

WebFIRE in CAERS

CAER Product Design Team
Research and Development Project

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1 Introduction

1.1 Project Description

State, Local, and Tribal authorities must submit annual emissions reports for the National Emissions Inventory (NEI) from their point sources. To estimate emissions from different point sources, industry frequently turns to EPA's WebFIRE emission factors, that they use to multiply by their activity data (throughput). In this regard, WebFIRE has proven to be useful. However, there are some known problems in WebFIRE that make its use for emissions reporting difficult. This report outlines a series of challenges in the use of WebFIRE data as the database currently stands, and outlines recommendations on how these issues could be addressed and how some situations could be handled in the Combined Air Emissions Reporting System (CAERS) to make emissions reporting easier.

Previous CAERS Product Design Team (PDT) research and development teams conducted work on Source Classification Codes (SCCs) and WebFIRE, which can be found on the [CAER website](#) under the following titles:

- In the [Short-Term Wins](#) Section: [Improvements to WebFIRE](#)
- In the [Product Design Team](#) Section: [SCC-WebFIRE for the Common Emissions Form](#)

However, that work was more focused on aspects of searchability and versioning of SCCs, and by extension, some issues with related emissions factors. The current report contains a deeper analysis of issues found with emission factors in WebFIRE as compared to previous work.

For this study, the team conducted analyses and issued recommendations for the current list of emission factors in [WebFIRE as of 09/22/2020](#) and [SCCs as of 1/5/2021](#) under four categories:

- Emission factors for new SCCs;
- Emission factors with multiple throughputs;
- Use of emission factors; and
- Recommendations for other WebFIRE issues.

In reviewing this report, the reader should keep in mind the following:

- This report refers to emission factors for *point* sources only, as well as active (as opposed to revoked) emission factors.
- At the time this analysis was conducted, some items were already being addressed by the EPA WebFIRE team but had either not yet been published, or were on a list of tasks awaiting funding so work could begin. These are noted in the document where applicable. No changes were made to WebFIRE between 9/22/2020 and 1/5/2021 (these dates are the download dates for the WebFIRE list of emission factor download and the SCC list download).
- At the time this analysis was conducted, steps were already being taken to address some of these issues to be included in the CAERS Version 2 release in March 2021. These will be noted in the document where applicable.

This report reflects an analysis conducted by Chun Yi Wu (MN), with comments and responses provided by the other team members. Assistance for this work was also provided by ECOS.

1.2 Team Members

The following team members participated in calls and discussions for this study:

- Chun Yi Wu, MN (co-chair)
- Julia Gamas, EPA (co-chair)
- Mike Ciolek, EPA
- Casey Bray, EPA
- Muntasir Ali, EPA
- Grant Hetherington, WI
- Josh Kalfas, OK
- Adam Ross, AZ
- Catherine Lucke, AZ
- Ben Way, WY
- Clara Funk, OR

1.3 The Current Version of WebFIRE

The Factor Information Retrieval System (FIRE) has been developed by the US EPA for criteria pollutants, hazardous air pollutants (HAPs), and other pollutants since 1995. In 2006, an online, searchable database and repository of FIRE, WebFIRE was introduced. The emission factors in WebFIRE include emissions factors for industrial and non-industrial processes.

Currently, WebFIRE contains most of the AP-42 emission factors. First published in 1972, the last major update to AP-42 was done in 1995. Some AP-42 chapters have been updated since then. At the time of this study, EPA was aware of discrepancies between AP-42 and WebFIRE and was already working to correct these to ensure all AP-42 factors were included.

WebFIRE also contains reports submitted to EPA via the [Compliance and Emissions Data Reporting Interface](#) (CEDRI). in response to regulatory requirements:

- Air Emissions Reports (AER) - Also known as periodic reports (e.g., semiannual reports, compliance reports);
- Performance Test Reports - Emissions source test data and performance evaluations/relative accuracy test audits (RATA); and
- Notification reports - Notifications of compliance status (NOCS) certifying that compliance with an applicable regulation was achieved.

Table 1-1 shows the number of emission factors in WebFIRE for point sources at the time this study was conducted.

Table 1-1. Number of Active Point source Emission Factors in WebFIRE

Type of Factor	Number
Active Emission Factors from WebFIRE	20,762
Active Emission Factors from AP-42 Documentation	14,723
Total Active Emission Factors	25,379

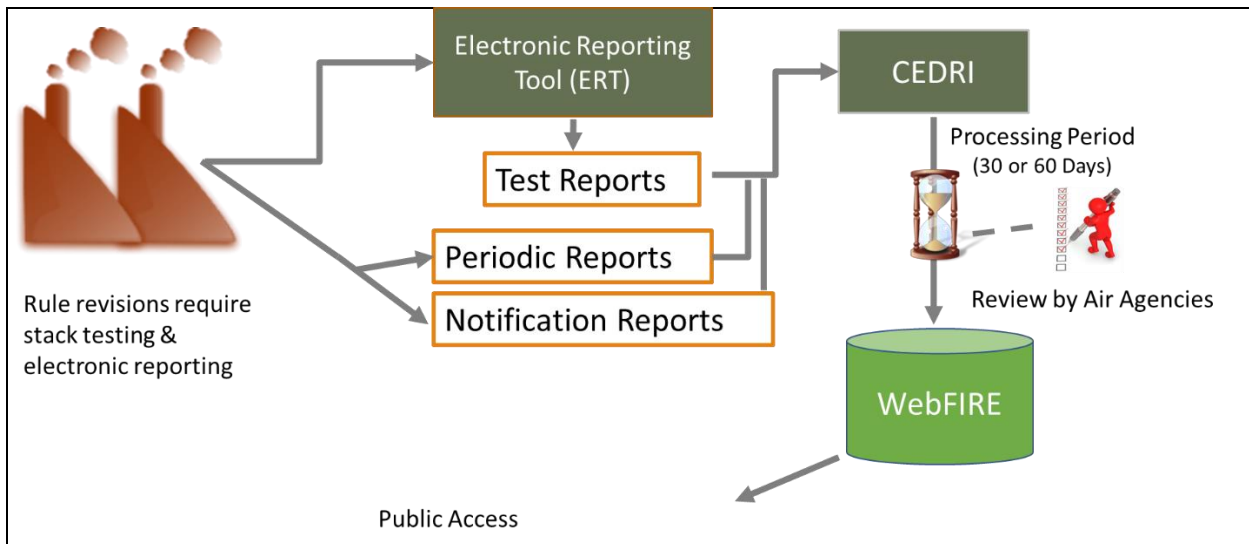
Note: Current WebFIRE contains 20,762 active emission factors (out of 25,379 emission factors total, including revoked) for 2,726 point source SCCs.

While WebFIRE has proven to be a useful tool for industry and SLT reporters, there are some known problems in WebFIRE that make its use for emissions reporting difficult. In what follows, challenges in the use of WebFIRE are described with examples.

1.4 New Approach to WebFIRE Emission Factor Development

A new emissions factor development approach is underway, that relies upon electronic submission of stack test reports. The WebFIRE team at EPA is in the process of developing a more streamlined approach to emission factor development. The Electronic Reporting Tool (ERT) is under development to allow electronic submission of stack test reports. A data submission portal is also under development in CEDRI. Stack test reports received through CEDRI will then be used to calculate new or revised emission factors automatically in WebFIRE. Rule revisions will require electronic reporting of stack test reports. **Error! Reference source not found.** shows a graphic representation of this new process. Emissions factor development through this new process will be faster, more representative, render higher quality data, and be more objective than the previous approach

Figure 1-1. New Emission Factor Development Process for WebFIRE



Additional functionality in WebFIRE is being created to allow users to develop own emissions factors from performance test data using EPA procedures. Users will be able to select which records they want to include in factor. A dataset will have to contain at least 3 values for data outlier test. It is important

to note that WebFIRE will not retain or endorse factors created with the user defined emissions factor functionality.

While this new approach will relieve some of the problems mentioned in the next section, it is important for the reader to keep in mind that in order to estimate a robust emission factor, source test data is needed via reporting.

2 SCC Retirements and Emission Factors for Map-to SCCs

2.1 SCC and Emission Factor Life-cycle

Source Classification Codes (SCCs) are used to classify different types of activities that generate emissions. These polluting activities or processes are reported through reporting systems including EPA's Emissions Inventory System (EIS) for the NEI, SLT inventory systems, and CAERS. The U.S. [EPA SCC website](#) provides a detailed description of SCCs in its [Introduction to SCCs](#) document.

EPA air rules specific to sectors and technologies periodically come under review, for example: [National Emission Standards for Hazardous Air Pollutants \(NESHAP\)](#) from 40 CFR Part 60, and Emission Guidelines and [New Source Performance Standards \(NSPS\)](#) from 40 CFR Part 62 and 63. More information regarding the rules reported via CEDRI can be found in the [CEDRI website](#). When an EPA rule revision takes place, the processes covered by that rule and thus, the SCCs used to identify them, are revised. For example, some SCCs may be found to be obsolete and no longer relevant to the rule, in which case they are retired. Some new technologies may have emerged that require an SCC for identification. Some SCCs that seemed sufficient at the time of the rule promulgation may be found to be either too general (in which case a number of more detailed SCCs must be created to replace the broader one), or unnecessarily detailed (in which case several SCCs may be consolidated into a broader category).

However, WebFIRE, as a repository of emission factors, does not progress as quickly as the SCCs are updated. This is because an emission factor for an SCC cannot be derived from source test data and published in WebFIRE, unless there is sufficient reported data to create it. This means that if source test data for an SCC is not being reported to CEDRI, for example because an SCC is brand new or because facilities are not complying with their reporting, then not enough data is available to estimate that factor.

Emission inventory preparers face a challenge because emission factors may not be available in WebFIRE for new SCCs (at least for some period after they are created). When an SCC is retired, it is no longer usable past its "last inventory year" as indicated on the list of SCCs. If there are new or existing SCCs related to it, that retired SCC is mapped to those new or existing SCCs (these will be referred to as "map-to" codes for the remainder of this document). Unless an emission factor for the retired SCC has been revoked, and is thus, no longer appropriate to use, it isn't always clear if an emission factor from a retired SCC is still valid, and thus, whether it should be used with a new map-to SCC. EPA expects emissions to be reported to the NEI only using new SCCs rather than retired SCCs. Thus, the usefulness of WebFIRE is reduced in this case; the user can no longer use the retired SCC and its emission factor, but the user has no new emission factor to use with the new SCC.

According to the SCC list downloaded on 1/5/2021 and listed in Appendix A, 1,549 out of 9,408 SCCs for point sources (in data category) were retired from 1999 to 2021. **Error! Not a valid bookmark self-reference.** shows the number of SCCs retired with emission years.

Table 2-1. Number of Retired SCCs by Year

Last Inventory Year	Count of SCC Retired in the Last Inventory Year
1999	16
2002	80
2005	296
2008	5
2011	28
2013	8
2014	8
2015	640
2016	36
2018	77
2019	350
2021	5
Total	1,549

There are several cases for situations where an SCC is retired and thus, determining how to find the new emission factor is a challenge. As described before, when an SCC is retired, it is no longer used for emissions reporting after the indicated “last inventory year”. If the technology is relevant, then the retired SCC is mapped to other SCCs

No map-to: In this case, a retired SCC has no new SCC to map-to and it’s “map-to” value in the SCC list is marked as “None”. In this case, the reporter is meant to stop using the retired SCC. Theoretically, the SCC has been retired and has no map-to value because the retired technology SCC is deemed obsolete – i.e. nobody is using it anymore. In this situation, if the reporter still feels the technology should be represented, the reporter should review the list of SCCs to see if another SCC was created that better represents the technology still being used. If the emission factor for the retired SCC has also been revoked, it is no longer appropriate to use under any circumstances and should, thus, not be used with the calculation method: “EPA emission factor”. Industry reporters with questions about an alternative calculation method or emission factor appropriate for their report, would reach out to their SLT for assistance. The SLT can reach out to the [NEI group](#) or the [WebFIRE team](#) for further guidance.

One to One: In this case, one retired SCC maps to a single map-to SCC. Table 2-2 shows the number of retired SCCs and how many SCCs they map-to. Out of those 1,549 retired SCCs, each of 1,423 or 92% of the retired SCCs, are mapped to another single new SCC. In this case, the reporter would stop reporting to the old SCC, and start reporting to the new SCC. This is possible, if there is an emission factor associated with the new SCC. In the majority of cases, there is no new emission factor associated with the new SCC, as described in section **Error! Reference source not found.** This situation, and what to do about it, has not always been clear to reporters. Thus, one recommendation for WebFIRE might be to populate the emission factor list for those new SCCs with an entry that indicates no data is available yet,

such as “NA”, or “ND”. This would make it clear to reporters that they should be seeking another calculation method for emissions for that SCC.

One to many: In this case, one SCC is retired and mapped to many other SCCs. From **Error! Reference source not found.** we can see that a single SCC can map-to more than one SCC. For example, two retired SCCs, are in a situation where each one maps to 14 new SCCs. In one case, for a single SCC there are 48 map-to SCCs, and for another single SCC there are 96 map-to SCCs. A situation like this usually indicates that the emissions technology is such that one SCC is no longer detailed enough to describe all potential processes. However, it again, makes it challenging for the reporter, as the reporter now has to determine which of the more detailed technologies (and thus, their SCCs) it should be reporting to and is, again, presented with the situation where there is no emission factor for any of the new SCCs, for the reasons described in the previous case.

Table 2-2. Number of Retired SCCs and Number of SCC they Map-to

Number of Retired SCCs	Number of SCCs They Map-to
87	None
1,423	1
14	2
4	3
7	4
6	5
6	6
1	48
1	96
1,549	All

However, for the rest of the retired SCCs (8%), mappings are not one to one, for which there are several cases:

Many to one or many to fewer: In this case, multiple retired SCCs map to a single SCC (or a smaller set of SCCs). **Error! Reference source not found.** shows how Map-to SCCs were used for SCC retirements. For example, 465 retired SCCs were mapped to a single SCC. There were 83 instances (166 total retired SCCs) where 2 retired SCCs were mapped to the same SCC. For example, SCC 28888801 was used as a map-to SCC for retired SCCs 28888802 and 2888880. There were 30 instances where 3 retired SCCs (90 total retired SCCs) were mapped to the same SCC.

Table 2-3. Many Retirements to One Map-to SCC Instances

Number of Times an SCC was used as a Map-to SCC	Number of Instances where an SCC was used as a Map-to SCC	Number of Retired SCCs in this Situation
1	465	465
2	83	166
3	30	90
4	54	216
5	10	50
6	14	84
7	8	56
8	3	24
9	3	27
10	3	30
11	2	22
13	1	13
15	1	15
16	1	16
18	1	18
19	1	19
21	2	42
22	1	22
25	1	25
29	1	29
33	1	33
87/None	1	87
All	-	1,549

2.2 Issues and Recommendations

All above SCC mappings create complexity in determining which emission factors in WebFIRE could be used for the mapped SCCs. There are many possible situations. Issues with these cases and recommendations are arranged from simple to more complicated, as follows:

2.2.1 One to one: A single map-to SCC from one retired SCC.

WebFIRE does not have an emission factor for the map-to SCC: In this case, it may not always be appropriate to continue to use the emission factor for the retired SCC. In this case, industry reporters and SLTs would benefit from guidance from WEBFIRE on whether or not the old emission factor may still be used. If it is not appropriate, then the reporter will need to use an alternative emissions calculation method. For example, WebFIRE might simply populate the map-to SCC emission factor with the emission factor from the previous SCC, or create a column in WebFIRE with a notation for whether a retired SCC emission factor may still be used, that CAERS can read in at the point where the user is selecting the emission factor.

2.2.1.1 *The map-to SCC has an emission factor in WebFIRE*

2.2.1.1.1 *WebFIRE does not have emission factors for the retired SCCs.*

In this case, the reporter should use emission factors associated with the map-to SCC and/or another calculation method.

2.2.1.1.2 *WebFIRE has emission factors for the retired SCC*

2.2.1.1.2.1 *The difference between the retired SCC and map-to SCC emission factor is small*

For example, less than 20%. In this case the new emission factor with the new map-to SCC could be used. However, the definition of “small” would depend on the technology in question, as well as, potentially, the geographic region or other criteria.

2.2.1.1.2.2 *The difference between the retired SCC and map-to SCC emission factors is substantial*

For example, more than 20%. EPA recommends using the new emission factor with the new SCC. However, there may be instances where the SLT and/or the industry reporter may have information specific to their SLT or facility, that leads them to conclude that the old emission factor for the retired SCC is still valid. In this case, the EPA should consider issuing a recommendation as to situations where the old factor from the retired SCC may still be appropriate to use with the new map-to SCCs. Also, what constitutes a “substantial” difference would, as in the above case, may depend on specific criteria as related to the technology and region in question.

For example, SCC 10200210 was retired and mapped to SCC 10200205. WebFIRE contains emission factors for both SCCs. A comparison of emission factors shows 14 emission factors for CAPs are available for the retired SCC 10200210. On the other hand, the map-to SCC 10200205 contains 32 emission factors for CAPs, ATs, and GHGs. The emission factors for SCC 10200210 are the same as those in SCC 10200205, except for VOC for which WebFIRE does not have an emission factor for SCC 10200205. Therefore, the recommended emission factors for SCC 10200205 would be all WebFIRE emission factors for the map-to SCC. However, for the additional VOC emission factor, WebFIRE should provide guidance on whether the emission factor from SCC 10200210 is still appropriate to use.

2.2.2 *One to many: One retired SCC maps to multiple SCCs.*

2.2.2.1 *There is an emission factor for the map-to SCCs.*

Then the recommendation is to use the new emission factors.

2.2.2.2 *There is no emission factor for the map-to SCC.*

Then refer to Case 1 above.

2.2.3 *Many to one: Multiple retired SCCs map to a single SCC.*

2.2.3.1 *The map-to SCC is new or WebFIRE does not have emission factors for the map-to SCC.*

In this case, the map-to SCC usually represents a more general, less detailed representation of the processes the retired SCCs represented. Therefore, emission factors for retired SCCs need to be investigated. There are many different scenarios. The following are examples.

Example 1: SCC 30102436, Level 1: Industrial Processes, Level 2: Chemical Manufacturing, Level 3: Synthetic Organic Fiber, and Level 4: Acrylic and Modacrylic: General, is mapped from 6 retired SCCs with the same descriptions for SCC Levels 1 to 3, Level 2, but different descriptions for Level 4 (See **Error! Reference source not found.**).

Table 2-4. Retired SCCs That Map to SCC 30102436

SCC and Status	SCC Level 4 Description	Number of Emission Factors
Map-to SCC		
30102436	Acrylic and Modacrylic: General	0
Retired SCC		
30102408	Acrylic: Copolymer (Inorganic)	0
30102409	Acrylic: Controlled	0
30102410	Acrylic: Uncontrolled	6
30102411	Modacrylic: Dry Spun	0
30102412	Acrylic and Modacrylic: Wet Spun	0
30102413	Acrylic: Homopolymer (Inorganic): Wet Spun	0

Only one retired SCC, 30102410 for Acrylic: Uncontrolled, has emission factors. There are 6 emission factors for VOC, which are different depending on whether the process is wet or dry (modacrylic, or acrylic) spun, melt spun (yarn, or staple), homopolymer, copolymer, and the presence of a control. Material (product), and action (produced) as well as UOMs are all the same. However, looking at AP-42 Section 6.9 that is the WebFIRE emission factors referred to, the emission factors for SCC 30102410 include emission factors for all these 6 processes that the retired SCCs represented. These are listed in the “DUPREASON” column of WebFIRE for SCC 30102410. See Table 2-5.

Therefore, since none of the emission factors for the retired SCC have been revoked, the recommendation for this map-to SCC would seem to be to use all emission factors for SCC 30102410 as per the detailed explanation in the “DUPREASON” column of WebFIRE would suggest. However, in WebFIRE, this description, as listed in “DUPREASON” should be moved to the “Notes” column to make these differences clearer. If there is any reason why this would not be appropriate, then clear and explicit guidance on this from EPA would help industry preparers and SLTs.

By extension, any emission factors that EPA deems are inappropriate for use with a new map-to should be revoked immediately to signal that EPA does not think reporters should use it.

Table 2-5. Emission Factors in WebFIRE for SCC 30102410

NEI_POLLUTANT_CODE	CONTROLID	CONTROL	FACTOR	UNIT	MEASURE	NOTES	DUPREASON
VOC	129	UNCONTROLLED	13.50	Lb	Tons	After solvent recovery from the spinning, washing, and drawing up stages.	Acrylic and modacrylic wet spun After solvent recovery from the spinning, washing, and drawing up stages.
VOC	129	UNCONTROLLED	250.00	Lb	Tons		Modacrylic, dry spun
VOC	129	UNCONTROLLED	41.40	Lb	Tons		Acrylic, inorganic wet spun, homopolymer
VOC	129	UNCONTROLLED	5.50	Lb	Tons		Acrylic, inorganic wet spun, copolymer
VOC	129	UNCONTROLLED	80.00	Lb	Tons		Acrylic, dry spun
VOC	151	ACTIVATED CARBON ADSORPTION	64.00	Lb	Tons	After recovery from spin cells.	

Example 2: Two retired SCCs 30300801 and 30300802 map-to SCC 30301511. All these SCCs have the same Level 1 and Level 2 descriptions as: Industrial Processes, Primary Metal Production. They have similar descriptions for Level 3, as shown in **Error! Reference source not found.**, but different Level 4 descriptions.

WebFIRE contains emission factors for PM10 filterable for both retired SCCs, one for each, with different values, 41.8 lb/tons iron produced for SCC 30300801 and 15.2 lb/tons iron produced for SCC 30300802.

A possible recommendation for this scenario is as follows:

- Select emission factors for one SCC as default for the map-to SCC, usually the most used retired SCC. For the SCCs in this example, there were a total of 20 processes in the 2020 MN Emissions Inventory, that used the retired SCCs, 16 for SCC 30300801 and 4 for SCC 30300802, respectively. The emission factor of 41.8 lb/ tons iron produced is selected as a default.
- Use emission factors for the other SCCs as process-specific emission factors. In this example, 15.2 lb/ tons iron produced was used for the four processes originally with SCC 30300802 as the process-specific emission factor.

Guidance from WebFIRE as to whether this recommendation would be appropriate, or an alternative recommendation if not, would be most helpful for reporters.

Table 2-6. Retired SCCs That Map to SCC 30301511

SCC and Status	SCC Level 3 Description	SCC Level 4 Description	Number of Emission Factors	Emission Factor
Map-to SCC				
30301511	Integrated Iron and Steel Manufacturing	Blast Furnace: Charging	0	NA
Retired SCC				
30300801	Iron Production (See 3-03-015 for Integrated Iron & Steel MACT)	Ore Charging	1	41.8 lb/ton
30300802	Iron Production (See 3-03-015 for Integrated Iron & Steel MACT)	Agglomerate Charging	1	15.20 lb/ton

2.2.4 The map-to SCC has an emission factor in WebFIRE

2.2.4.1 *WebFIRE does not have emission factors for the retired SCCs*

In this case, use the emission factor associated with the map-to SCC.

2.2.4.2 *WebFIRE has emission factors for the retired SCCs*

The question here is whether it is appropriate to exclude the original emission factors for the more detailed technologies represented by the retired SCCs in favor of using a more “generic” or averaged out emission factor for the new map-to SCC. It may not be appropriate to use the old emission factors, for example, if they are revoked. However, if the facility is still using the technology as originally described by the more detailed SCC, and the SLT has expertise to assess that this technology is not appropriately represented by the more generic emission factor for the map-to SCC, then perhaps the recommendation here is to continue to use the original emission factor. Guidance from WebFIRE on whether this is appropriate or not (i.e. if the original emission factor is truly inappropriate and thus revoked given new information or better data, versus simply being lost due to the new SCC), would be very helpful to reporters.

3 Emission Factor Units of Measure, Throughputs, and Types of Activity

3.1 Multiple Units of Measure, Throughputs and Types of Activity

WebFIRE contains active emission factors for 2,649 point source SCCs. Emission factors describe an amount of pollution given an amount of activity. In very general terms:

Emission Factor = Amount of pollutant emitted (numerator) / Amount of activity that emits that pollutant (denominator)

Activity is expressed as: a material (also referred to as throughput for emission inventory reporting), the unit of measure (UOM) of that material (e.g. tons, megawatt hours, etc.), and actions (e.g. produced, stored, burned, etc.).

From the perspective of the reporter, an emission factor can be used for reporting if it is expressed in activity values that the reporter can measure or calculate. If, for a single SCC, the emission factors for the multiple pollutants associated with that SCC are all expressed in the same units of measure, for the same material (throughput) and action, this allows the reporter to estimate all emissions for this SCC with relative ease. However, if some emission factors are expressed in different units of measure than others, or there are different material throughputs, and/or actions for the different emission factors, this begins to make it time consuming for the reporter to do all necessary calculations. From the perspective of the webservices that could be built for use in CAERS and SLT systems, this also adds a layer of complication in that some units of measure are easily convertible to others, but some are not.

Table 3-1 shows the number of instances where SCCs have emission factors with one or more combinations of UOM, material, and action. For example, 84% of SCCs (2,224) in WebFIRE have emission factors for all pollutants using the one UOM, material, and action combination. On the opposite extreme, SCC (50100701) has 33 combinations of UOM, material, and action. Appendix B shows more details about these calculations.

Table 3-1 also shows the number of SCCs with one or more materials, measures, actions. For example, two SCCs have emission factors listed with 5 different materials, 68 SCCs have emission factors listed with 3 different UOMs, and 290 SCCs have emission factors listed with 2 different actions.

Table 3-1. Number of SCCs with Active Emission Factors in Different Materials, Measures, Actions, and Combinations for Point Sources

Number per SCC	Number of SCCs for Material	Number of SCCs for Measure	Number of SCCs for Action	Number of SCCs for Combination
33	1			1
8	1			1
7				2
5	2			2
4	4	7	1	16
3	47	68	9	114
2	305	206	290	289
1	2,289	2,368	2,349	2,224
All	2,649	2,649	2,649	2,649

The differences in throughput materials, measures, actions, and combinations are coming from the conditions and parameters in performance tests that are associated with emission factor development.

3.1.1 Convertible Throughput Materials, Measures, Actions, and Combinations

Some of the differences are generally related and could be converted. There are two situations:

3.1.1.1 Fuel burned and heat input for a process could be converted with the fuel heat value.

Ninety four out of 305 SCCs with two materials are related to external and internal combustion with one material for heat and another one for fuel. Those 94 SCCs include 81 with SCCs whose code starts with 1 and 2, another 13 SCCs whose code starts with 3 and 5. For example, for SCC 10100101 (External Combustion Boilers > Electric Generation>Anthracite Coal>Pulverized Coal), there are 21 emission factors (some numerical, some formulas). Most of these are expressed as pounds of pollutant (numerator UOM) per ton (denominator UOM) of anthracite (material) burned (action). But one is expressed as pounds per million BTUs (denominator UOM) of heat (material) input (action).

3.1.1.2 Throughputs for the same material and same action but in different measures could be converted with constants.

An example of this is SCC 10100204 that has emission factors for PM10 filterable in Tons of Bituminous Coal Burned, and emission factors for Arsenic and Cadmium in Million BTUs of Bituminous Coal Burned.

The approaches used in the current SLT emission inventory systems to assist in the use of emission factors with different UOMs, throughputs, and actions are as follows:

- A. The system only allows one default throughput for one process, usually the default throughputs are set based on SCC. All throughputs of emission factors must be in the same process defaults. WI has this approach.
- B. The system allows multiple throughputs for one process. Reporters must enter process throughputs matching emission factor throughputs for each pollutant in the process. There are two approaches:
 - 1) The system does not perform emission calculations; reporters must enter emissions for the pollutants.
 - 2) The system performs emission calculations based on the throughput amount and emission factor amount.

The option to enter alternative throughputs is already in CAERS, although energy conversions are not currently possible. The ability to have either converted emission factors from WebFIRE, or allow the conversion to happen in CAERS is a desirable enhancement contemplated for future versions of WebFIRE and CAERS.

- C. The system allows reporters to enter multiple throughputs for emission factors that are convertible to process throughputs. The system converts throughput fuel amounts to throughput heat amounts based on process-specific heat contents; and converts throughput measures with constants. However, reporters must enter a process throughput and an emission factor for each pollutant emitted from the process to enable the conversion and the emission calculation.
- D. The system allows multiple throughputs for emission factors that are convertible to the process throughputs. The system converts throughput fuel amounts to throughput heat amounts and converts throughput measures with constants. The system auto populates the process throughput and corresponding emission factor for each pollutant emitted from the process. Emissions are calculated automatically for all pollutants with corresponding emission factors. There are also two practices here:

- 1) The system only auto populates one default process throughput, corresponding emission factors, and emissions for one process. The system allows throughputs other than the default in the process; but reporters must enter the throughputs and emission factors to enable emission calculation. This is the practice in MN online reporting system.
- 2) The system auto populates all multiple process throughputs, corresponding emission factors, and emissions for one process. This is the practice in MN desktop emission inventory system.

3.1.2 Unconvertible Throughput Materials, Measures, Actions, and Combinations

While an energy conversion is relatively straightforward to do with the use of fuel heat content, and the use of constants also enables easy conversions (e.g., from tons to lbs), for some emission factors, a conversion is not as straightforward. Other differences are very process-specific and do not have a generic conversion. For example, Tons of Materials Processed and Tons of Toluene Diisocyanate Produced for SCC 30118180; Tons of 100% Sulfur Produced, Tons of Sulfur Produced, and Million BTU of Heat Input for SCC 30103201. There are no constants that can be used to convert among them.

Most SLT EI systems use the approaches outlined in A and B in section 3.1.1.2 above for this situation.

The Minnesota desktop emission inventory system can automatically calculate emissions for multiple throughputs. As long as one throughput is entered for a process, all emission factors corresponding to the throughput will be used automatically to calculate emissions for pollutants associated with those emission factors.

3.2 Recommendations for CAERS

CAERS needs to be able to use emission factors with both convertible and non-convertible throughputs in WebFIRE. The following are some recommendations:

1. Convertible Throughput Materials: CAERS should be able to perform conversions so that emission factors of different UOMs can be used with different throughput values.
 - 1) Fuel/heat conversions
 - i. CAERS should at least have a place for users to enter heating values at a process level and use the heating values in conversion. Accompanying this feature, a future enhancement of CAERS would run a QA check on the fuel type to ensure that the heat content claimed is not an error, and that an appropriate value is being used for the fuel in question. Further, high and low heat value bounds could be placed in a similar QA check.
 - ii. In an advanced stage of CAERS development, it should allow users to enter heating values also at an SCC level, a state level, and a generic level. Those heating values should be used in the conversion following a prioritization schema (from the highest to the lowest):
 1. Process-specific
 2. SCC-specific
 3. State-specific
 4. Generic

There are several sources for heating values. At the time of this study the list of heat values listed in Appendix C was being incorporated into CAERS for reference to

reporters. Some SLTs also use their state-specific heating values or SCC-specific heating values. When a reporter selects UOMs for their fuel use that is in the same UOMs as this list, CAERS automatically prepopulates the default heat content. In future, CAERS should be customized to allow SLTs to use specific heat content values for their reporters, and should also allow simple fuel conversions from the default heat content to the UOMs the user has entered. See Appendix D for examples from the state of MN.

- 2) CAERS should be able to convert the different measures for the same throughput material.
 - i. At least it should be able to auto convert the most commonly used measures for the same throughput material. For example, from LB to TON, FT3 to E3FT3, SECOND to HR. At the time of this study, CAERS was already enabled to perform simple conversions of this kind in the user interface, when the reporter is using an emission factor to calculate emissions and the throughput UOMs can be converted to match the emission factor UOMs.
 - ii. In an advanced stage of the CAERS development, it should be able to automatically convert almost all used UOMs for the same throughput material. For example, from HP-HR to E6 BTU, MEGAGRAM to LB.

CAERS is already able to calculate emissions when a user enters an emission factor. As described above, since CAERS MVP users have been able to use different UOMs for the throughput, where convertible, to perform simple conversions between like units of measure to allow the throughput UOMs to match the emission factor UOMs. For example, if the user has a throughput in lbs, but the emission factor denominator is in tons, then CAERS will automatically do the conversion so that the emission factor can be used. Similarly, if throughput and the emission factor denominator are in different systems (metric versus imperial), CAERS will factor the conversion into the emissions calculation directly.

- 3) A more advanced form of conversion that CAERS should do in future would be for it to automatically calculate emissions for all pollutants that have emission factors in convertible throughput or matching throughput with multiple throughputs for a process when users enter those throughputs. This auto-calculation feature will be considered for inclusion in future versions of CAERS. Since the first version of CAERS (MVP), the user must recalculate all emissions when using the user interface, but can automatically recalculate emissions when entering updated throughput values in the bulk entry screen.
2. Non-convertible throughput materials: Non-convertible throughput materials are difficult for reporters to handle because a straightforward conversion factor simply doesn't exist. Thus, at the time of this study, CAERS MVP was being enhanced so that reporters can enter different throughputs for the same process in CAERS V2. This allows the calculation of emissions from different pollutants for a process, using emission factors in with non-convertible UOMs. When an emission factor for a pollutant cannot be converted, the user can, instead, use an alternative throughput for that pollutant, so that the emission factor can be used.
 3. To perform automatic emissions calculations, the emission estimator needs to be improved to handle possible emission factors in multiple throughputs for one pollutant in one process.

One additional point to note is that WebFIRE contains, in many instances, recommendations for conversions. For example, for SCC 10100901, External Combustion Boilers > Electric Generation > Wood/Bark Waste>Bark-fired Boiler, the “Notes” column entry contains: “To convert the emission factor from Lb/MMBtu to Lb/ton, multiply the emission factor by (HHV * 2000) where “HHV” is the higher heating value of the fuel (MMBtu/lb). Factors are for boilers with no controls or with particulate matter controls.” Similarly, SCC 20100101, Internal Combustion Engines > Electric Generation > Distillate Oil (Diesel) > Turbine. In the future, the ability for these types of notes to be readable by CAERS and other systems, would allow CAERS to assist the user in such a conversion by automatically prepopulating the suggested high heat value, for example, where appropriate. In CAERS, through customizations, the SLT could also set specific values for high and low heat content, as appropriate for certain facilities and processes.

4 Emission Factor Ranges and Formulas

Although most emission factors are in discrete values (one number), some emission factors are in a “less than” format, a range, or a formula. This section has been developed to assist in including these factors in CAERS in an appropriate and usable way.

Table 4-1 shows active emission factors by factor types for point sources. For brevity, only revoked factors have been tabulated. The reader should note that revoked factors are also listed in WebFIRE. The PDT feels it important to track revoked emission factors in case revisions are required or analysis are needed on previously reported data in emission inventories.

Table 4-1. Number of Emission Factors by Factor Type for Point Sources

Emission Factor Type	Total Number of Emission Factors	Active Emission Factors
Discrete	23,334	19,318
Less than	412	393
Range	234	211
Formula	1,399	840
Total	25,379	20,762

4.1 Emission Factors in “Less than” Format

About 304 of the 412 emissions factors in “Less than” format are from AP-42. All emission factors in “Less than” type seem to have been developed in the 1990’s. According to the background information documents from several chapters of AP-42, EPA used the procedures outlined in “Procedures for Preparing Emission Factor Documents,” U.S. EPA, EPA-454/R-95-015, November, 1997, when all runs and tests are non-detects, half the detection limit is presented with a “less than”.

EPA further provided draft final guidance on Recommended Procedures for Development of Emissions Factors and Use of the [WebFIRE Database](#) in 2013. Page B-3 of the 2013 procedure indicates if all candidate data are below the minimum detection limit (BDL), then an emissions factor is not determined; the emissions factor is reported as “BDL” and the range of minimum detection limit (MDL) values from low to high will be provided in the comment field. The 1997 procedures may be more appropriate for the emission factors in the “less than” type.

WebFIRE lists any emission factors that should be less than a value with the “<” preceding the value. For example, for SCC 10300903, for Benzaldehyde, the factor listed is “< 8.500E-7”. Some SLTs discard all emission factors in the “less than” type such as WI, which results in no emissions reported for the pollutants with the “less than” type emission factors from the processes (SCC). However, those pollutants tested are usually present from the relevant processes, unless a facility has reasons to believe a non-detected substance is not present in its process.

The recommendation for using emission factors in “less than” format is to use the values after the “<”. This approach has been taken by many SLTs in their emission inventory compilation when better emission factors are not available, such as IL, MI, MN, OH, and WY. CAERS V2 contains the emission factor value presented in WebFIRE with the comment that it is expected that the value of the emission factor will be less than the number provided.

4.2 Emission Factors in Ranges

There are 234 emission factors represented as ranges in WebFIRE. For example, SCC 30400301 has a factor of “1.000E-1 - 1.100E0” for lead. Among those 234 emission factors, 198 are from AP-42. AP-42 indicates that the ranges for many emission factors represent the ranges of factors reported in the literature. For other emission factors, the value reflects the variation of process throughputs, controls, and quality of products. Although some SLTs discard WebFIRE emission factors in ranges, such as WI, the reasonable recommendations for using emission factors in ranges are as follows: first, based on process specifications if the information is achievable; second, generally using an average of upper bound value and lower bound value without process specific information. For example, an uncontrolled Lead emission factor for SCC 30400301 is 1.000E-1 - 1.100E0 lb/tons of Gray Iron, the value $\frac{1}{2} * (1.000E-1 + 1.100E0) = 0.6$ lb/tons of Gray Iron is used. This approach is used by other SLTs as specified above. CAERS V2 does, in fact, contain the mid-range value in the cases where the emission factor is represented as a range. For SCC 30400301, for Lead, CAERS lists “0.6” with the comment that this value represents the mid-range of the expected emission factor. However, further guidance on WebFIRE on whether there are cases where this value is not appropriate, and how best to represent it in CAERS will help in future.

4.3 Emission Factors as Formulas

Although WebFIRE contains active emission factors for 288 pollutants, the emission factors as formulas are only for 13 pollutants. Table 4-2 shows the number of active emission factors in formula for each pollutant.

Table 4-2. Number of Active Emission Factors in Formula for Each Pollutant

Pollutant	Number of Emission Factors in Formula for the Pollutant
Carbon dioxide	7
Hydrogen chloride	1
PM, condensable	108
PM, filterable	125
PM, primary	3
PM ₁₀ , filterable	135
PM ₁₀ , primary	46
PM _{2.5} , filterable	125

PM _{2.5} , primary	46
Sulfur dioxide	47
Sulfur oxides (SO _x)	166
Sulfur trioxide	29
Volatile organic compounds (VOC)	2
Total	840

4.3.1 General Analysis

Among the 840 active emission factors in formula, 751 emission factors are for internal and external combustion (SCCs start with 1 and 2). Seventy five of the remaining 89 formula emission factors are for SCCs starting with 3 and 4, which are for process heaters or in process fuel use. Only 14 formula emission factors are not combustion related.

For the 816 out of 826 formula emission factors related to combustion, the variables in formulas are the weight percent sulfur content of the fuel (S %) and the weight percent ash content of the fuel (A %) except for carbon dioxide and hydrogen chloride. Emission factors for these two pollutants use the weight percent of carbon or chlorine in fuel.

For the 14 formula emission factors not related to combustion, the variables are SCC-specific.

Therefore, if an emission inventory system can handle formulas with S% and A%, the system will be able to handle > 97% of WebFIRE emission factors in formula. For example, the Minnesota and Wisconsin emission inventory systems are designed to automatically using S% and A% in the fuel to achieve emission calculations with the formulas. For the other emission factors in formula, Minnesota uses default variable values to calculate discrete emission factors while allowing facilities to report process-specific emission factors. See Appendix D for MN specific Ash and Sulfur % values.

4.4 Recommendations for CAERS

To promote the use of emission factors in formula, the recommendations for CAERS are as follows:

1. CAERS should be able to handle emission calculations with formulas at least for those formulas using A% and S% if it cannot not handle formulas using all parameters.
2. CAERS should allow reporters to specify process-specific A% and S% and use those process-specific parameter values in emission calculation.
3. CAERS should allow SLTs to specify their jurisdiction-specific A% and S% and use those jurisdiction-specific parameter values in emission calculation when the process-specific A% and S% are not available. The SLT specific default could also have an SLT specific upper and lower bound to enable customized QA checks.

Those jurisdiction-specific values could be found in AP-42 APPENDIX A, MISCELLANEOUS DATA AND CONVERSION FACTORS or compiled by SLTs based on their jurisdiction specific defaults.

4. If it is possible, CAERS will allow SLTs to specify SCC-specific A% and S% and use those process-specific parameter values in emission calculation when the process-specific A% and S% are not available. The SCC-specific A% and S% will be used before seeking the jurisdiction-specific A% and S%.

At the time of this study, CAERS V2 was set up to read the relevant formulas from WebFIRE, and present to the user the relevant data fields to include for the formula calculation. In the bulk upload, the user must select the right formula from one of the reference tabs, and then enter the relevant fields. In future, if the SLT has state or site specific factors that require formulas, these can be uploaded into CAERS for use by that SLTs reporters.

5 Recommendations for Other WebFIRE Issues

5.1 Data for Revoked Emission Factors

WebFIRE, as the retrieval system, maintains all historical emission factors, and never deletes any emission factors. It should continue to maintain this integrity as part of a historical record. However, there is some incompleteness in data for revoked factors that make it confusing to reference these factors. Note that while it is understood that maintaining a historical record is helpful for reference, *EPA never recommends that users continue to use an emission factor after it has been revoked*. Given that revoked emission factors should not be used by reporters, EPA considers addressing issues exclusive to revoked emission factors lower priority than other issues that need attention in WebFIRE. It is important to note that the reason for the factor being revoked should weigh in on whether the factor is even appropriate to use for revisions of data reported in previous years.

WebFIRE contains emission factors in formula type, but 3 formulas (for revoked emission factors) show “No Data” in the Formula field.

Based on AP-42 and the bulk download file from WebFIRE, these factors do not contain data and are therefore referred to as ‘ND’ (No Data) in the chapter. For these factors, the ‘No Data’ entry will be moved from the ‘Formula’ field to the ‘Factor’ field to make clear that no factor should be expected to appear in that field.

5.2 Complete Missing Data

5.2.1 Missing Data

1. For the following 2 SCCs, 30500321 and 50200602 (50 records), there is missing data in the data fields:
 - Unit
 - Measure
 - Material
 - Action

It is important to have complete data so that CAERS and other systems can provide reporters with the best possible data, or clarity as to why data may not exist or be available so the user is not confused. The WebFIRE team has noted this gap in the data and will address it.

2. The QUALITY field in WebFIRE provide the quality rating for emission factors. The quality could be A, B, C, D, E, and U with A at the highest quality and U as untradeable. However, there are missing values in quality field for 80 records. Among those 60 records are revoked.

In the future, the WebFIRE team has plans for upgrading the current quality rating system with the new version of WebFIRE. At that time the team will be able to ensure the data for quality is complete.

5.3 Improve Inconsistencies

5.3.1 WebFIRE includes maximum two control measures for one emission factor.

The PRIMARY field indicates if the control measure is primary or secondary. If an emission factor is controlled by two control measures, WebFIRE has two records for the same FACTORID. Value “1” in the PRIMARY field indicates the control measure is the primary control measure and value “0” in the PRIMARY field indicates the control measure is the secondary control measure. If an emission factor is only controlled by one control measure or uncontrolled, the PRIMARY field should be “1” too. However, this field is null for 10,040 records (including 3,334 revoked records), 1,613 SCCs (149 revoked). Among 10,040 records, 773 (60 revoked) emission factors (1,546 records) have two control measures, but it is not possible to distinguish the primary control measure from the secondary control measure.

For use of these emission factors, a clear indication of the primary and the secondary control measures is necessary. For CAERS to read the list of emission factors without errors, in order to assist users, the data in the data fields must be laid out consistently. Also, it is recommended that a list of data fields and their values and meanings be provided for users. In this way, users will know when and how to use specific emission factors. CAERS would be able to point users to that resource as it already contains a glossary for NEI data fields.

The WebFIRE team has noted this issue and is looking into it. In future, consistency will be added.

5.3.2 The “REF_DESC” field does not match AP42SECTION field.

For example, for 45 emission factors from AP 42 12.10, “AP42SECTION” column in WebFIRE lists them as belonging in “12.1”, which is not the same chapter. A list of the factor ID’s with this problem is listed in Appendix E

5.4 Clarity for Duplicate Factors

There are 711 emission factors (229 revoked) that are duplicated. The duplicated emission factors are for the same SCC, the same pollutant, and the same control measures, but with different information in the NOTES and DUPREASON fields. The reason for the duplication could be the description of additional controls, testing methods, operation conditions, or different processes. It is very hard for any automated EI system to pick up the appropriate emission factors from the duplicates. An example of this problem was noted in section 2.2 for emission factors for SCC 30102410. Factor ID’s for duplicate emission factors are listed in Appendix F.

The WebFIRE team has noted the issue of duplicate emission factors. This issue was already in the process of being corrected while this study was ongoing.

In future, for CAERS and other reporting systems using WebFIRE webservice, those systems could pre-select factors given specific criteria entered by the reporter, based, for example, on the most popular scenarios for the SLT. Facilities could be allowed to select emission factors that fit their real-life situation. Future work is needed to determine what those criteria would be and add those in a consistent format in WebFIRE.

5.5 More Easily Readable Formula Conditions

5.5.1 Certain SCCs are used for different fuel types per SCC.

1. Emission factors are dependent on fuel types. This causes trouble when reporting systems need to perform auto emission calculations. For example, SCC 10200402 is for External Combustion, Industrial: Boilers, Residual Oil, 10-100 Million BTU/hr. Residual oil has different grades. Particulate emission factors for residual oil combustion without emission controls are, on average, a function of fuel oil grade and sulfur content where S is the weight % of sulfur in the oil. There is a formula for PM10-FIL, 7.17 A, where:

$$A = 1.12(S) + 0.37 \text{ for No. 6 oil}$$

$$A = 1.2 \text{ for No. 5 oil}$$

$$A = 0.84 \text{ for No. 4 oil.}$$

For this particular SCC and many others like it, the different formulas, as suggested for the different oil grades are listed in the “notes” section as follows “Particulate emission factors for residual oil combustion without emission controls are, on average, a function of fuel oil grade and sulfur content where S is the weight % of sulfur in the oil. For example , if the fuel is 1.00% sulfur, then S=1. For Number 6 Oil: A=1.12(S)+0.37. For Number 5 Oil: A=1.2. For Number 4 Oil: A=0.84.” In this case, the recommendation is to separate the emission factors and list each by type of fuel to reflect the residual oil grades. This would make it easier for a reporting system using the WebFIRE webservice, and for CAERS, to read the correct emission factors in. Another suggestion is for WebFIRE to list each one out per fuel grade.

5.5.2 Emission factors could be associated with conditions but WebFIRE does not show the condition.

For example, AP-42 Table 1.1-5. CONDENSABLE PARTICULATE MATTER EMISSION FACTORS FOR BITUMINOUS AND SUBBITUMINOUS COAL COMBUSTION lists a formula emission factor, $0.1S - 0.03$, for many SCCs. However, when the coal sulfur percent is 0.4 or less, this formula provides a negative value. AP-42 guidance says to use a default emission factor of 0.01 lb/MMBtu rather than the emission equation. WebFIRE only shows the formula emission factor, not the default for $S < 0.4$. Instead, this information is found in the Notes column in WebFIRE. For example, for SCC: 10100302 and 10300306, the Notes column reads: “Factors should be multiplied by fuel rate on a heat input basis (MMBtu) as fired. If the coal sulfur percent is 0.4 or less, use a default emission factor of 0.01 lb/MMBtu rather than the emission equation. S=% Sulfur content. 80% of the condensable PM is inorganic; 20% of the condensable PM is organic.”

It is possible for an emission inventory (EI) system to handle the problem by setting a condition in the formula. For example, the MN EI system is able to do so. If WebFIRE sets the formula in that way, it will be easy for an automated EI system to adapt. As with the previous issue, the WebFIRE team and the CAER team will determine a way to include this kind of information and make it readable via webservices.

5.6 Shed Clarity on Methodology Discrepancies

5.6.1 PM Emission Factors for Natural Gas Combustion

In previous years, PM10-PRI, PM2.5-PRI and PM-CON emission factors for natural gas combustion AP-42 and WebFIRE were found to be too high because of artifact formation in test method 202. As a result, values for 46 point source SCCs were adjusted. See the files are provided as:

- Appendix G “ratios_to_adjust_pmvalues_in_nei_for_naturalgas_combustion082005.xls” and
- Appendix H “NG_process gas_LPG_PM factors_from EPA Feb 3 2010.xls”.

These values were used to adjust the 2002 NEI. However, the original emission factors themselves were never corrected. Thus, it is necessary to continue adjusting any estimates that use the original emission factors.

The WebFIRE team has taken note of this problem. Test results for the revised method 202 will help update these values so that this method can be supported with real data. In order for the team to be able to update method 202, it is necessary for sources to conduct testing and submit results so as to produce reliable factors. Without incoming data, it is not possible for WebFIRE to create and publish a reliable emission factor.

5.6.2 Metal Emission Factors for SCC 30400403

For SCC 30400403, Industrial Processes > Secondary Metal Production > Lead > Blast Furnace (Cupola), the original reference was: EPA. October 1990, in “Assessment of the Controllability of Condensable Emissions. EPA-600/8-90-075. U.S. Environmental Protection Agency, Air and Energy Engineering Research Laboratory. Research Triangle Park, North Carolina. However, the WebFIRE emission factor data were entered incorrectly, by several orders of magnitude.

Table 5-1 shows the emission factors in WebFIRE and in the original reference (page 2-32 on pages 2-32 to 2-33 for blast furnaces with afterburner, cyclones, and fabric filter control).

Table 5-1. Comparison of Emission Factors for SCC 30400403 in WebFIRE with the Original Reference. (Emission Factors are in lb/tons of Lead Produced)

Pollutants	WebFIRE	Original Reference
Antimony	< 1.300E0	<1.3E-04
Arsenic	2.90E+00	<2.9E-04
Beryllium	2.20E+00	<2.2 E-05
Cadmium	1.30E+00	<1.3E-04
Chromium	1.90E+00	<1.9E-04
Manganese	< 1.100E0	<1.1E-05
Mercury	2.20E+00	<2.2E-06
Nickel	1.00E+00	<1.0E-04

The WebFIRE team has noted the need to make these corrections, and is in the process of issuing these corrections.

5.6.3 Remove or Clarify Inconsistencies Between SCCs

5.6.3.1 Differences Between Emission Factors For Similar Processes

There is a discrepancy among emission factors for similar processes, that seems to be mainly due to emission factors from a variety of reference sources that reflect performance tests conducted in different time periods and/or by different companies.

Table 5-2 shows an example for uncontrolled emission factors of formaldehyde between two external combustion boiler SCCs that are for external combustion boilers burning Grade 5 Oil. The factors for the two SCCs are different by 4 orders of magnitude.

Table 5-2. Comparison of Uncontrolled Emission Factors for Formaldehyde

SCC	LEVEL2	LEVEL3	LEVEL4	FACTOR Value
10100405	Electric Generation	Residual Oil	Grade 5 Oil: Normal Firing	4.70E-01 lb/MBTU
10200404	Industrial	Residual Oil	Grade 5 Oil	4.70E-05 lb/MBTU

Another similar case is observed for benzo(a)anthracene emission factors (Table 5-3) as the original emission factor for SCC 31000402 is listed as < 5.510E-5 lb/million BTU heat input, or < 8.265E-3 lb/1,000 gallon burned, and 4.010E-6 lb/1,000 gallon burned is listed for and SCC 10100404. SCC 31000402 is a process heater for oil and gas production using residual oil, while SCC 10100404 is for an external combustion boiler for electric generation also using residual oil (Grade 6 Oil: Tangential Firing). There are no significant differences between process heaters and boilers, so it is not easy to reconcile this large difference in emissions factors.

Table 5-3. Comparison of Uncontrolled Emission Factors for Benzo(a)anthracene

SCC	LEVEL2	LEVEL3	LEVEL4	FACTOR Value
31000402	Oil and Gas Production	Process Heaters	Residual Oil	< 8.265E-3 lb/1,000 gallon
10100404	Electric Generation	Residual Oil	Grade 6 Oil: Tangential Firing	4.010E-6 lb/1,000 gallon

This problem was identified in 2002, Velalis, T. and Wu, C.Y., Applicability of FIRE Emissions factors in State-Wide Emission Inventories. In Proceedings of the 101st Annual Meeting of the A&WMA, Portland, OR, June 24-26, 2008. EPA should carefully investigate the differences and provide a permanent solution to the discrepancies, or provide the rationale for differences such as these, so that users of the factors understand under which conditions one or the other would apply.

5.6.3.2 Inconsistencies between factors for individual versus pollutant groups

Occasionally, the sum of speciated HAP emissions produce emissions greater than the VOC factor produces at a singular process. AP-42 acknowledges the issue but the language in AP-42 implies it is acceptable to report individual organic compounds with a sum-total that exceeds the VOC or TOC emission totals. For example, a footnote in AP-42 Table 1.4-3 – External Natural gas combustion indicates “The sum of individual organic compounds may exceed the VOC and TOC emission factors due to differences in test methods and the availability of test data for each pollutant.” However, in reality, this is an artifact of the different test methods used to arrive at emission factors.

The state of Oklahoma provides a guidance to the regulated entities in regards to this issue: In every case, the availability of an emission factor and its quality/applicability both must be considered to determine proper use, especially when mixing emission factors from various information sources or tests. Where VOC emission quantities appear to be less than the sum of individually reported VOC HAPs, the source is asked to ensure the derived values use the most accurate/highest quality emission factor(s) as the foundation of emission calculations. It is the company’s duty to ensure that emissions

are reported appropriately (that no individual pollutants are improperly included or excluded from VOC). At no time and under no circumstances should VOC be less than the sum of individually reported HAPs that are also VOCs.

Based on Oklahoma 's guidance, the recommendation for CAERS is to add one QA/QC check to make sure the sum of VOC HAP emissions is less or equal to VOC emissions for a process. CAERS will show a critical error if the above condition does not meet and the facility will not be able to submit its emission report until the error is corrected. The CAER team has noted this suggestion, as it is also a QA check that the inventory developers would appreciate. In addition, any guidance and clarity that can be shed on why emission factors listed in WebFIRE may be producing this discrepancy, will help industry reporters and SLTs understand which factor(s) are appropriate under which conditions.

5.6.3.3 The emission factors in "Download WebFIRE Data in Bulk" are different from the online "Emission Factor Search" results. For example, there are 22 active emission factors in the bulk downloaded WebFIRE for SCC 10200402, but only 10 active emission factors obtained from online "Emission Factor Search" for the SCC.

The WebFIRE team has noted these differences and will ensure that in future, both the downloadable list of emission factors as well as the searchable list are drawing from the same master list.

Appendix I shows a list of steps that the state of WY takes to curate the list of emission factors in WebFIRE so that it can use that list in its reporting system. In future, it would be ideal for SLTs and CAERS staff not to have to make those updates manually, either because WebFIRE contains the necessary data in a format the system can read, or that such steps can be automated.

6 References

"Procedures for Preparing Emission Factor Documents," U.S. EPA, EPA-454/R-95-015, November, 1997.

[WebFIRE Database](https://www.epa.gov/air-emissions-factors-and-quantification/procedures-development-emissions-factors-stationary-sources) in 2013 (<https://www.epa.gov/air-emissions-factors-and-quantification/procedures-development-emissions-factors-stationary-sources>).

AP-42 Appendix A, Miscellaneous Data and Conversion Factors

AP-42 Table 1.1-5. Condensable Particulate Matter Emission Factors for Bituminous and Subbituminous Coal Combustion

EPA. October 1990, in "Assessment of the Controllability of Condensable Emissions. EPA-600/8-90-075. U.S. Environmental Protection Agency, Air and Energy Engineering Research Laboratory. Research Triangle Park, North Carolina.

2002, Velalis, T. and Wu, C.Y., Applicability of FIRE Emissions factors in State-Wide Emission Inventories. In Proceedings of the 101st Annual Meeting of the A&WMA, Portland, OR, June 24-26, 2008.

AP-42 Table 1.4-3 – External Natural gas combustion indicates "The sum of individual organic compounds may exceed the VOC and TOC emission factors due to differences in test methods and the availability of test data for each pollutant."