in meeting emissions monitoring needs?
5. Do you or your constituents provide data to EPA for developing emissions factors? What about the process for developing EPA emissions factors enhances or inhibits your participation?
6. Have you, your constituents, or others proposed to use emissions quantification procedures other than emissions factors? If so, why and what were those procedures?
7. Have you, your constituents, or others imposed or had imposed on you the use of emissions factors when there may have been other procedures providing more representative results?
8. If EPA decided not to update AP-42 again, what would your reaction be?
9. Would you consider more direct involvement in an effort to improve emissions factors or in developing appropriate alternatives to emissions quantification by emissions factors? If so, what level of involvement would that be?

## **2.2 Stakeholder Responses to Interviews and Surveys**

Stakeholders' responses to the interviews and surveys were grouped in the following basic topic areas:

1. Stakeholder involvement.
2. Emissions factors application guidance.
3. Activity data issues.
4. Specific emissions factors.
5. Concept of AP-42.
6. Prioritization of efforts and resources.
7. Process for developing and improving factors.
8. Format and accessibility.
9. Emissions factors data quality.
10. Special emissions factors.

Responses in each of these ten topic areas are described below.

### **2.2.1 Stakeholder Involvement**

One of the key goals of the effort was to identify potential stakeholders who would be willing to participate in the efforts to improve the emissions factors program and AP-42. There was considerable interest by respondents with a wide variety of affiliations who indicated a willingness, even an eagerness, to participate with the EPA in such efforts.

### **2.2.2 Emissions Factors Guidance Needed**

Stakeholders indicated a need for guidance related to emissions factors usage for inventory and non-inventory applications. The general types of guidance suggested were related to both selecting and using factors and to communicating emissions estimates calculated from factors. Three specific areas in which the respondents reported the desire to use emissions factors are in permitting, enforcement, and emissions inventory development. The respondents rely on emissions factors in these areas, but they were concerned that procedures for applying emissions factors are used inconsistently. Others noted the emissions factors are applied inappropriately in some instances. Therefore, several respondents requested that EPA develop guidance on the use of emissions factors for these three air pollution program areas.

The respondents also expressed uncertainty in how to select the most appropriate factor for a specific application and asked that guidance be developed to aid in this process. These requests also extended to what to do when an emissions factor is not available for a particular application. They would like guidance on how to ascertain the type and level of data needed to generate new emissions factors and how to obtain these data. This includes guidance on ordering and overseeing emissions tests designed to develop emissions factors.

The respondents recognized the uncertainties associated with emissions estimates generated through the use of emissions factors. They voiced a concern related to how to consider uncertainty data when applying emissions factors in certain situations and how to report emissions to reflect uncertainties. They asked for guidance to address the use of caveats, ranges, and other methods to recognize these uncertainties.

Finally, the respondents expressed a need for guidance to help inform and educate the public on how emissions factors are used and how to understand and interpret emissions estimates generated with emissions factors. This guidance should particularly address emissions estimates that the public may see in permits, enforcement actions, and site-specific emissions estimates.

### **2.2.3 Activity Data Issues**

The respondents raised issues related to activity data. They stated that some emissions factors are in units for which the activity data needed cannot be easily measured, or for which the activity data is very costly to obtain. The respondents requested that the activity data and equations used to develop emissions factors be in practicable, usable units. Also, the respondents commented that EPA did not provide enough information to allow them to improve activity data. For example, some of the respondents stated that the emissions inventory data they received from the EPA were not clear on the origin of the activity data and how they could obtain more detailed information to improve the activity data supplied in the National Emissions Inventory. The respondents noted a lack of access to activity data. They suggested that EPA develop a clear method of communication related to activity data via the internet and through specific contacts.

### **2.2.4 Specific Emissions Factors**

Overall, the respondents proposed over 130 emissions factors or groups of emissions factors that they believe need to be developed or revised. Many respondents provided specific suggestions (e.g., a specific

chemical/group of chemicals from a specific type of source); however, many of the emissions factors suggested were more general. For example, some respondents requested creating emissions factors for a specific chemical across all source types while others want EPA to create emissions factors for a specific source type across all chemicals produced by that source type.

### **2.2.5 Concept of AP-42**

Many respondents had comments related to the overall concept of AP-42. Some respondents (Federal, State, and local agencies) stressed the importance of keeping all emissions factors data available through one source. One of the respondents stated that the EPA needs to reexamine the purpose of AP-42 and whether its purpose would allow it to recognize (and link) other emissions factors that are available.

### **2.2.6 Prioritization of Efforts and Resources**

Several respondents suggested that EPA both update and improve the AP-42 program. While they seemed to agree that a shift in prioritization of efforts and resources is needed, they did not necessarily agree on exactly what those shifts and prioritizations should be. Some suggested “filling in the blanks” related to emissions factors by creating emissions factors for new sources and/or chemicals that currently do not have emissions factors. Some respondents proposed prioritizing the new emissions factors by focusing on high-risk pollutants first. Instead of applying resources to AP-42, others suggested shifting them toward projects that reduce emissions and/or create better measurement techniques.

### **2.2.7 Process for Developing or Improving Factors**

The respondents stated that EPA needs to redesign and then maintain the process for developing and improving emissions factors in four different ways. First, they believed that the EPA should use a transparent process to develop emissions factors and resolve associated issues.

Also, they suggested that EPA standardize and streamline not only the development and improvement of emissions factors but also the improvement of the program as a whole. EPA should improve the format and access for AP-42. This includes organizing the emissions factors program and associated documentation, providing links to emissions factors developed outside of EPA, and collecting source test data into a central repository.

Next, the respondents proposed that EPA determine a way to provide more accurate emissions factors information to users more quickly. EPA should provide an avenue for users to submit data and other information more directly to the AP-42 program. Lastly, the respondents stressed a need for the AP-42 program to accept data and emissions factors from other sources into the AP-42 program.

### **2.2.8 Format and Accessibility**

The respondents made suggestions related to the format and accessibility of emissions factors. Respondents indicated they do not believe AP-42 emissions factors, as well as background documentation, are currently very accessible to users. Also, they stated that EPA has used emissions factors that were not in AP-42, making it difficult to find the emissions factor used as well as its background documentation. They suggested that the AP-42 program should be reorganized in a more easily accessible format and should include accessibility to non-AP-42 emissions factors. Likewise, they believe that EPA needs to improve the accessibility of emissions factors and related documentation and that this information should be available via the Internet.

### **2.2.9 Emissions Factors Data Quality**

Several respondents also raised concerns related to the data quality of emissions factors. The respondents suggested that the EPA make the emissions factors more defensible both by improving their ratings (e.g., improving “E” and “F” emissions factors to “A” and “B” emissions factors) and by adding more information related to error bounds and standard deviations. Moreover, some respondents would like EPA to caveat data so that users can understand the limitations associated with each emissions factor. Lastly, some respondents would like more background data on emissions factors such as test method information so that users would gain a better understanding of the emissions factors quality.

### **2.2.10 Special Emissions Factors**

Since different regions of the country have different features that may influence emissions such as meteorology, topography, and population density, some respondents expressed a desire to have emissions factors that are tailored to specific regions. They believed that the EPA should develop emissions factors not just for the macroscale (e.g., nationwide) but on the microscale level (e.g., statewide) as well. Also, several respondents suggested creating emissions factors for special events such as start-ups, shutdowns, and malfunctions, which may result in sources emitting large amounts of pollutants.

### **2.3 Conclusions from Stakeholder Interviews and Surveys**

EFPAG drew several conclusions from the this initial investigation effort. First and foremost, AP-42 continues to be a tool upon which many groups and agencies rely heavily in their efforts to develop, implement, and comply with air pollution regulations. Although the emissions factors presented in AP-42 were originally intended for use during the development of regional emissions inventories, stakeholders indicated that they are currently used for many other purposes. The stakeholders identified the following current uses of emissions factors:

- Development of regional emissions inventories.
- Development of site-specific emissions inventories.
- Identifying and evaluating control strategies.
- Determining applicability of permit and regulatory requirements.
- Assessing risks.

There are a number of areas where emissions factors users believe the program can be improved. These areas include:

1. A more open and less cumbersome process needs to be established that allows interested parties to assist in the improvement and development of emissions factors.
2. The format of AP-42 should be updated along with the methods for accessing the factors and associated documentation.
3. Guidance is needed to help users: select the most appropriate factor; understand how to consider uncertainties when using factors; and, gather data to estimate emissions when a factor is not available. Guidance is also needed on applying emissions factors in permitting and enforcement applications.
4. Existing emissions factors should be updated and more factors are needed where gaps currently exist. In many cases, the new factors requested were related to more speciation (particle size for PM, specific chemicals for air toxics and VOC). Attention also needs to be given to the development of regional factors and factors for unique events and circumstances.

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### **3.0 DEVELOPMENT OF PRELIMINARY OPTIONS TO IMPROVE THE EMISSIONS FACTORS PROGRAM**

After reviewing all of the data collected from stakeholders, EFPAG performed an internal assessment of the existing status of the emissions factors program. Subsequently, EFPAG identified the following four program elements as the primary areas where improvements will occur:

1. Assessing and documenting the quality of source tests.
2. Assessing and documenting the quality of emissions factors.
3. Automating components of the emissions factors development and delivery process.
4. Providing guidance regarding the use of emissions factors for purposes other than emissions inventories.

Improvements in these four emissions factors program areas would address the first three recommendations that EFPAG received from stakeholders (see Section 2.3). Although EFPAG understands that many individual emissions factors could be improved, EFPAG decided to expend current, limited resources on programmatic improvements rather than on the improvement of individual emissions factors. As a result, the fourth stakeholder recommendation has not been addressed.

EFPAG developed several options that might be implemented to improve each of the four program areas identified above, and identified and analyzed the advantages and disadvantages of implementing each option. These options were intended to provide a basis for future discussions with the stakeholders; they were not intended to limit the options considered by stakeholders or to predispose stakeholders to make specific recommendations. The options and their advantages and disadvantages are summarized below. Papers that provide additional details regarding the options developed, as well as the advantages and disadvantages of each option are presented in Appendices A through D. These option papers were made available to stakeholders prior to the stakeholder meetings that are described in Section 4 of this document with the intent of allowing meeting attendees to think in broad terms about the future of the emissions factors program. They do not necessarily reflect the current direction of the emissions factors improvement program.

#### **3.1 Assessing and Documenting the Quality of Source Tests**

The ability to assess the overall accuracy, precision, and validity of source test data is a key element in the process of developing reliable emissions factors. Current emissions factors development procedures stipulate that prior to inclusion of emissions factors in AP-42, the reliability of the underlying emissions

test data must be appraised in accordance with the rating system specified in *Procedures for Preparing Emission Factor Documents*. Under this rating system, test data are assigned a rating from A to D, where an “A” rating is assigned to the highest quality data. The existing criteria used to assign a specific data quality rating are summarized in Table 3.1.

**Table 3.1 Existing Source Test Data Rating Criteria**

Rating	Criteria
A	Tests are performed by using an EPA reference test method, or when not applicable, a sound methodology. Tests are reported in enough detail for adequate validation and raw data are provided that can be used to duplicate the emissions results presented in the report.
B	Tests are performed by a generally sound methodology, but lacking enough detail for adequate validation. Data are insufficient to completely duplicate the emissions result presented in the report.
C	Tests are based on an unproven or new methodology, or are lacking a significant amount of background information.
D	Tests are based on a generally unacceptable method, but the method may provide an order-of-magnitude value for the source.

Four specific criteria are identified in *Procedures for Preparing Emissions Factor Documents* for consideration to assist in the assignment of a test data quality rating. These four criteria are:

1. Source operation. If the manner in which the source was operated is well documented in the report and the source was operating within typical parameters during the test, an A rating should be assigned. If the report stated parameters were typical, but lacked detailed information, a B rating should be assigned. If there is reason to believe the operation was not typical, a C or D rating should be assigned.
2. Test methods and sampling procedures. In developing the ratings, the estimated accuracy and precision of the test method as well as the adequacy of the documentation should be considered. In general, if a current EPA reference test method, appropriate for the source, was followed, the rating should be higher (A or B). If other methods were used, an assessment should be made of their validity. If it is judged that the method was likely to be inaccurate or biased, a lower rating (C or D) should be given. A complete report should indicate whether any procedures deviated from standard methods and explain any deviations. If deviations were reported, an evaluation should be made of whether these were likely to influence the test results.
3. Process information. During testing, many variations in the process can occur without warning and sometimes without being noticed. Such variations can induce wide deviations in sampling results. If a large variation between test run results cannot be explained by information contained in the site final test report or from final test reports of other sources, the data are suspect and

should be given a lower rating or excluded. The reviewer should recognize that a process may have naturally occurring highly variable emissions and a lower rating may not be appropriate solely on the basis of wide deviations in sampling results.

4. Analysis and calculations. Ideally, final test reports should contain original raw data sheets and other documentation such as gas parameters (dry cubic feet per minute, oxygen percentage), calculation sheets, or example calculations describing how the calculated emissions results were obtained. If there are data sheets, the nomenclature and equations used should be compared to those specified by EPA to establish equivalency. The depth of review of the calculations should be dictated by the reviewers' confidence in the ability and conscientiousness of the tester, based on such factors as consistency of results and completeness of other areas of the final test report. Reports may indicate that raw data sheets were available, but were not included. If the final test report is of high quality based on the other criteria, the quality rating should not be lowered because of a lack of data sheets.

The following inadequacies were identified with the existing test data rating system:

1. The existing rating system lacks detailed guidance regarding the assignment of ratings; as a result, the rating system is very dependent on the personal judgement of the data reviewer and is highly subjective. While clearly unacceptable data may uniformly receive a D rating, different evaluators may assign test data any of the three higher ratings based upon their assessment of the information presented in the test report.
2. The quality ratings assigned under the existing rating system have little effect on the final reported emissions factors or on the end user's acceptance and use of the emissions factors.
3. The existing rating system does not provide any information regarding the uncertainties of the test results or the uncertainties associated with the process data measured. Consequently, there is not a clear-cut relationship between the ratings assigned and the margin of error that could be expected in applying the data to developing emissions factors.
4. The assignment of ratings under the existing test data rating system is very time consuming. For each pollutant measured, the accurate assignment of a test rating has been estimated to require 4 hours of effort.

EFPAG identified and evaluated six approaches that could be implemented as alternatives to the current test data rating criteria and that would address the deficiencies noted above. Each of these options is described below.

Option 1.1: Rather than assigning an A, B, C, or D rating to test data, designate the test data as either “Applicable” or “Not Applicable” for use in developing emissions factors. Data that were obtained using the appropriate EPA Test Methods or a sound methodology would be rated as applicable and would be used for subsequent emissions factors development efforts. Alternatively, source test data that have been accepted for use by a state/local agency would be rated as applicable. Test data obtained using inappropriate procedures or that were deemed inappropriate for emissions factors development by a state/local agency would be rated not applicable.

The advantages to implementing this option are that this option would simplify the test data rating system, reduce the amount of effort required to rate the test data, and would provide a somewhat more objective rating system by eliminating the fine lines between A, B, and C rated data. The disadvantage of implementing this option is that it would not provide any information regarding the uncertainties of the test results or the uncertainties associated with the process data measured.

Option 1.2: Accept only test data for use in emissions factors development that have been quality assured by an independent third-party reviewer not directly associated with the source testing team. State and local agency staff might fulfill the third-party review requirements as part of their quality assurance evaluations of source test reports. Under this option, detailed quality assessment guidelines would be developed to be followed by the test teams and independent reviewers. Alternatively, source testing firms could become “certified” through the use of qualified individuals such as Professional Engineers, Certified Industrial Hygienists, or similar professionals. Presently, several organizations are working on programs for qualifying individuals who conduct stack testing.

The advantages to implementing this option are that this option would reduce the amount of effort required to rate the test data and would standardize the quality assessment process, thereby decreasing the rating system’s subjectivity. The reduced effort would be achieved by reducing the current duplication of quality assurance efforts by emissions factors developers and test data review agencies. The disadvantages to implementing this option are that it would place an increased burden on state/local agencies or source testing firms (depending upon the alternative selected) and it would not provide any information regarding the uncertainties of the test results or the uncertainties associated with the process data measured. Some of the increased burden would be offset by the development of the standardized test data quality assurance guidelines.

Option 1.3: Continue to use the existing test data rating system, but develop clear-cut guidelines for assigning data quality ratings to the data. Although general guidelines are presented in *Procedures for*

*Preparing Emission Factor Documents*, more specific guidelines to assigning a data quality rating would be developed under this option. Such guidelines would include detailed checklists of items that must be included in a test report in order to assign a specific data quality rating. Through careful selection of the items to be included on the checklist, more weight could be assigned to the more critical items in the testing process.

The advantages to implementing this option are that it would improve consistency among reviewers, provide a more defensible assessment of the accuracy of the results, and reduce the subjectivity of the rating system. The disadvantages to implementing this option are that it would not reduce the amount of effort required to rate the data or provide any information regarding the uncertainties of the test results or the uncertainties associated with the process data measured.

Option 1.4. Revise the existing test data rating system to incorporate an expanded range of quality ratings. The existing categories under which source test data are reviewed (i.e., source operating status, test method and sampling procedures, analysis and calculations, and quality assurance) would be divided into additional subcategories. Each subcategory would be numerically scored based upon the data completeness and accuracy. All subcategory scores would then be summed and a data quality rating would be assigned based upon the overall score.

The advantage to implementing this option is that it would provide a less subjective quality rating system. The disadvantages to implementing this option are that this option would increase the amount of effort required to rate the data and would not provide any information regarding the uncertainties of the test results or the uncertainties associated with the process data measured. Furthermore, a significant amount of effort would be required to set-up and test the scoring system for this option.

Option 1.5: Replace the existing test data rating system with a system that would allow the uncertainties associated with the test data to be quantified. Results from previous studies would be used to quantify the uncertainties of tests that were conducted in accordance with the source test methods. Alternatively, the uncertainties would be developed based upon an analysis of measurement errors, systematic errors, and statistical errors. For source tests that do not fully comply with the conditions of the source test methods, adjustments in the overall uncertainties would be made using information regarding the noncompliant components.

The advantages to implementing this option are that it would provide an objective quality rating system and information regarding the uncertainties of the test results. The disadvantages to implementing this

option are that this option would not reduce the amount of effort required to rate the data or quantify the uncertainties associated with the process data measured, and a significant amount of effort would be required to establish the criteria to quantify the uncertainties associated with specific test data elements.

Option 1.6: Implement Option 1.5 and develop guidelines and standard operating procedures (SOPs) for assessing process and emissions control device operating conditions during source tests. The guidelines would include predicted uncertainties so that uncertainties could be assigned to the process data in a manner similar to that for the emissions data.

The advantage to implementing this option is that this option would quantify the uncertainties associated with the process data measured. The disadvantage to implementing this option is that this option would require a significant amount of effort to establish the criteria to quantify the uncertainties associated with specific process data elements.

### **3.2 Assessing and Documenting the Quality of Emissions Factors**

Under the existing emissions factors development and rating process, five separate tasks are typically conducted to develop and rate an emissions factor. First, test, process, and emissions factor data are identified via literature searches and contacts with EPA, other Federal Agencies, state and local agencies, and industry contacts and trade associations. Second, the desired data are collected. Third, the data are evaluated to determine which data should be used to develop emissions factors. As part of this step, data quality ratings are assigned to the test data, as described in the previous section of this report. Fourth, the emissions factor data are grouped into related clusters and average (arithmetic mean) emissions factors are developed. Fifth and finally, the emissions factors are assigned quality ratings that are dependent upon the number of test data points averaged, the test data quality ratings associated with the data points, and the degree to which the test data appear to be representative of the source category as a whole.

The existing emissions factors quality rating system is documented in Section 4.6.8 of *Procedures for Preparing Emissions Factor Documents* and is presented in Table 3.2. Under the existing system, emissions factors are assigned a rating ranging from “A” to “E” depending upon the emissions factor’s quality. Emissions factors assigned A ratings are perceived to be of higher quality than B-rated factors and so on, with E-rated factors being of the lowest quality.

Although guidance regarding the assignment of an emissions factor rating is provided in the *Procedures* document, the existing rating system is highly subjective in nature. As a result of this inherent

subjectivity, the assignment of emissions factors ratings is dependent upon the engineering judgment of the individual developing the rating. Therefore, an emissions factor rated B by one individual might be rated an A, B, or C by someone else.

**Table 3.2 Existing Emissions Factors Rating System**

Rating	Guidance
A	<b>Excellent.</b> Emissions factor is developed primarily from A- and B-rated source test data taken from many randomly chosen facilities in the industry population. The source category population is sufficiently specific to minimize variability.
B	<b>Above Average.</b> Emissions factor is developed primarily from A and B-rated test data from a moderate number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As with the A rating, the source category population is sufficiently specific to minimize variability.
C	<b>Average.</b> Emissions factor is developed primarily from A-, B, C-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. As with the A rating, the source category population is sufficiently specific to minimize variability.
D	<b>Below Average.</b> Emissions factor is developed primarily from A-, B-, and C-rated test data from a small number of facilities, and there may be reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source population.
E	<b>Poor.</b> Factor is developed for C- and D-rated test data from a very few number of facilities, and there may be reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population.

The following three inadequacies were identified with the existing AP-42 emissions factors development and rating system.

1. The existing process of developing emissions factors for inclusion in AP-42 is labor intensive, time consuming, and expensive. For example, the process of revising an existing AP-42 section to incorporate revised emissions factors for only three pollutants would typically require an effort of approximately 150 hours.
2. The existing emissions factors rating system is largely subjective in nature and does not quantify the accuracy or uncertainty associated with each rating. Therefore, although the accuracy is presumably greater for an A-rated emissions factor than for a B-rated factor, the increase in accuracy cannot be quantified based upon the emissions factors rating. Furthermore, the cut points at which an emissions factor would be upgraded from one rating to another are not clearly defined.
3. The emissions factors presented in AP-42 are typically representative of the arithmetic mean value and do not indicate the uncertainty associated with the values. As a result, the uncertainty of emissions inventories developed with the emissions factors is not available. Furthermore,

there is no means by which to determine where additional effort should be expended to reduce the level of uncertainty in either the emissions factors or emissions inventories developed using these factors.

EFPAG identified and evaluated four approaches that could be implemented as alternatives to the current emissions factors development and rating system and that would address the inadequacies noted above. Each of these options is described below.

Option 2.1. Modify the existing emissions factors rating system to increase its objectivity and consistency of application. Specifically, the subjective elements of the existing emissions factors rating system related to the number of test data points and the test data ratings would be addressed under this option by assigning a numeric value to the test data quality rating associated with each test data point. A numeric score would be calculated for each emissions factor by multiplying the number of test data points used to develop the emissions factor by the corresponding test data rating value. Cut points would be established to define the emissions factors rating associated with a given numeric score.

The advantages of implementing this option are that the option would require little additional effort to implement, would provide a more objective means of assigning an emissions factors rating, and would standardize the system of assigning emissions factors ratings. The disadvantages of implementing this option are that the process of revising an AP-42 section would remain labor intensive, time consuming, and expensive; and the uncertainty associated with emissions factors would remain unquantified.

Option 2.2. Replace the existing emissions factors rating system with a system that would quantify the uncertainty associated with each emissions factor. For statistically valid data sets, the uncertainty would be expressed as a standard deviation, relative standard deviation (i.e., a sample's standard deviation divided by its arithmetic mean), variance, or confidence interval. An average measure of uncertainty would be assigned to data sets that are too small for statistical manipulation. Assuming that no modifications were made to the test data rating system previously described, the uncertainty calculated for each emissions factor would be an indication of the variability between test data points, but would not be an indication of the uncertainty associated with each test data point.

The advantage to implementing this option is that the option would quantify much of the uncertainty associated with each emissions factor. The disadvantages to implementing this option are that the process of revising an AP-42 section would remain labor intensive, time consuming, and expensive; and the uncertainty associated with each test data point would remain unquantified. Furthermore, the calculation

of the uncertainty would require a little more effort than is currently required to calculate just the arithmetic mean value.

Option 2.3. Implement Option 2.2, modify the test data rating system, and automate the data collection process. Under this option, the statistical analyses described under Option 2.2 would be implemented and the current rating system would be eliminated. In addition, test data rating system Option 1.6 (described previously in Section 3.1) and data automation Option B2 or B3 (described below in Section 3.3.2) would be implemented. The implementation of test data rating system Option 1.6 would allow the uncertainty associated with each test data point to be quantified. These data could then be integrated with the inter data point uncertainty (previously described under Option 2.2) to give a complete indication of the uncertainty associated with each emissions factor. The implementation of data automation Option B2 or B3 would allow substantially more data points to be used for the development of emissions factors and for the process to be conducted at a reduced cost.

The advantages to implementing this option are that the option would reduce the time and effort for data collection and test data analysis, and would allow the uncertainty associated with each test data point to be quantified in addition to quantifying the variability between sources. The disadvantages to implementing this option are that the up-front cost to implement test data rating system Option 1.6 and data automation Option B2 or B3 would be substantial and the calculation of the uncertainty would require a little more effort than is currently required to calculate just the arithmetic mean value.

Option 2.4. Implement Option 2.3 and screen the test data prior to use in emissions factors development. Under this option, the statistical analyses described under Option 2.3 would be implemented and the current rating system would be eliminated. In addition, the test data would be screened prior to incorporation into an AP-42 section to eliminate data points with unacceptably large uncertainties. The advantage to implementing this option is that the uncertainty of the resulting emissions factors would be reduced. The disadvantages to implementing this option are that the assignment of a numeric value to the cut point at which data would be eliminated would be subjective and screening the data would require additional effort.

The emissions factors development and rating option selected will determine what information is available for presentation in AP-42 and in the Background Documents. For Option 2.1, the arithmetic mean emissions factors and the existing A through E emissions factors rating would be presented in AP-42. For Options 2.2 through 2.4, the arithmetic mean emissions factors and a standard deviation or

confidence interval would be presented in AP-42. If desired, additional descriptive statistics such as the median, mode, and variance could be provided either in AP-42 or in the Background Documents.

### **3.3 Automating Components of the Emissions Factors Development and Delivery Process**

Numerous organizations including EPA, state, local, and tribal agencies, private industry, and contractors are involved with developing and delivering emissions factors. To date, the following aspects of the emissions factors development process were automated:

1. Source testing contractors typically develop source test protocols and plans in word processing programs for submittal to reviewing agencies prior to initiating testing.
2. Most source test contractors use spreadsheets to automate the manipulation of the source test data gathered.
3. Source test contractors typically transfer data electronically from their spreadsheet to word processing software for the development of source test reports that are subsequently sent to reviewing agencies in either hard copy or Adobe's portable document format (PDF).
4. Reviewing agencies often use spreadsheets to evaluate the quality and accuracy of source test protocols, plans, and reports.
5. Reviewing agencies often use spreadsheet or word processing programs to maintain indices of source tests that have been conducted.
6. Emissions factors are typically calculated using automated methods such as spreadsheets and databases that provide the capability to assess different scenarios for aggregating and segregating the data, as well as for identifying anomalies in the data.
7. EPA's *Compilation of Emissions Factors*, commonly referred to as AP-42, is available in PDF format on EPA's website.
8. Two emissions databases, the Factor Information and Retrieval (FIRE) system and SPECIATE, are available EPA's website. In addition to these databases, EPA's website provides access to several automated tools that are used to calculate emissions factors and/or emissions from specific source categories.
9. Various State agencies also provide mechanisms for retrieving emissions factors from their websites.

While the aspects of the process that are identified above have been automated, the automation has been limited and standardized automation procedures do not exist. As a result, the existing process is inefficient, time consuming, and expensive. In addition, the quality of source test data are often redundantly assessed by the testing contractor, the agency to whom the test data were submitted, and the

organization tasked with calculating an emissions factor. Furthermore, large numbers of source test reports and data are not easily accessible for use in developing emissions factors. Specific inadequacies that have been identified with the existing automation processes include the following:

1. Although eXtensible markup language (XML) may be used in Adobe's PDF software, XML is rarely used when testing contractors develop source test protocols and plans. As a result, the contractors must manually incorporate a reviewing agencies' comments into their test protocols and plans.
2. Because XML is rarely used in test protocols, plans, or reports, reviewing agencies must manually reenter data to evaluate the quality and accuracy of these documents.
3. Many State, local, and Tribal agencies maintain source test protocols, plans, and reports as well as any quality assurance documentation in hard copy or PDF format only. As a result, organizations that desire to develop emissions factors based upon the source test reports often must undergo a labor intensive, time consuming, and expensive process to identify the appropriate source test reports and obtain them.
4. Emissions factors may not be efficiently transferred electronically from AP-42 to spreadsheets for use in air emissions inventory calculations or other analyses. Rather, the factors must be manually entered into the spreadsheets prior to further use.

EFPAG identified four components of the emissions factors development and delivery process that could be improved through the use of automation. These components are:

- A. The preparation of source test plans and the evaluation and delivery of source test data.
- B. The storage and availability of source test data.
- C. The analysis of source test data to develop emissions factors.
- D. The dissemination of emissions factors and related information.

Automating these aspects of the emissions factors development and delivery process would promote a more efficient and comprehensive process and should:

- streamline the process,
- remove redundancies,
- allow additional data to be accessed in a cost effective and timely manner,
- provide standardization,
- capture appropriate process data so that emissions factors may be calculated,
- allow the subjective quality assessment of source test data and emissions factors ratings to be replaced with quantitative methods that characterize the data in statistical terms of precision and variation,

- improve the robustness of existing emissions factors,
- allow for the development and continuous refinement of emissions factors with current data.

EFPAG identified and evaluated three levels of automation (“low,” “intermediate,” and “high”) that could be implemented to improve each of the four components of the emissions factors development and delivery process that are identified above. Each of these options is described below.

### **3.3.1 Component A - Source Test Planning, Evaluation, and Delivery**

Option A1 (Low Automation). No changes from present procedures would be implemented. Source testers would typically submit data to review agencies in hard copy or PDF format. After extracting data manually from source test documents, reviewing agencies would evaluate the data using manual methods or automated tools.

Option A2 (Intermediate Automation). Standardized formats and data elements would be defined for source test reports. Source testers would typically submit data to review agencies in word processor and/or spreadsheet (i.e., electronic) format, but the data might not be in a data rich environment (e.g., XML, HTML, etc.). After extracting data electronically from source test documents, reviewing agencies would evaluate the data using automated tools.

Option A3 (High Automation). Standardized formats and data elements would be defined for source test protocols, test reports, and quality assurance forms. Source testers would typically submit data to reviewing agencies in a data rich environment (e.g., XML, HTML, etc.). Reviewing agencies would evaluate source test documents using automated tools.

The advantages to implementing Option A2 are that this option would reduce the amount of time spent by personnel performing manual data entry, reduce recurring costs for the completion of this component, and make the data much more useful for Components C and D. The additional advantage to implementing Option A3 is that this option would reduce data entry errors by dramatically reducing the amount of redundant data entry. The disadvantage of implementing either Option A2 or A3 is the cost associated with the development of the options, with Option A3 being more expensive than option A2.

### **3.3.2 Component B - Storage and Availability of Source Test Data**

Option B1 (Low Automation). Source testing documents would be collected from State, local, and Tribal agencies by EPA or EPA-sponsored contractor personnel on a regular basis. The documents would be scanned and stored on CD ROMS or on a web server for public access.

Option B2 (Intermediate Automation). EPA would receive source test data from State, local, and Tribal agencies in electronic format. EPA would request State and local agencies to provide specific file format or the file contents, or data that meets specific criteria.

Option B3 (High Automation). Source testing documents (test protocols, test reports, and quality assurance forms) would be stored on State, local, and Tribal agencies' public servers. Depending on the format and storage method, differing levels of effort would be required to obtain the data. Data mining software could be used to search the web for publicly available data.

The advantages to implementing Option B1 are that this option would provide a substantial amount of data that could subsequently be used to develop emissions factors and would be inexpensive to implement. However, this option would have high recurring costs and would be very time consuming and labor intensive. Furthermore, it is questionable whether EPA would be able to collect all of the necessary data from State and local agencies.

The advantages to implementing Options B2 and B3 are that these options would provide a substantial amount of data that could subsequently be used to develop emissions factors, allow EPA to obtain more current source test reports and associated information than Option B1, and reduce recurring costs and efforts compared to Option B1. The implementation of Option B3 could also allow users other than EPA to have access to current source test data from numerous states, thereby allowing them to develop their own emissions factors. The disadvantage to implementing Options B2 or B3 is the cost associated with the development of the options, with Option B3 being more expensive than option B2. Furthermore, implementing Options B2 or B3 would probably preclude the EPA from receiving historical source test reports as it is doubtful that State and local agencies would have the resources to transfer them to an electronic format.

### **3.3.3 Component C - Analysis of Source Test Data for Emissions Factors Development**

Option C1 (Low Automation). EPA would use optical character recognition technology to capture applicable portions of the source test report and State/local agency source test assessment. Factor development would still entail manual labor to pool/aggregate data and generate factors for each broad category of process/control/pollutant. Alternatively, if set rules could be developed for pooling or aggregating data, this task could be automated.

Option C2 (Intermediate Automation). EPA would receive data in formats precluding the use of optical character recognition. Factor development would still entail manual labor to pool/aggregate data and generate factors for each broad category of process/control/pollutant. Alternatively, if set rules could be developed for pooling or aggregating data, this task could be automated.

Option C3 (High Automation). Data rich text would be captured and used for the emissions factors development process. Factor development would still entail manual labor to pool/aggregate data and generate factors for each broad category of process/control/pollutant. Alternatively, if set rules could be developed for pooling or aggregating data, this task could be automated.

The Component C option selected for implementation would be highly dependent upon the options selected for Components A and B. For example, using low levels of automation for either of these components would entail the use of optical character recognition software to scan in applicable portions of the source test report and related information to translate the process, control, emissions, and quality assessment of the source test.

The advantages to implementing Option C1 are that this option would provide a substantial amount of data that could subsequently be used to develop emissions factors and would be inexpensive to implement. However, this option would have high recurring costs and would be very time consuming and labor intensive. Furthermore, it is questionable whether EPA would be able to collect all of the necessary data from State and local agencies.

The advantages to implementing Options C2 and C3 are that these options would provide a substantial amount of data that could subsequently be used to develop emissions factors and would dramatically reduce recurring costs and efforts compared to Option C1. The disadvantage to implementing Options C2 or C3 is the cost associated with the development of the options, with Option C3 being more expensive than option C2.

### **3.3.4 Component D - Dissemination of Emissions Factors and Related Information**

Option D1 (Low Automation). No changes from present procedures would be implemented. The current methodologies used to disseminate emissions factors (e.g., AP-42, FIRE, SPECIATE) would be retained.

Option D2 (Intermediate Automation). Emissions factors and related information would be made available through an automated system similar to those used by stock trading and information web sites. However, the ability to customize emissions factors to meet an end user's specific needs would not be provided.

Option D3 (High Automation). Emissions factors would be made available using an automated system similar to those used by stock trading and information web sites. The system would be developed so that the end user could tailor emissions factors to meet their specific needs (i.e., reflect criteria such as the age of the equipment tested, the size of equipment tested, the quality assessment values associated with the source test reports, the dates the tests were conducted, and the regional locations of the sources).

EPA currently makes databases and programs available over the Internet that deliver and calculate emissions factors. This system, albeit functional, can be very cumbersome. For example, individual databases and programs have to be downloaded in order to obtain emissions factors. In some instances, it has been shown that these programs can be configured or altered to run over the Internet. For example, Michigan's MAERS, and CARB's CATEF databases can be queried online. It is highly unlikely that programs that require input files (e.g., MOBILE6) could be configured to run over a web server.

The advantages to implementing Options D2 and D3 are that these options would improve the dissemination of emissions factors to users and, for Option D3, provide customized emissions factors to meet a user's specific needs. The disadvantage to implementing Options D2 or D3 is the cost associated with the development of the options, with Option D3 being more expensive than option D2.

### **3.4 Providing Guidance Regarding the Use of Emissions Factors for Purposes Other than Emissions Inventories**

The emissions factors presented in AP-42 were originally developed to enable the preparation of area-wide air emissions inventories. Since its original publication in 1972, AP-42 has grown from a limited number of source categories and a small number of pollutants to a resource containing over 200 major

source categories that include criteria and toxic air pollutant emissions factors. It is the most complete referenced source of air emissions factors within the United States.

Because AP-42 emissions factors were developed to represent source category averages, their use to calculate emissions for a specific facility may result in significant errors for that facility. As stated in the AP-42 introduction, “Use of these factors as source-specific permit limits and/or as emission regulation compliance determinations is not recommended by EPA.” In spite of this warning, the application of emissions factors has expanded through the years because emissions factors are widely accepted by federal, state, local, and tribal agencies as well as industry as robust and cost-effective tools for emissions estimation. Some of the current emissions factors uses include:

- Area-wide (national, regional, state, county, and local) emissions inventories.
- Facility emissions inventories.
- Estimation of excess emissions that result from permit violations.
- Consent decree emissions reduction estimates.
- Compliance determinations and demonstrations with regulatory or permit requirements.
- Regulatory applicability determinations.
- Emissions trading and banking.
- Basis for emissions modeling.
- PSD netting analyses.
- Emissions calculations conducted in support of NSR analyses.
- Plant wide applicability limitations.
- Best Available Control Technology (BACT) analyses.
- Best Available Retrofit Technology (BART) analyses.
- PSD appeals.
- Health risk and health hazard assessments.

In addition to their other uses, emissions factors, and AP-42 in particular, are cited numerous times in Federal regulations. For example, the Code of Federal Regulations cites AP-42 in eight different parts within Title 40. Following the requirements in the regulations, users are directed to use the factors for purposes for which they were not originally intended or developed. Thirty-two states have followed the EPA’s lead and included AP-42 references in their state regulations. The main areas in the state regulations where AP-42 is cited include definitions, air controls, emissions banking, open burning, conformity analysis, tanks, landfills, non attainment, NSR, permitting, stationary sources, and individual pollutants.

It is apparent that AP-42 emissions factors are currently being used for purposes for which they were not originally intended. While some of the current uses may be reasonable, others may result in a poor representation of actual emissions. Although alternatives to using AP-42 emissions factors to calculate emissions (e.g., conservative mass balances, performance testing, continuous emissions monitoring) are available, it appears unreasonable to assume that the use of AP-42 emissions factors for purposes other than area-wide emissions inventories will be discontinued in the near future.

As a result, EFPAG identified and evaluated three options that could be implemented to guide the use of emissions factors for non-emissions inventory purposes and each of these options is described below. The three options are intended to be a starting point for discussing modifications regarding the uses of AP-42 emissions factors. These options will be reviewed with federal, state, local, and tribal agencies, as well as with industry to establish a consensus for improving how emissions factors are used. It is understood that incorporating input from such end users is critical because EPA must depend on the users to implement any changes developed as a result of this task.

Option 4.1. Define the manner in which emissions factors may be used based upon the existing emissions factors rating system. For this option, EFPAG assumed that the existing emissions factors rating system and existing AP-42 emissions factors would not be modified. Guidance regarding the use of emissions factors would be developed based upon the rating associated with each emissions factor. Cut points would be defined below which an emissions factor would not be recommended for use in a particular application. For example, it could be recommended that only emissions factors with ratings of B or better be used to establish permit limitations. If an emissions factor rating was insufficient for use in a given application, the guidance would suggest that alternate means (e.g., conducting a source test) be employed to better quantify the emissions.

The advantages to implementing Option 4.1 are that it is very simplistic and could be implemented regardless of whether any of the options related to the improvement of the assessment and documentation of source tests or emissions factors, or the automation of emissions factors development and distribution process are implemented. The disadvantages of implementing Option 4.1 are that the establishment of cut points for each application would be highly subjective and, likely, highly contentious. In addition, this option would not address the underlying concern that average emissions factors from AP-42 are being used in applications where it might be more appropriate to use a maximum or minimum emissions factor. Furthermore, it is questionable whether the guidance developed in accordance with Option 4.1 would be implemented by state, local, or tribal agencies.

Option 4.2. Arbitrarily adjust emissions factors for use in specific applications. There are many instances wherein it would be more appropriate to use a maximum or minimum emissions factor rather than an average emissions factor as currently published in AP-42. However, AP-42 provides limited information regarding the uncertainty or range of values that might be applicable for a given emissions factor. Under Option 4.2, an approximate maximum and minimum value for each emissions factor would be estimated by multiplying or dividing the existing emissions factor by a somewhat arbitrary value. For example, the maximum value could be estimated by multiplying the average value by a factor of 3 while the minimum value could be estimated by dividing the average value by a factor of 2. Guidance would be developed regarding the appropriate (average, maximum, or minimum) emissions factors to use for a given application. If a user was unsatisfied with the use of the maximum or minimum value for a given application, the guidance would suggest that alternate means (e.g., conducting a source test or obtaining an emissions factor from source tests at a similar facility) be employed to better quantify the emissions.

The advantages to implementing Option 4.2 are the same as for Option 4.1; that is, the option is very simplistic and could be implemented regardless of whether the other emissions factors program improvements are implemented. Furthermore, Option 4.2 addresses the use of an average emissions factor in applications where it might be more appropriate to use a maximum or minimum emissions factor. The disadvantages of implementing Option 4.2 are that the establishment of arbitrary factors for the estimation of maximum and minimum emissions factors would be subjective and, likely, contentious. Furthermore, if the guidance recommended using a maximum emissions factor rather than an average emissions factor, it could have significant ramifications with regard to regulatory applicability determinations, compliance determinations, and permitting requirements, and would therefore be contentious.

Option 4.3. Adjust emissions factors for use in specific applications using statistical data. This option is similar in nature to Option 4.2. However, rather than using somewhat arbitrary means to estimate maximum and minimum emissions factors values, upper and lower emissions factors values would be established using statistical techniques. For example, the upper and lower bounds would be established based upon an emissions factor's standard deviation, relative standard deviation, or variance. Such methods would recommend a confidence interval (e.g., 95 percent) that would be dependent on the intended use of the factor. As with Option 4.2, if a user was unsatisfied with the use of the upper or lower value for a given application, the guidance would suggest that alternate means be employed to estimate the emissions.

The advantage to implementing Option 4.3 is that it addresses the use of an average emissions factor in applications where it might be more appropriate to use a maximum or minimum emissions factor. In addition, Option 4.3 addresses many of the concerns raised by Option 4.2 regarding the arbitrariness of the development of the upper and lower bounds for each emissions factor. The disadvantage of implementing Option 4.3 is that in order to provide the statistical data necessary to define the upper and lower bounds, it would be necessary to implement Option 2.2, 2.3, or 2.4 described in Section 3.2 of this document. Implementing these options may require a large capital investment and significant effort. A second disadvantage associated with Option 4.3 is that the development of a confidence interval to define the upper and lower bounds would be somewhat subjective. To ensure the process is more objective, the same confidence interval would need to be applied to the emissions factors by the various users. Finally, implementation of this option could lead to the same contentions regarding regulatory applicability determinations, compliance determinations, and permitting requirements as Option 4.2.

A summary of all of the options that EFPAG developed to improve each of the four program areas is presented in Table 3.3. As previously stated, these options were intended to provide a basis for future discussions with the stakeholders; they were not intended to limit the options considered by stakeholders or to predispose stakeholders to make specific recommendations.

**Table 3.3 Summary of Options Developed to Improve the Emissions Factors Program**

<b>Option</b>	<b>Description</b>
<b>Assessing and Documenting the Quality of Source Tests</b>	
1.1	Eliminate existing test data rating system and designate test data as applicable or not applicable
1.2	Accept only test data for use in emissions factors development that have been quality assured by an independent third party reviewer not directly associated with the source testing team.
1.3	Continue to use the existing test data rating system, but develop clear-cut guidelines for assigning data quality ratings to the data.
1.4	Revise the existing test data rating system to incorporate an expanded range of quality ratings.
1.5	Replace the existing test data rating system with a system that would allow the uncertainties associated with the test data to be quantified.
1.6	Implement Option 1.5 and develop guidelines and SOPs for assessing process and emissions control device operating conditions during source tests.
<b>Assessing and Documenting the Quality of Emissions Factors</b>	
2.1	Modify the existing emissions factors rating system to increase its objectivity and consistency of application.
2.2	Replace the existing emissions factors rating system with a system that would quantify the uncertainty associated with each emissions factor.

**Table 3.3 - concluded**

Option	Description
2.3	Implement Options 1.6 and 2.2 and automate the data collection process as described in Option B2 or B3.
2.4	Implement Option 2.3 and screen the data prior to use in emissions factors development.
<b>Automating Components of the Emissions Factors Development and Delivery Process</b>	
Component A - Source Test Planning, Evaluation, and Delivery	
A1	No changes from present procedures would be implemented.
A2	Standardized formats and data elements would be defined for source test reports.
A3	Standardized formats and data elements would be defined for source test protocols, test reports, and quality assurance forms.
Component B - Storage and Availability of Source Test Data	
B1	Source testing documents would be collected from State, local, and Tribal agencies by EPA or EPA-sponsored contractor personnel on a regular basis.
B2	EPA would receive source test data from State, local, and Tribal agencies in electronic format.
B3	Source testing documents (test protocols, test reports, and quality assurance forms) would be stored on State, local, and Tribal agencies' public servers.
Component C - Analysis of Source Test Data for Emissions Factors Development	
C1	EPA would use optical character recognition technology to capture applicable portions of the source test report and State/local/Tribal agency source test assessment.
C2	EPA would receive data in formats precluding the use of optical character recognition.
C3	Data rich text would be captured and used for the emissions factors development process.
Component D - Dissemination of Emissions Factors and Related Information	
D1	No changes from present procedures would be implemented.
D2	Emissions factors and related information would be made available through an automated system similar to those used by stock trading and information web sites. However, the ability to customize emissions factors to meet an end user's specific needs would not be provided.
D3	Emissions factors and related information would be made available through an automated system similar to those used by stock trading and information web sites. The system would be designed so that the end user could tailor emissions factors to meet their specific needs.
<b>Providing Guidance Regarding the Use of Emissions Factors for Purposes Other than Emissions Inventories</b>	
4.1	Define the manner in which emissions factors may be used based upon the existing emissions factors rating system.
4.2	Arbitrarily adjust emissions factors for use in specific applications.
4.3	Adjust emissions factors for use in specific applications using statistical data.

#### **4.0 PROGRAM IMPROVEMENT OPTIONS DISCUSSED AT STAKEHOLDER WORKSHOPS**

EFPAG held four workshops over the summer and fall of 2004 to further engage stakeholders and identify the critical activities necessary for improving the emissions factors program. In preparation for the workshops, papers discussing the options described in Section 3.0 of this document were made available to prospective stakeholders. As previously stated, these options were intended to provide a basis for discussions with the stakeholders; they were not intended to restrict the options proposed by the stakeholders.

EFPAG endeavored to solicit stakeholders from the entire range of emissions factors users to attend the workshops, while simultaneously focusing the discussions during each workshop. Attendees at the first workshop primarily included EPA, State/local agency, regional planning organization, and industry personnel involved with the development of area-wide emissions inventories. The second and third workshops involved a broad range of emissions factors users from EPA, State/local agencies, trade organizations, and industry. Attendance at the fourth workshop was limited to personnel from EPA offices and regions.

As part of the workshop sign up process, stakeholders were requested to select the topics that they wished to discuss during the workshops. The list of topics provided to the stakeholders included the following:

1. What changes to the emissions factors development protocol are needed to maximize the amount of data available for emissions factors development and insure the factors and data are acceptable to all stakeholders?
2. What criteria would you impose in assessing emissions data (e.g., compliance test reports) and how would you report the data quality in a process for establishing and publishing emissions factors?
3. What application guidance would you impose to ensure adequate consideration of emissions factors data quality issues (e.g., higher uncertainty in some emissions factors data has little effect on the resulting inventory but may have significant compliance implications when applied in a permit)?
4. What tools or changes to the emissions factors program would improve the effectiveness of the non-emissions inventory programs and the consistency among these programs?
5. What should be done in the emissions factors program to address perceived differences in emissions due to differences in feed material, climate, control measures, and other process parameters?

6. How should information on emissions factors uncertainty and the variability of source emissions be accommodated when used in inventory and non inventory programs?
7. We envisage an emissions factors' development process where the source testing data are collected and submitted electronically; first to the state or local program for their normal review, and then to EPA for updating AP-42. Under what conditions could this be accomplished? What EPA and non EPA actions are needed to produce this situation?
8. Although emissions factors represent an average, they are used for many programs (emissions limitations, PTE determinations, compliance assessments, fee calculations, penalty calculations, etc.) where other values may be more appropriate. What information and guidance is required to develop and support the use of these more appropriate values? What would be needed to achieve some congruity between the different emissions values?
9. Factor-based emissions estimates are use in some trading programs. What emissions factors information and guidance would be necessary to allow for trading across broader situations and accommodate potential differences between actual emissions and an emissions estimate based upon emissions factors information?

EFPAG tallied results from the stakeholders and identified four topics for detailed discussion at each workshop.

During each workshop, EFPAG provided participants with background information regarding the emissions factors program, program status, results from the initial stakeholder interviews and surveys, and current and proposed emissions factors development activities. Following these presentations, the stakeholders broke into between three and five groups to discuss the topics previously chosen for the workshop and to develop recommendations. At the conclusion of each workshop, the workgroups briefed all workshop participants on the focus of their discussions as well as their recommendations.

Each of the workshops is described in more detail in the following sections. Additional information regarding the workshops is presented in Appendices E through H.

#### **4.1 Stakeholder Workshop Number 1**

The first stakeholders' workshop was held on June 8, 2004, at the Hilton Clearwater Beach Resort, Clearwater, Florida. Its stated purpose was to assess challenges facing the emissions factors program over the next 3 to 5 years and to develop action items that maintain attendees' involvement in the future of the program. Approximately 75 people attended the workshop. The attendees included personnel from EPA,

State governments, foreign governments, regional planning organizations, universities, trade organizations, industry, and consulting firms. The majority of the attendees were involved with the development of area-wide emissions inventories.

Following EFPAG's background information presentations, the attendees broke into five groups of approximately equal size. A facilitator and recorder were assigned to each group. Each group was assigned one of the following discussion topics:

1. Tools, rules, and guidance for non-inventory applications.
2. Establishing, understanding, and using emissions factors data quality information.
3. Test report assessment and reporting for developing emissions factors.
4. Tapping into industry-sponsored emissions testing to build emissions factors databases.
5. Authority for approving and criteria for using emissions factors.

Approximately 1½ hours were devoted to group discussions. At the conclusion of the individual break out sessions, each group presented all of the attendees with a summary of the topic discussed, issues identified, and at least one proposal to improve management of emissions factors in the area discussed. The key points and proposals made by each group are discussed below.

#### **4.1.1 Topic 1: Tools, Rules, and Guidance for Non-Inventory Applications**

The group discussion focused on three areas: a description of non-inventory applications of emissions factors, tools and guidance that should be developed, and the need for additional emissions factors data. The group recommended that guidance be developed regarding the use of speciation profiles and the estimation of uncertainty. The group also recommended that emissions factors confidence limits be developed and limits on the use of emissions factors be defined. Furthermore, the group recommended that incentives be developed to encourage industry to conduct source tests to quantify emissions uncertainty.

The group developed one proposal: Develop metadata for each emissions factor to evaluate its applicability for non-emissions inventory applications. EPA will take the lead in establishing a template for the meta data. The metadata will include information that can be used to evaluate the uncertainty associated with each emissions factor.

#### **4.1.2 Topic 2: Establishing, Understanding, and Using Emissions Factors Data Quality Information**

The group discussion focused on the need to develop uncertainty data to better evaluate emissions factors quality. Recommendations from the group included: establish a database to serve as a community pool of information and allow for information exchange, develop an electronic system to capture process-specific and QA data, define a template/criteria for emissions factors data quality, and establish international collaboration regarding emissions factors development activities and source category compatibility.

The group made one proposal: EPA should solicit experts to establish an emissions factor QA workgroup. The workgroup would define QA criteria for uncertainty (e.g., ranking of criteria, relevance by source). The workgroup would also define requirements and user needs for an electronic cataloging (database) system.

#### **4.1.3 Topic 3: Test Report Assessment and Reporting for Developing Emissions Factors**

The group discussion focused on the need to streamline and standardize the test report assessment and reporting process. Specific tasks would include developing minimum requirement checklists for test reports, establishing a web-based clearinghouse of test reports and assessments that have been conducted, prioritizing emissions factors for update, and conducting a public relations effort to educate people regarding the existence of the clearinghouse and to convince them to place data in it. The group also recommended that incentives be established in association with the public relations campaign, that the uncertainty associated with each emissions factor be quantified, and that minimum data requirements be defined.

The group made two proposals: (1) EPA, in collaboration with stakeholders, will map out a process to develop guidance documents for test report assessment and reporting, including guidance for streamlining the process, checklists of minimum requirements, and standardization. (2) EPA will lead an effort to develop an electronic clearinghouse of test data reports to make data available to all interested parties. The clearinghouse should be easy to enter and access data, include data quality ratings, include an indicator regarding the use of test reports, contain clear contact information, and replace paper files. A public relations effort and incentives will need to be developed to encourage people to enter test reports into the clearinghouse.

#### **4.1.4 Topic 4: Tapping into Industry-Sponsored Emissions Testing to Build Emissions Factors Databases**

The group discussion focused on four primary issues: barriers to industry-sponsored emissions testing, development of an administrative process to manage the development of the emissions factors, communication amongst stakeholders, and the development of incentives. Barriers to industry-sponsored emissions testing include the availability of resources to develop/review emissions factors, fear that the results will affect compliance status, and lack of trust between stakeholders. Administrative process issues include defining and establishing an organizational structure, developing protocols and performing QA/QC, standardizing test methods, and streamlining the review and publication of emissions factors. Communication issues include encouraging participation by all stakeholders, establishing trust between stakeholders, managing perceptions, and establishing a web-based reporting system. Incentives to industry-sponsored emissions testing include encouraging/acknowledging industry involvement, providing amnesty, and reducing compliance and annual testing requirements.

The group made one proposal: Establish a task force of stakeholders (EPA, State, local, and Tribal organizations, Regional Planning Organizations, STAPPA/ALAPCO, environmental organizations, trade associations, and industry) to:

- Create an administrative structure/process that will govern the development of an emissions factor database, establish QA/QC procedures and protocols, coordinate the development of new test methods, and streamline key processes.
- Improve communication and establish trust between stakeholders, allow open participation by all stakeholders, identify priorities, and manage perceptions.
- Develop incentives for industry to participate in the program.

#### **4.1.5 Topic 5: Authority for Approving and Criteria for Using Emissions Factors**

The group discussion focused on two primary points: the authority for approving emissions factors for use, and criteria for accepting and using emissions factors. The group recommended that a Federal Advisory Committee Act (FACA) committee be established to develop criteria to rate emissions factors and approve and authorize the emissions factors for specific uses. In addition, the group recommended that a data format be established that would allow initial and continual improvement of the emissions factors. Finally, the group recommended that a consistent protocol for the development of emissions factors be developed to ensure that the emissions factors reflect current technology and practices and that all appropriate criteria are included to allow for electronic data management.

The group made one proposal: Establish a FACA-like process to frame guiding principles for the emissions factors development process. The desired outcome of such a process would be the establishment of peer review practices, criteria for using emissions factors, and community/expert involvement that would lead to the acceptability/legitimacy of emissions factors.

## **4.2 Stakeholder Workshop Number 2**

The second stakeholders' workshop was held on August 25, 2004, in conference room 1153 of the EPA East building, Washington, D.C. Its stated purpose was to assess challenges facing the emissions factors program over the next 3 to 5 years and to develop action items that maintain attendees' involvement in the future of the program. Forty-two people attended the workshop. The attendees included personnel from EPA, state governments, local and county governments, non-profit organizations, trade organizations, industry, and consulting firms. Unlike at the first workshop, the attendees at this workshop included stakeholders that apply emissions factors for a broad range of uses other than area-wide emissions inventories.

Following EFPAG's background information presentations, the attendees broke into three groups of approximately equal size. A facilitator and recorder were assigned to each group. Each group was assigned one of the following discussion topics:

1. Information Transfer and Sharing.
2. Emissions Factors Data Uncertainty.
3. Non-Inventory Applications of Emissions Factors.

Approximately three hours were devoted to group discussions. At the conclusion of the individual break out sessions, each group presented all of the attendees with a summary of the topic discussed, issues identified, and at least one proposal to improve management of emissions factors in the area discussed. Each attendee was then allowed to vote on the proposals to determine which proposals were most important to the group as a whole. The key points and proposals made by each group are discussed below as are the vote tallies.

### **4.2.1 Topic 1: Information Transfer and Sharing**

The group discussion focused on the need to develop criteria for incorporating emissions tests performed under other programs in the development of emissions factors. For example, a mechanism needs to be developed for evaluating industry tests and using them to support emissions factors development. To

accomplish this goal, the group concluded that baseline criteria or requirements for information transfer and sharing and for accepting outside data in the development of emissions factors need to be developed. In addition, a mechanism to audit QA/QC process information from emissions tests would need to be established to ensure that data incorporated into emissions factors development meets EPA quality standards.

The group made three proposals:

Proposal 1A: Establish, through stakeholder collaboration, baseline criteria and protocols for developing emissions factors and for accepting and applying test data to factor development.

Proposal 1B: Develop, through stakeholder collaboration, standard operating procedures for test data auditing, conducting QA/QC, and completing the certification process.

Proposal 1C: Develop a certification process to ensure the validity and veracity of test data.

#### **4.2.2 Topic 2: Emissions Factors Data Uncertainty**

The group discussion focused on the need to develop a standardized evaluation process for emissions factors. In addition, the group concluded that a standardized depository of emissions factors information would improve access to basic data as well as to summary data. Finally, the group concluded that basic data should be distilled for wider use.

The group made one proposal:

Proposal 2: Establish a collaborative group to develop standard protocols for data generation and collection, data evaluation, a data depository, and use of emissions factors data.

#### **4.2.3 Topic 3: Non-Inventory Applications of Emissions Factors**

The group's discussions focused on four issues: the inappropriate use of emissions factors, acquisition of existing emissions data, the format of available emissions data, and the desire for emissions factors of better quality. They felt that more data, particularly uncertainty data, should be collected and reported with emissions factors.

The group made one proposal:

Proposal 3: Collect better data in a specified/standard format in an electronic format. Data should include more than simply an emissions factor and should include sufficient detail to be correctly applied to activities other than an air emissions inventory.

#### 4.2.4 Prioritization of Proposals by Workshop Attendees

At the conclusion of the individual break out sessions, each attendee was allowed to vote on the proposals to determine which proposals were most important to the group as a whole. The vote tallies are summarized in Table 4.1 and indicate that the collection and management of the data used to develop emissions factors is of great importance to stakeholders. The consensus appears to be that EFPAG should take advantage of the many emissions tests conducted for other programs or for state agencies and should incorporate this data in emissions factors development. In order to ensure that the emissions tests used are appropriate, the stakeholders recommended that EFPAG establish protocols by which the data should be collected and QA/QC procedures for its approval before being incorporated into emissions factors development.

**Table 4.1 Prioritization of Proposals by Second Workshop Attendees**

Proposal Number	Number of Votes
1A	20
1B	5
1C	3
2	26
3	10

#### 4.3 Stakeholder Workshop Number 3

The third stakeholders' workshop was held on August 26, 2004, in conference room 1153 of the EPA East building, Washington, D.C. Its stated purpose was to assess challenges facing the emissions factors program over the next 3 to 5 years and to develop action items that maintain attendees' involvement in the future of the program. Thirty-three people attended the workshop. The attendees included personnel from EPA, state governments and local agencies, trade organizations, industry, consulting firms, and universities. As at the second workshop, the attendees at this workshop included stakeholders that apply emissions factors for a broad range of uses other than area-wide emissions inventories.

Following EFPAG's background information presentations, the attendees broke into three groups of approximately equal size. A facilitator and recorder were assigned to each group. Each group was assigned one of the following discussion topics:

1. Information Transfer and Sharing.
2. Emissions Factors Data Uncertainty.
3. Non-Inventory Applications of Emissions Factors.

Approximately three hours were devoted to group discussions. At the conclusion of the individual break out sessions, each group presented all of the attendees with a summary of the topic discussed, issues identified, and at least one proposal to improve management of emissions factors in the area discussed. Each attendee was then allowed to vote on the proposals to determine which proposals were most important to the group as a whole. The key points and proposals made by each group are discussed below as are the vote tallies.

#### **4.3.1 Topic 1: Information Transfer and Sharing**

The group discussion focused on the need to develop a standardized methodology for collecting and reporting emissions factors data. The group felt that this could be best accomplished by a centralized emissions factors authority, and that this authority should develop a standardized electronic format for test reports, including a template for stack sampling. The authority should also develop and manage mechanisms for approval and certification of testers and test data, develop a clearing house for source test data, and organize the clearing house so that it can be searched by SCC or SIC. It was also recommended that the authority develop a strategy for outreach to small business and ensure that training is available to small businesses.

The group made two proposals:

Proposal 1A: With stakeholder collaboration, develop a data model and interface to standardize certifiable electronic reporting and submittal formats.

Proposal 1B: Make the development and use of emissions factors small business friendly. Identify small business needs and develop training and outreach to ensure that small businesses are awareness of emissions factors and their applicability.

### **4.3.2 Topic 2: Emissions Factors Data Uncertainty**

The group discussion focused on the need to evaluate and improve the emissions factors development process and to incorporate uncertainty data into emissions factors development. The recommended actions included standardization of the process of collecting and reporting uncertainty data, acquisition of uncertainty data relative to emissions factors, and the incorporation of accuracy and precision in published emissions factors. These actions would be supported by performing outreach to stakeholders and by studying the effect of emissions factors uncertainty on compliance.

The group made one proposal:

Proposal 2: Collaboratively standardize the emissions factors development process by: defining uses of emissions factors, establishing quality-affecting standards for data collection, and collecting additional information associated with tests to ensure that the data collected are of sufficient quality. Also establish outreach programs and ensure that emissions factors will meet the needs of stakeholders.

### **4.3.3 Topic 3: Non-Inventory Applications of Emissions Factors**

The group discussion focused on the need to streamline the process of updating emissions factors and the need to develop better characterization of uncertainty in emissions factors. Additionally it was recommended that the algorithm used to estimate road dust emissions for both paved and unpaved roads be revised.

The group made two proposals:

Proposal 3A: Streamline the emissions factors development process by: involving partners who are willing to commit resources, developing objective criteria for emissions factors rating tests, developing a standard testing protocol, and forming a group to certify tests.

Proposal 3B: Reduce the uncertainty in emissions factors by: using only A or B rated test data in emissions factors development, providing both a range and a median value for emissions factors, establishing criteria for quantifying uncertainty, and explaining uncertainty in AP-42.

#### 4.3.4 Prioritization of Proposals by Workshop Attendees

At the conclusion of the individual break out sessions, each attendee was allowed to vote on the proposals to determine which proposals were most important to the group as a whole. The vote tallies are summarized in Table 4.2 and indicate that the stakeholders found it most important that a standardized electronic submittal format for emissions factors be developed. They stated that a standardized data model and interface should be developed by collaboration between EPA and stakeholders. This would ensure that EPA can collect and use data more efficiently and that stakeholders would gain the maximum benefit from their contributions. Stakeholders also stated that the development and use of emissions factors should not harm small businesses. For this reason, they recommended that EPA continue to explore ways to make the program small business-friendly.

**Table 4.2 Prioritization of Proposals by Third Workshop Attendees**

Proposal Number	Number of Votes
1A	23
1B	18
2	13
3A	8
3B	14

#### 4.4 Stakeholder Workshop Number 4

The fourth stakeholders' workshop was held on November 8, 2004, in conference room C111 of the EPA campus in Research Triangle Park, NC. Its stated purpose was to acquire input from EPA staff on improvements to be made to the emissions factors program over the next 3 to 5 years. Forty-six people attended the workshop. The attendees included EPA personnel from OAQPS, the Office of Research and Development (ORD), and the Toxics Release Program.

Following EFPAG's background information presentations, the attendees broke into three groups of approximately equal size. A facilitator and recorder were assigned to each group. Each group was assigned one of the following discussion topics:

1. Standardize and streamline the emissions data collection and reporting process for emissions factors.
2. Establish procedures for defining data uncertainty in reporting and using emissions factors, for inventory and non-inventory applications.

3. Establish an outreach program to improve the understanding and application of emissions factors and other emissions quantification tools.

Approximately three hours were devoted to group discussions. Once the breakout sessions concluded, each group presented a summary of the discussion, topics of most concern, and recommendations to the entire group. The key points and proposals made by each group are discussed below.

#### **4.4.1 Topic 1: Standardize and Streamline the Emissions Data Collection and Reporting Process for Emissions Factors**

This group's discussion focused on the procedures and mechanisms required to tap into industry-conducted emissions testing. Specific topics addressed included developing the content for standardized test reports, developing a review process, and developing a model and interface for electronic emissions data collection and reporting. Three goals were identified by the group: develop standardized formats for data collection and reporting; identify the data that are available from industry; and develop procedures for independent assessment of the emissions factors developed from industry testing. The group believed that the best way to achieve these goals would be to develop a web-based test report format that would ensure consistent information was submitted and would allow for electronic upload and data processing. The group recommended that the test reports be form-driven and customized by industry type. In addition, the group recommended that incentives (both positive and negative) be explored as a means to convince states, one of the primary stakeholders, to implement the new procedures and mechanisms. Finally, the group outlined the steps necessary to develop and implement their recommendations.

#### **4.4.2 Topic 2: Establish Procedures for Defining Data Uncertainty in Reporting and Using Emissions Factors, for Inventory and Non-inventory Applications**

This group's discussion focused on defining statistical procedures and criteria to apply in developing and reporting emissions factors, and establishing protocols for applying data uncertainty in non-inventory applications. The group concentrated on two concerns: defining emissions factors as a function of uncertainty, variability, and application; and developing guidelines and alternatives for emissions factors characterization for non-inventory applications. The group recommended that a tool be developed to identify/characterize the uncertainties associated with emissions factors and determine if the uncertainties are acceptable for the factor to be used for a specific application. A generic model or table for use by state/local/tribal agencies to assess uncertainty/variability in emissions calculations was envisioned. The group believed that a beta version of the generic model could be developed in approximately 6 to

12 months. The group also recommended that non-inventory applications be prioritized and that the generic model be applied to the non-inventory applications. In addition, the group recommended that rules/guidelines be developed for collecting data for existing technologies and for using the data, and that guidance for non-inventory applications of emissions factors be developed.

#### **4.4.3 Topic 3: Establish an Outreach Program to Improve the Understanding and Application of Emissions Factors and Other Emissions Quantification Tools**

This group's discussion focused on designing the form and structure of information distribution tools and identifying high priority types of guidance or knowledge area needs. The group recommended that a menu or matrix be developed to assist users in determining how and when to use emissions factors rather than another means to quantify emissions. This tool would be a web-based document that would be tailored to different audiences and applications, be presented in bilingual format, and serve as a single point to obtain information regarding emissions factors and their uses. A companion document would be developed in hard copy format to communicate with users that either do not have access to computers or do not feel comfortable using them. The group believed that a beta version of such a tool could be developed over a 2-year period using funding from industry groups and other federal agencies (e.g., DOD).

#### **4.5 Summary of Comments Received from Stakeholders During the Workshops**

A total of 14 workgroups met over the course of the four workshops. The consensus recommendations that they workgroups made to EFPAG are as follows:

1. Standardize source test plans and reports and associated QA procedures.
2. Develop an automated mechanism for the submission of source test plans and reports.
3. Develop a web-based clearinghouse of source test reports including emissions factors developed, operating parameters tested, uncertainty associated with the test, and QA steps conducted.
4. Quantify the uncertainty associated with emissions factors.
5. Provide guidance regarding the use of emissions factors in non-emissions inventory applications.
6. Streamline the process of developing emissions factors.

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## **5.0 STATUS OF PROGRAM IMPROVEMENT AREAS**

EFPAG has initiated four projects to address the stakeholders recommendations identified in Section 4.5 of this report. First, EFPAG is assessing the quality of source tests by characterizing and quantifying the uncertainties associated with several stack testing methodologies. Second, EFPAG is in the process of developing an automated mechanism to standardize the development and submission of source test plans and reports, as well as to standardize test plan and test report QA procedures. Third, EFPAG has initiated a project to understand and quantify the uncertainties associated with the development of emissions factors and the application of emissions factors to achieve various program objectives. Fourth, EFPAG is evaluating the use of emissions factors for non-emissions inventory purposes. Each of these projects is described in more detail below. These projects will lead to the development of reports or other products that will be submitted to stakeholders for review and input.

### **5.1 Quantifying Uncertainties Associated with Stack Tests**

EFPAG is assessing the quality of source tests by characterizing and quantifying the uncertainties or potential errors associated with several stack testing methodologies. The initial methods under investigation are EPA Methods 1 through 5 and 202. For each method, all of the measured source parameters that affect the determination of emissions rates or concentrations have been identified. For each parameter, EFPAG has also quantified the maximum measurement error that could occur while complying with the method's QC requirements or equipment specifications. Procedures to quantify the variation in the emissions rate or concentration that would result from each individual parameter varying from its minimum to maximum value have been developed. The uncertainty of the emissions rates or concentrations associated with each method will be estimated by combining the variations associated with each parameter.

In addition, the uncertainties that result when stack tests deviate from the prescribed methods are being evaluated. Specifically, data quality questions (DQQs) pertaining to documentation, results, process operations, sampling procedures, and other factors or parameters affecting data quality, will be used to adjust the uncertainties or allowed error ranges. The quality of source test data will be defined by the numerical uncertainty value calculated for each emissions rate or concentration reported. The procedures defined above may be summarized as:

1. Assign a default error or uncertainty for each parameter based on the method QC criteria or equipment specifications.
2. Adjust the uncertainty according to the responses to the pertinent DQQs.

3. Use the adjusted uncertainties to derive an estimated set of parameter values.
4. Calculate the estimated emissions and concentrations from the set of estimated parameter values.
5. Use the difference between the original and estimated emissions and concentrations as the assessment uncertainty for a run.

## **5.2 Standardizing Source Test Plans, Reports, and QA Procedures**

The Electronic Reporting Tool (ERT) is a Microsoft Access program that is intended for use by both source testers and review agencies. Use of this tool will standardize the development of source tests plans and reports, reduce the amount of effort necessary for source testers to submit plans and reports, reduce the amount of effort necessary for agencies to review source test data, and provide a mechanism by which EPA may gain access to electronic data from the large number of source tests that are conducted for compliance purposes.

Source testers will be able to enter information into the ERT including facility data, operating parameters, and test procedures to generate a test plan. After the test plan is approved by the appropriate agency or test sponsor, the tester will add the test data and analytical data to the ERT. It will be possible for source testers to import point-by-point test data from a specifically formatted Excel spreadsheet directly into the ERT, thus saving time and reducing potential data input errors. Once pertinent data entry is complete, source testers will be able use the ERT to generate the source test report. Use of the ERT will standardize the format of the test plans and reports, thereby reducing the effort necessary to both prepare and review the documents.

Review agencies will be able to use the ERT to assess the quality of the source test results. In addition, procedures are being developed (as described in Section 5.1) to allow review agencies to determine the uncertainty values associated with the test results. Electronic data contained in the ERT's Access database could subsequently be used in the development of emissions factors.

EFPAG does not envision that use of the ERT would be mandated; rather, the anticipation is that source testers and agencies will voluntarily use the program in order to save time and effort during the submission and review of test plans and reports. Furthermore, it is not EFPAG's intent to increase reporting requirements as part of this project, but instead, to assist source testers and agencies to complete their jobs

EFPAG is designing the ERT to assist source testers and agency personnel with the completion of their jobs and anticipates that such personnel will voluntarily use the program in order to save time and effort during the submission and review of test plans and reports. Furthermore, EFPAG anticipates that organizations will use the ERT to voluntarily submit source test data to EPA for incorporation into the emissions factors program. It is not EFPAG's intent to mandate the use of ERT, to mandate the submission of source test data to EPA, or to expand existing reporting requirements as a result of this project.

### **5.3 Understanding the Impact of Uncertainty on the Application of Emissions Factors to Achieve Various Program Objectives**

EFPAG has initiated a project to understand and quantify the uncertainties associated with the development and application of emissions factors to achieve various program objectives. EFPAG is currently evaluating several series of "A" rated emissions factors to characterize the underlying statistical distributions of the data as well as to quantify the uncertainty associated with each factor. "A" rated data were chosen because they are typically associated with large test data sets. Efforts to date indicate that the emissions factors data are typically distributed in a log-normal or Weibull fashion. Using these statistical distributions, the 5<sup>th</sup> and 95<sup>th</sup> percentile confidence intervals were estimated for the emissions factors investigated. Preliminary results indicate that the following:

1. The 95<sup>th</sup> percentile confidence value may be as much as 10 times the mean value.
2. Because the mean value for these distributions is greater than the median value, more than half (i.e., the majority) of all source test data points obtained will be less than the mean value. As a result, emissions factors developed based upon the source test data will tend to under estimate the mean value.

Future efforts will focus on determining whether additional emissions factors are statistically distributed in the same fashion as the data sets evaluated to date.

### **5.4 Evaluating the Use of Emissions Factors for Non-emissions Inventory Purposes**

EFPAG is evaluating the use of emissions factors for non-emissions inventory purposes. Numerous uses of emissions factors have been identified, ranging from applicability determinations, to permitting, to regulatory development. EFPAG is assessing the implications that incorporating uncertainty estimates into the emissions factors program will have on the many programs that currently rely on emissions factors.

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