Development of a State-Local-Tribal Emission Factors Compendium Research and Development Project 10

1 Project Description and Goals

1.1 Project Goal

The work of this team consisted of developing an emission factor compendium that will support state, local and tribal authorities (SLTs) and other relevant stakeholders who utilize point source emission factor information. The compendium could also, eventually, be used as one of several inputs to the Common Emissions Form (CEF). The CEF is a conceptual design under development in the CAER project, which would provide reporters the tools to share data across reporting programs, including EF data.

1.2 Project Description

Work for this team was concentrated in four major steps:

1. **Research** (see Section 2): Investigated and researched the development of a compendium of State-Local-Tribal (SLT) emission factors (EF) that states could share and use for their emissions development needs. Data was compiled from EF data provided by SLTs from the previous source classification codes (SCC)/EF project's Phase I Survey, data from the states on the team and database development was iterative.
   a. Reviewed databases submitted with the survey from PDT Phase I and collect additional information as needed
   b. Reviewed databases from states in the team.
   c. Reviewed format of WebFIRE data elements, as a starting point for compendium
   d. Identified metadata for the compendium (source, use, etc).
2. **Business Rules:** Developed compendium business rules and guidelines, including: data elements to be included (level of detail, data sources and documentation, state-specific parameters); database maintenance (who contributes and how), and limits on EPA involvement in database maintenance and data vetting.
   a. Determined data elements
   b. Compiled draft database
   c. Compiled and drafted business rules associated with database management

3. **Venue:** Explore electronic venues for the repository of the database for potential leveraging via web services, that will allow compendium updates and maintenance, including potential future automatic EF data export or batch upload from SLT, if and when possible and workable. It will be important to understand how SLTs may send updates to the compendium. Some may have their EF data in their own systems already, but it may be possible to set up a webservice that pushes that data automatically so the state in question doesn't have to do anything to maintain their part of the compendium.
4. **Integration with Common Form:** Explore how the compendium can be used with the common emissions form (CEF). Compendium data could be one input database to the CEF's menu of EF. Additional business rules on compendium use with the CEF (e.g. state controls over EF presented to facilities) will be developed. A future step might include the possibility that EF data could also be entered via the CEF and sent to the compendium automatically.

Deliverables for this project included:

1. Documentation of draft guidelines, business rules, and data elements for the compendium entries and input information, CEF EF menu creation and general data retrieval and usage.
2. Documentation of the exploration of electronic venues for the repository of the database for potential leveraging via web services and the possibility of creating such a repository, and recommendations for next steps.
3. Documentation of recommendations on using SLT compendium in CEF.
4. Database containing the draft compendium of state emission factors (i.e. given the scope and time of this project, not all states or all factors available from the survey may be included in this first stage).

Deliverables 1 to 3 are contained in this document. Deliverable 4, the compendium database is contained in Appendices to this document in three excel files. These are listed in Table 1, as follows:

Table 1. Compendium Databases

File	State	Number of Emission Factors
Appendix 1	Minnesota	7,129
Appendix 2	Michigan	3,559
Appendix 3	South Carolina	1,052

2   Research

2.1   Reviewed databases submitted with the survey from PDT Phase I

Databases were submitted from PDT Phase I by the following states, who were not participants in Phase II: Colorado, Florida, and Illinois.

Illinois submitted both point and non-point emission factors. The submitter reported that the point source emission factors they have are all standard USEPA emission factors from AP-42, WebFIRE, and

AFSEF[1], and are not state-specific factors which is what the team would like to include in the compendium.

Florida submitted two examples of their "Annual Air Emissions Calculators" for some SCC in the form of excel files, and provided a website: http://www.dep.state.fl.us/air/emission/eaor/default.htm. While many of the emission factors provided in their examples were referenced as coming from AP-42, some came from source testing, were derived from other emission factors (for example, for PM10-PRI emission factor was derived from the sum of P10-FIL and PM-CON). For example, in one file 59 emission factors for a variety of pollutants were listed for SCC 10100501, 6 were listed as having been derived from other emission factors and one was listed as coming from a stack test. Another file had 85 emission factors for a variety of pollutants for SCC 30500255, out of which 5 were derived from other factors and the rest were listed as being based on EPA emission factors from AP-42.

Colorado does not have a single comprehensive list of factors. Most of their factors are found within calculation templates, that are process specific. Any other factors may be based on testing or modeling and a reporting facility sends those. The state graciously provided examples of these templates for emissions calculations for a variety of activities. Many of the emission factors listed in those templates are AP-42 factors.

2.2   Reviewed databases from states in the team

Georgia - Georgia does not currently have a compendium or separate database of emission factors. Thus, the creation of the compendium would be of great benefit to states like Georgia.

South Carolina - South Carolina's web-based emissions inventory database, the State and Local Emission Inventory System (SLEIS), relies on an emission factor table comprised of AP-42/ WebFIRE factors and state-specific factors. These emission factors address both criteria pollutants and toxic air contaminants. The emission factor table is maintained by the South Carolina Department of Health and Environmental Control (SCDHEC) and is updated as needed for each inventory year. The SCDHEC SLEIS emission factors includes both controlled and uncontrolled emission factors per Source Classification Code (SCC). The table only accommodates one emission factor per SCC per EPA EIS method code. SCDHEC has a separate 'multiple emission factor' reference table. This table contains any SCC and method code combination, where multiple emission factors are available and can't be added to the SLEIS factor table. The SCDHEC emission factor table does not have a field that easily allows the separation of WebFIRE factors and state specific factors. However, an attempt was made to separate out state-specific emission factors only, which were provided for this effort. The SCDHEC state-specific emission factor table may not be all-inclusive. The state-specific factors include some factors from WebFIRE, which were selected to fill a gap for a similar SCC. It may also include trade group factors, EPA white paper factors, older FIRE factors, etc. The comment field should contain information about the source of the factor.

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[1] AFSEF was a booklet that documented all emission factors for criterial pollutants (CO, NOx, PM, PM-10, SO2, VOC and Lead) that existed in the AIRS mainframe look-up tables as of March 1990. See: https://www3.epa.gov/ttnchie1/faq/firefaq.html

Michigan – Michigan's web-based emissions inventory application, the Michigan Air Emissions Reporting System (MAERS), relies on an emission factor table comprised of over 14000 generic (WebFIRE) and about 3700 state-specific factors. These emission factors address both criteria pollutants and their precursors, as well as toxic air contaminants. The emission factor table is maintained by MAERS administrators and updated as needed for each inventory year. The MAERS emission estimator relies on the use of uncontrolled criteria pollutant emission factors and the application of appropriate control efficiencies where provided by facilities. The state-specific factors include factors from WebFIRE selected to fill a gap for a similar SCC where that pollutant is reasonably expected, or where the specified control device was removed, and a presumed control efficiency backed out to create an uncontrolled factor for use by the MAERS emission estimator. In the future, state-specific factors specific to processes at individual facilities will likely be added where facilities can demonstrate that the factor is reasonable and appropriate.

Minnesota – An emission factor is defined as, described in AP-42, "a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant." Emission factors can be generic, state-specific, source-specific, or process-specific. In the Minnesota state emission inventory system, the Consolidated Emission Data Repository, (CEDR), the emission factors from WebFIRE and AP-42 are defined as generic. In most cases, these emission factors are derived from actual measurements of the emissions from representative sources/processes and are assumed to be the long-term averages for all facilities in the source category.

Since WebFIRE and AP-42 do not contain emission factors for all processes, the Minnesota Pollution Control Agency (MPCA) encourage facilities to report their process-specific and source-specific emission factors based on information from performance tests, chemical analyses, mass balance, or permit application. Those process-specific and source-specific emission factors are used for the specified process and processes under the specified SCC in the facility, respectively.

However, the availability of process-specific or source-specific information cannot be expected for all facilities. The MPCA developed state-specific emission factors that mainly fill gaps of generic emission factors. The state-specific emission factors are used for all facilities in Minnesota when process-specific or source-specific information is not available. The state-specific emission factors are derived using the following methods:

1. Augmentation of generic emission factors to similar processes where generic emission factors are missing. Since majority of generic emission factors are for combustion SCCs, the augmentation method is also mainly used for combustion SCCs too. For example, HAP emission factors for SCC, 10200204, External Combustion /Electric Generation /Bituminous Coal / Boiler Spreader Stoker were augmented from AP-42, Table 1.1-14,1.1-15, and 1.1-18 for other coal combustion SCCs.
2. Information from other resources. For example, emission factors for individual dioxins for coal combustion were taken from EPA 2003 Dioxin study.
3. Speciation factors from EPA PM Calculator. We used the information from EPA PM Calculator to fill up gaps for missing emission factors for PM condensable. We also used PM2.5 filterable to PM10 filterable ratios directly derived from WebFIRE and EPA PM Calculator for estimating PM2.5 filterable emissions. In our experience, using generic emission factors for PM2.5 filterable could results in emissions of PM2.5 filterable greater than PM10 filterable when facilities have

performance tests for PM10 filterable but not for PM2.5 filterable. To avoid the problem, we don't use any generic emission factors for PM2.5 filterable, but only state-specific speciation factors for PM2.5 filterable from PM10 filterable.

4. Selection of emission factors from the most popular retired SCC used in the state for the new SCC that replaces multiple retired SCCs. For example, 20 retired SCCs are mapped to one SCC code, 30301599, after the 2015 NEI. Generic emission factors for CAPs were available for multiple retired SCCs at different values. Emission factors for SCC 30300901 were selected because it was the most popular SCC among the 20 retired SCCs used in our state. The generic emission factors for other retired SCCs were assigned as process-specific emission factors if facilities didn't have any process-specific information.

In addition to state-specific emission factors and speciation factors, MPCA also included state-specific heat contents and greenhouse gas CO_2 equivalent factors in the emission factor table to enable formula calculations and calculations of CO2 equivalent emissions in their Emission Inventory system.

Up to now, there are 17,069 records in the emission factor table containing state specific information. Details are shown in Table 2.

Table 2. Details of Minnesota Emission Factors

Type	Total Number	Active Currently
Emission Factors	9,818	8,931
Speciation Factors	6,980	5,125
Heat Contents	100	90
Greenhouse Gas CO_2 Equivalent Factors	171	171

The Minnesota EI system takes emission factors at different levels in the following prioritization: process-specific, source-specific, state-specific, generic. The system also considers control status, updated date, and reliability in prioritizing emission calculations.

2.3   Reviewed format of WebFIRE data elements

The team reviewed data elements or data fields from WebFIRE. Many data elements in WebFIRE will be in the compendium such as: SCC, pollutant code, control code, factor, units. Any data elements from WebFIRE not in the compendium may be added later, upon consideration, if needed.

2.4   Identified metadata for the compendium

The team identified several sources and relevant metadata from their data and for the compendium, such as:

- WebFIRE factors for a very similar SCC used to gap-fill

- Trade group factors
- Existing controlled emission factor backed out to an uncontrolled one by assuming a control efficiency
- Taken from EPA and other studies

At this stage in the project, the State of Minnesota presented their database and data elements. The group decided to use this work, together with WebFIRE, as models or starting points for the discussion on business rules for the compendium.

3   Emission Factor Compendium Business Rules

This section of the document covers "business rules" for the compendium of emission factors for the SLT governance of the compendium. New business rules could be added, or current ones modified once the compendium is in use, if needed.

3.1   Compendium SLT Emission Factors

The definition of a Compendium Emission Factor is any emission factor that is not currently in WebFIRE and AP-42, and is, thus, used by an SLT jurisdiction in the absence of the site/process-specific information. Examples include:

1. An emission factor from WebFIRE is augmented by the state to fulfill the need for a missing emission factor.

    a) For similar SCCs: WebFIRE can have emission factors for certain SCCs, but not others. For example, HAP emission factors for SCC 10100204 (Ext Comb /Electric Gen /Bituminous Coal /Spreader Stoker) are not available. However, WebFIRE contains emission factors for SCC 10100202 (Ext Comb /Electric Gen /Bituminous Coal /Pulverized Coal: Dry Bottom). Both processes are for bituminous coal combustion. SLTs may allow the use of the emission factor for SCC 10100202 to calculate emissions for SCC 10100204, and thus include it in its SLT-specific emission factors.
    b) Between pollutants: In some cases, an emission factor may be available that can be used as a surrogate for another pollutant where there is no emission factor for it. If that is the case, then ideally, the missing emission factor is provided as such for clarity. For example, an emission factor for TOCs can be used as a surrogate for VOC's when the factor for VOC's is missing. Rather than have the user figure out that only the TOC factor is available and that it could be used in place of the missing VOC factor, the compendium would include the VOC factor as well as the TOC factor. This would prevent confusion and potential misreporting.

2. An emission factor is derived by a facility reported stack test data within the state.

3.2 Data Elements Included in the Compendium

The goal of the compendium is to provide emission factors from states to other states particularly, to support the emission calculation needs in the future Common Emission Form (CEF). Because each state may have its own inhouse database, formatted according to its own needs, it would be helpful to harmonize data elements, in such a way that the data in the compendium is easy for everyone to understand, use, and update.

This section of the final report contains the compendium business rules (or Deliverable B of the original workplan) that explain what data elements we will use in the compendium and how they should be coded and/or presented. These data elements are based on the emission factor database from the state of Minnesota.

The team created a template in excel that provides a standard and easy format to anyone wanting to upload data into the compendium. Because the compendium will have to be maintained by contributing states, contributing states are highly encouraged to use the template and abide by these business rules in terms of appropriate coding and data organization. The more consistency there is in the compendium database, the easier it will be for users of the compendium to understand and use the compendium and thus benefit from it. Furthermore, consistency is also important because the CEF will read the compendium in an automated way.

3.2.1 Source Classification Code

An SCC is used to identify a process for which the emission factor is being sought. It links the process activities to emission factors, therefore, enables the emission calculation. An SCC Web Services was developed in 2017 under the CAER project (see the link https://epa.gov/scc). The SCC Web Services provides an interface to the terms and descriptions that are related to SCCs found in the Terminology Services (TS) registry and allows searching for SCCs by name or facet, as well as querying an SCC by its code.

3.2.2 Emission Factor

The emission factor itself is a value in the form of a discrete number or a formula. The compendium will not take ranges, considering the emission estimator in CEF will not be able to calculate emissions based on an emission factor in a range. Since values of emission factors in discrete numbers could vary by several orders of magnitude depending on pollutants and SCCs, the team decided the format of an emission factor should be in a scientific notation even though some state databases have the exponent in a separate field.

3.2.3 Pollutant

The pollutant for which the emission factor will be used to calculate emissions. It should be represented in a standard way across the compendium.   The easiest way to represent such a pollutant is to use a code and possibly the description of that code, especially for pollutants whose code is a number, as opposed to an abbreviation. The team agrees on the following business rules for the use of pollutant codes:

1. Use NEI Pollutant Code to reference each pollutant. These codes can also be found in EIS (https://eis.epa.gov/eis-system-web) in the "Reporting Codes Tables" link, and also in one of the tabs of the excel template.
2. For pollutants not included in NEI, use the Chemical Abstract Service (CAS) number without hyphens
3. If a pollutant has neither an NEI Pollutant Code nor a CAS number, then use the TRI code
4. A pollutant with no code under 1-3 would then use the SRS internal tracking number from https://ofmpub.epa.gov/sor_internet/registry/substreg/LandingPage.do

The team is open to other ideas of pollutant coding systems. The codes suggested above could be easily mapped to any new pollutant codes in the future CEF.

3.2.4 Primary and Secondary Control Measure

The primary control and secondary control refer to the sequence of control devices, if any are being applied, used to reduce pollutant emissions from a particular source. Examples of control devices include fabric filters, venturi scrubbers, and gravity collectors. Although an emission factor could be associated with more than two control devices, the team decided to include only two control devices in the compendium. The presence of a primary or secondary control will be indicated by the use of the numeric control device code (e.g., "202" for spray dryer, "127" for a fabric filter).

The team agrees on the following business rules for the use of control measure codes:

1. Use NEI control measure codes first. These codes can also be found in EIS (https://eis.epa.gov/eis-system-web) in the "Reporting Codes Tables" link, and also in one of the tabs of the excel template.
2. If no NEI code is available, then a new one should be created using the NEI code list "logic". The state should reach out to the Compendium committee with a suggested code for review.

The committee will review the proposed control device code and provide feedback within 30 days of the proposal

3.2.5   Throughput (Material)

Throughput is the activity associated with the release of a pollutant that is in the emission factor. Examples of throughputs could be fuel inputs, amount of material processed, amounts of products, operation hours. Throughput is also indicated by a throughput material code. Different programs may use different throughput material codes. Currently, the NEI has 637 throughput material codes. Among those codes in NEI, 235 material codes are not in WebFIRE. On the other hand, currently, WebFIRE has 412 throughput material codes. Among those code in WebFIRE, 10 material codes are not in NEI. The NEI uses numeric throughput material codes, for example, "100" for Feed, "279" for Residual Oil.

The team agrees on the following business rules for the use of throughput material codes:

1. Use NEI codes first. These codes can also be found in EIS (https://eis.epa.gov/eis-system-web) in the "Reporting Codes Tables" link, and also in one of the tabs of the excel template.
2. If no NEI code, use WebFIRE codes.
3. If no NEI code and WebFIRE code is available, then a new one should be created. The state should reach out to the committee with a suggested code for review. The committee will review the proposed unit code and provide feedback within 30 days of the proposal.

3.2.6   Emission Factor Numerator Units of Measure

These are the units of measure associated with numerator of the emission factors (e.g. pounds, short tons). The team agrees on the following business rules for the use of pollutant unit codes:

1. Use NEI codes first. These codes can also be found in EIS (https://eis.epa.gov/eis-system-web) in the "Reporting Codes Tables" link, and also in one of the tabs of the excel template.
2. If no NEI code, use WebFIRE codes.
3. If no NEI code is available, then, a new one should be created. The state should reach out to the committee with a suggested code for review. The committee will review the proposed code information and provide feedback within 30 days of proposal.

3.2.7   Emission Factor Denominator Units of Measure

These are units of measures associated with the denominator of emission factors. Standard codes are also needed for emission factors denominator units of measures. Currently, the NEI has 67 units of measure associated with emission factor denominators. Among those codes in NEI, some codes are not in WebFIRE. On other hand, currently WebFIRE has 59 units of measures codes for emission factor denominators. Among those code in WebFIRE, 10 material codes are not in NEI. The NEI uses numeric throughput material codes, for example, "100" for Feed, "279" for Residual Oil.

1. Use NEI codes first. These codes can also be found in EIS (https://eis.epa.gov/eis-system-web) in the "Reporting Codes Tables" link, and also, in one of the tabs of the excel template.
2. If no NEI code, use WebFIRE codes.
3. If no NEI code is available, then, a new one should be created. The state should reach out to the committee with a suggested code for review. The committee will review the proposed code information and provide feedback within 30 days of proposal.

3.2.8   Start Date and End Date

Start date is the date the emission factor became active or valid for use in emissions calculations. End date is the date the emission factor became obsolete and is no longer valid for use in emissions calculations. Example: an emission factor is with a start date of 1/1/2012 and an end date of 12/31/2014. The emission factor will be valid for calculation of the 2012 EI, 2013 EI and 2014 EI, no matter when users perform the emission calculation, for example, on 2/14/2018.

3.2.9   State

An SLT that provides an emission factor to the compendium is represented by a code. FIPS code is a universally accepted and useful way to represent the SLT. The "FIPS Codes for States and the District of Columbia" tab could be found at the following link: https://www.census.gov/geo/reference/ansi_statetables.html

The list is also provided in the excel template.

3.2.10 Emission Factor Type

Emission factor type is used to describe the type of factor being represented. Table 3 shows possible factor types and their associated codes:

Table 3. Types of Emission Factors

Factor Type	Description
G	Greenhouse Gas CO2 Equivalent Factor
C	Material Conversion Factor
E	Emission Factor
S	Speciation Factor

3.2.11 Notes

This is a free text comment field containing a brief description of the way the factor was derived. States may have developed their own factor in one of many ways, including basing the factor on an estimate, engineering judgement, or from transforming an emission factor from EPA's WebFIRE or AP-42. This data can also contain the citation of any resources from which the factor was derived. For example, literature review, stack tests and reports.

3.2.12 Formula

As discussed in Section 3.2.2, an emission factor could be in a discrete number or a formula. At this stage, the formula will be incorporated as, first, the formula, and then the variables in the formula listed beneath it. For example:

1.5/(5.17*(1.12*S+0.37)+1.50E0);

S=sulfur content

Ideally, the CEF would be able to read the formula, present it to the user and automatically pick up the variables as well as allow the user to enter the value or values for each variable. Then, the CEF would perform the necessary calculations.

3.2.13 Action

Action is used to describe how the throughput is associated with the process which the emission factor is for. There are three different actions defined in the EIS Calculation Parameter Type Code table that can be found at https://eis.epa.gov/eis-system-web. The team decided to adopt those three codes as is, as shown in:

Table 4. Types of Actions

Action Code	Description
I	Input, e.g. burned, fed
O	Output, e.g. produced, outputted
E	Existing, e.g. hours of operation, area of land

3.2.14 Ranking

The team discussed the inclusion of a data field to disclose the rank of the emission factor, in terms of how desirable it would be as compared to other codes for the same SCC and pollutant. WebFIRE as

historically used the following letter grades for emission factors to characterize the ability of the factor to represent the national annual average emissions factor for the source activity:

A = Excellent: The emission 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 = Above average: The emission factor is developed primarily from A or 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 = Average: The emission factor is developed primarily from A, B, and 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 = Below average: The emission 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 = Poor: The emission factor is developed from C and D-rated test data from a very small 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.

U = Unrated: These are only used in the EPA's Locating and Estimating (L&E) documents. The emission factor is developed from source tests which have not been thoroughly evaluated, research papers, modeling data, or other sources that may lack supporting documentation. The data are not necessarily "poor," but there is not enough information to rate the factors according to the rating protocol. "U" ratings are commonly found in L&E documents and FIRE rather than in AP 42. Discretion should be used for any emissions factors with a "U" rating. Quality of these factors are unknown and unverifiable.

For now, all emission factors in the compendium will be coded as "U" for their ranking. This data field will evolve as data is added to the compendium. Because the "U" rating should be used with caution, the states using the compendium would have to determine whether a specific emission factor from another state is appropriate for facilities in their own state, as described in section 3.3.

3.2.15 Scope

This data field refers to the applicability of the emission factor. For now, all emission factors will be coded as "State". As the compendium evolves other factors such as facility specific or process specific could be included.

3.3   Compendium Users and Use Governance

The goal of the compendium is to supplement WebFIRE for missing emission factors or override WebFIRE emission factors; to support future CEF emission calculations; and to share STLs-specific emission factors among SLTs. Therefore, any SLTs can use the compendium. Each SLT providing an emission factor will reference itself as the source state and will reference how the specific factor was obtained. The following guidelines will be observed:

- A "using" state (state using the compendium) may take an emission factor published in the compendium by another state but must reference back to it. States may indicate in a separate intersection table in the CEF, which factors from other states they find appropriate for use by facilities in their state. This will assist facilities in the selection of appropriate emission factors to use in reporting their emissions.
- A "using" state must reference the use of the emission factor published by another state, even if the using state has done calculations and adapted that factor to its local conditions. If this is the case, this should be noted in the "Notes" data field.
- The emission factors may contain the specific jurisdictional information as compiled by each SLT. Another state using this information should be cautioned to determine if the use of that emission factor is appropriate for its purposes. Should any questions arise, they should contact the responsible jurisdictions for emission factors and background information for their selection.

3.4   Compendium Maintenance

The SLTs providing data to the compendium will be responsible for updating their data as follows:

- SLT jurisdictions control emission factors specified for use in their own jurisdictions
- SLT jurisdictions take full responsibilities for the quality of the emission factors
- SLTs should provide background information regarding the process utilized for validation
- Participating states will be encouraged to update at least once per year before the CEF opens for facilities to report for a new EI year, no later than January 1 of each year.

The following are some examples of compendium maintenance challenges the group discussed.

3.5   Version control

The emission factor will have a start and end date. The state who owns the factor will be in charge of removing an outdated emission factor if it is no longer needed for reporting for previous emission inventory years, and/or it has not been used by any facilities, noting that some emission factors may still

be valid for current reporting. For example, a factor may be retired in 2018 but would still be valid for reporting for 2017, unless the state who owns it has removed it from the database.

3.6   Controlled and Uncontrolled

If a controlled emission factor is available but not the uncontrolled one for that process, there are several options to use the controlled factor.

- Use the controlled emission factor if process control devices are matching control devices in the emission factor
- Back-calculate the uncontrolled factor making an assumption about control efficiency, for example, to be able to include the uncontrolled factor in the compendium
- Take the controlled emission factor directly for the process but don't apply control efficiency on the top of the emission factor

3.7   Quality Assurance

Sometimes a simple typo can lead to an error of several orders of magnitude. Some QA will be required by each state supplying emission factors to the compendium. For example, an emission factor is entered as EF = $Y \times 10^{-1}$ instead of $Y \times 10$ -10.

Each state would have to be responsible for maintenance of their data. This would include data QA, update and maintenance. The QA part would include: scanning for errors such as typos, filling in missing fields, backing out an uncontrolled factor when only the controlled one is available if it is needed, etc. It is not possible to compel anyone contributing data to the compendium to update it on a regular basis. The commitment would have to come from participating states. Ideally, they would conduct QA checks before uploading the data and provide regular updates.

Furthermore, SLT collaborative work on the compendium is also suggested. For example, SLTs can form a work group where each member is assigned to certain SCCs. The SLTs participated in the group will review and analyze WebFIRE for missing data and make the augmentation for their corresponding SCCs to avoid duplication of efforts.

Compendium outreach: when a new SCC is added or there are retirements, the people using the compendium should be made aware of this via outreach efforts.

3.8   Availability of Compendium for Bulk Download

While the PDT is working towards a compendium that can be used by the common form, the compendium should be downloadable for any SLT if desired. The compendium download format in CSV is suggested by the team, as it is standard practice for government databases.

3.9   Examples of Compendium Use Cases

- Two use cases are defined:

    - I am a state and I want to tag emission factors from other states in the compendium to indicate they are appropriate for use in my state.
    - I am an industry reporter and I want to see a drop-down menu of emission factors both from WebFIRE as well as from my state or approved by my state, so I may select the most appropriate one to report emissions for that process.

4   Venue for the Compendium

Virtual Exchange Services were explored as a possible venue for the repository of the compendium. Several states already have a node in EPA's VES, but also, ECOS has a node. Node use can be cumbersome with code needed for uploads. The states don't have time and resources for this so that web services would have to be developed so that states can upload their data in a simple excel template and then have that data translated into the relevant code required to create the database for VES. Windsor may also have its own node and thus, may be one option for states using SLEIS to upload their compendium emission factors.

While work is ongoing within EPA to explore the use of VES for the compendium, at the time this report was written, the team felt that the expertise of the incoming CAER Fellow would be helpful in determining the specifics of which VES node to use and how to set up the compendium and updates.

5   Integration with the Common Form

To support the Common Emissions Form (CEF), the team has set business rules, designed, and developed a State-Local-Tribal (SLT) Emission Factors Compendium. The compendium already contains about 11,000 emission factors from multiple states. It could grow when more SLTs upload their SLT-specific emission factors there. However, the compendium is only a stand-alone data set. The team realized the complete design of the compendium relies on the system that uses the compendium. Following are recommendations for CEF with aspects of using the compendium.

1. The compendium must be readable to a facility reporting to the CEF, for example, via a drop-down menu showing the emission factors available for a given SCC.

2. The CEF needs to have an interface for SLT users to view and edit the compendium.

3. A state should decide whether the use of emission factors from other states, for specific SCCs, are appropriate for their facilities to use. Given that choice, the compendium should display emission factors for the SCCs that the state has authorized for their facilities.

4. The CEF must have an emission estimator to calculate emissions based on throughputs and emission factors from the compendium.

5. The CEF must be able to select and list the emission factors and throughput to the user from both the compendium and WebFIRE, in order of ranking, an allow the user to choose the emission factor they want to use, provided their state has authorized the use of that factor.

6. A ranking schema must be established in the CEF for emission factors and throughputs. The schema will be for all emission factors, both from WebFIRE and the Compendium at the SCC level. WebFIRE and stack test derived emission factors would be listed first, then SLT factors. Emission factors could be displayed in a list form and ranked according to different criteria:

   a. Data source: The emission factor hierarchy in Table 16 of the Emissions Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations (https://www.epa.gov/sites/production/files/2017-07/documents/ei_guidance_may_2017_final_rev.pdf) provides a good reference for ordering of emission factors.
   b. Emission factor creation timeframe. Age or validity of the data used to derive the emission factor for a given period of time.
   c. Basis of different throughputs.
   d. Emission factor quality, as described in section 3.2.14.

In the future, compendium factors could include data from stack tests, and so forth, and thus, the same coding system used in WebFIRE would have to be used in the compendium, and the two data fields would be added, as discussed in the section on data elements regarding Rankings (Section 3.2.14).