Does Your Emission Inventory Make Sense?
Checking Your Inventory for Errors

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ABSTRACT

The Environmental Protection Agency (EPA) develops and maintains the National Emission Inventory (NEI), containing detailed information on emissions of criteria pollutant from all sources, as appropriate. The NEI for calendar year 1999 was completed in October 2002 and is now final and publicly available. This 1999 NEI is called version 2 and is the first 1999 emissions inventory (EI) to contain data from state, local, and/or tribal authorities (S/L/T) (earlier versions of 1999, version 1.0 and 1.5, were developed by applying growth factors to 1996 emissions for most point and some area sources, adding EPA information on 1999 emissions from electric generating units (EGU), and creating estimates of 1999 emissions for some other area source categories and for mobile sources. EPA is currently working on Version 3.0, which builds on version 2.0 and adds more data from the S/L/T's). All data submittals must be in proper format before EPA can load onto our server, therefore EPA checks for format errors. There are some checks for content errors that EPA does and some outliers get identified, but for the most part, if bad data exist in the state submitted data, it will continue to exist in the NEI. Also, as EPA add data from other information sources, some inaccuracies may be introduced. Obviously a S/L/T review of the NEI is critical, but how best to review? How should the inventory be reviewed for errors? What are some tips to help a reviewer focus his/her limited time and gain the most benefit? This paper attempts to answer these questions and offer suggestions on how interested parties, particularly state, local, and tribal agencies, could conduct their review.

INTRODUCTION

This discussion will mostly consider point sources and not be specific to any particular year. Before we get started, let us orient ourselves with what resources are typically available. For every NEI review cycle, the EPA will post on the CHIEF website (http://www.epa.gov/ttn/chief/) four categories of information. The resources are listed below.

RESOURCES

1. **EPA Announcement**. This is a copy of the Listserve announcement by EPA that a draft NEI is out for public review. The announcement has a lot of information, including what exactly is ready for review, when the revisions are due to EPA, known uncertainties, errors, and open issues with the NEI, and the exact website where NEI information can be downloaded.
2. **README file**. This file is a roadmap to all the information regarding the NEI.. Information about the data files, data summary files, and the documentation files are in this file. Also in the README file are directions on how to submit corrections to the EPA.
3. **EI data**. The EI data is available by state or for the nation. All of the EI files are in the NEI Input format (NIF). The individual state files are zipped and in Microsoft Access. There are also data summaries, which do not have the detail that the NIF data files have but the presentation of the data makes it easier to understand, and can be quite useful in your review.
4. **Documentation**. Each sector (point, area, onroad, and nonroad) has a pdf document that explains how the particular sector was developed. Essential reading for reviewers.

GETTING STARTED

Where should you begin? First, retrieve the data and the other resources that EPA provides.

Step 1. Download the EPA's announcement file from the CHIEF website and the README file from EPA's CHIEF website (http://www.epa.gov/ttn/chief/net/index.html#1999). Read.

Step 2. Download your S/L/T data from the web. The file is a zipped Microsoft Access file in NEI Input Format (NIF). Unzip your point source data file. You should see eight tables. These are the data records that the EPA has for your State/Local/Tribal agencies. It is important to note that if you submitted point source data to EPA, then what you are looking at is what you submitted to EPA *plus* the changes EPA made (see point source documentation for information regarding EPA's changes). So it is different than the data you submitted, and part of your review will be to get familiar with the changes EPA made. Note that in the emissions table (EM), one of the blank fields is used for the data source code. The data source code indicates the source of the data. For example, if the data source code is a "S", then the emissions are from a state submittal. The data source codes are explained in full in the README file and the Point Source documentation. If you did not submit point source data to EPA, then what you are looking at is what EPA has for your S/L/T. In this case, EPA's data is carried over from some previous year and might be significantly out of date. Now is an opportunity for you to update/improve the point source inventory data that EPA has for your S/L/T. Please note that these are also the records that you should use to transmit back to EPA any corrections. More about that later. Questions about the NIF? Check out EPA's website for more information (http://www.epa.gov/ttnchie1/nif/index.html).

Step 3. Download the documentation file for the point source NEI. This is a single pdf file that applies to the entire point source NEI, with an appendix that gives information specific to individual states. Read this for general information on how the EPA developed the NEI, and also for information on what EPA did to the point source data that your S/L/T submitted. EPA also points out in this document any particular issues/questions we have with your inventory.

Step 4. Download the facility summary file for Draft Version 3.0. EPA provides numerous data summary files. A description of these files is in the documentation. These files will be used to facilitate your review. For point sources, the facility summary file will be quite useful. This is a list of all the facilities in the NEI with all of the criteria emission crosstabbed. More on this file later.

REVIEW TIME

We recognize that you, the reviewer, do not have unlimited time or resources to review the NEI and should prioritize and start reviewing the NEI where you can get the best value for your effort. Our suggestion is that you take the following strategy and do these three steps.

1. Address the issues that EPA flags. You will find the issues that EPA wants the S/L/T's to address in the announcement as well as in the sector documentation.
2. Check your top twenty. Make sure the data for the twenty top polluters are correct. Recall that one of the assumptions made in this paper is that reviewers have limited time to review the NEI and probably should adopt a common sense approach to get the best review in the limited available time. Obviously, if you have more time, extend your facility review to more facilities.
3. Review the point source inventory for consistency. The purpose of this review is to step back and look for odd things in the inventory. I present some suggestions on how to do this in this paper.

4. Missing Facilities. Compare the current NEI against an older inventory**.** Did some facilities get skipped in the most recent NEI?
5. Check for double counting.

Address EPA-flagged Issues

For example, for draft version 3 of the 1999 NEI, EPA removed all of the state-submitted records for residential fossil fuel combustion and replaced them with our own. To quote from the announcement for draft version 3 of the 1999 NEI, "EPA believes that these estimates are more accurate in many cases than the estimates in version 2, which were a mixture of old and new estimates created with various methods and emission factors." Another example where EPA flagged an issue is in the point source documentation for draft version 3 of the 1999 NEI, where EPA encourages reviewers to check the stack parameters.

Top Twenty

Ideally, you should review the data fields for all of your point sources to make sure that you agree with what is in the NEI. But realistically, time is short. We suggest that your goal now is to get your largest emitting facilities as accurate and complete as possible in the NEI. Think about the largest emitting facilities in your S/L/T area and work on as many of these as you can. Here are some pointers.

1. Emissions. Look for gross errors first. Use the facility summary file to look at emissions aggregated to the facility level. Look for emissions that seem way too high or way too low. There is more discussion on the facility summary later in this paper.
2. Stack parameters (stack height, diameter, exit gas temperature and flow rate). People who model emissions need to know these stack parameters at the release point. The larger the emitter, the more important it is for stack parameters to be accurate. Check/confirm the values and units for the stack parameters. Also, the emission release point type field was frequently incorrectly used in the 1999 submittals. The emission release point type code for fugitives emissions is "01" and "02" for vertical stack emissions. See the NEI code table (on the web) for all of the NEI codes.
3. Locations. All stacks must have xy coordinates (latitude/longitude or UTM coordinates). Emission modelers need to know where the emissions occur. The larger the emitter, the more important it is that the NEI contain accurate locations for these stacks. Please confirm that the stack locations are correct. If the location coordinates are missing in a data submittal, EPA has procedures to populate the field, but lack of information means that EPA may have to locate the stack at the county centroid.
4. SCC. Are the SCC's correct? Remember that SCC's that start with "101" or "201" are for EGU's. Do not code industrial, institutional, or commercial units with EGU SCC's. They will get counted as EGU emissions. Do a search on your non-EGU point source inventory for SCC's that start with a "101" or a "201", and make sure that only the EGU's have these SCC's.
5. Other Data. Review the emission data as well as the plant name, start/end dates, and the codes (codes for facility ID, emission type, pollutant, NAICS, SIC, etc).

Reviewing the Non-EGU Point Sector for Inconsistencies

You have addressed the issues EPA has flagged, and made sure your biggest emitters are in the inventory and are correctly inventoried. Now let's look for inconsistencies in the non-EGU point source sector.

We suggest that the non-EGU point source inventory is the best place to start. Why the non-EGU point source sector? We arrive at this conclusion by the process of elimination. Remember that the criteria EI is made up of four sectors; point, area, onroad, and nonroad (the HAP inventory has slightly different nomenclature). The point source sector can be further divided into the EGU point and the non-EGU point. Let's look at the EGU point, the area sector, and the onroad and nonroad sectors. EPA has models and/or methods to estimate emissions from these sources (for more information on EPA's methodologies on emission estimation, read the documentation for the applicable sector available on the web at http://www.epa.gov/ttn/chief/). While there remains opportunities for S/L/T's to improve the EPA estimates, EPA does have methodologies to make estimates. However, for the non-EGU point sector, EPA mostly pleads ignorance. The S/L/T's are the primary, if not sole, source of reliable information for the non-EGU point sources. So to improve the NEI, we suggest you, the reviewer, start where the most benefit can be gained; the non-EGU point source sector.

There are some common sense techniques that you can use to spot errors, inconsistencies, or incongruities in the non-EGU point source inventory. These techniques work best when you are familiar with the inventory in your state/county/tribe and you are willing to do some sleuthing. This is why your review is so important. EPA personnel are not going to be familiar with any particular state or county to the extent that you are. So let's get started.

Unzip and open the facility summary file. This file contains a table that has all the facilities in the country with the emissions summed to the facility level. Open the table. The facility summary file contains numerous fields including state name, county name, facility name, facility description, SIC code, xy coordinates, and emission totals of the reported pollutants (note that there is a separate file on the web for facility sums for HAPs). This file "sums up" emissions to the facility level, which means that for each of the pollutants, all of the emissions at that facility are added together and presented as a single total.

Now that you are familiar with the data format, close the table and run a simple query to select only the facilities in the state or county that you are interested in. This query should contain only the facilities in your state or county. [One of the best features of Access is the ease of running simple queries. But, if you don't want to query the database, you can sort by state, select your state or county, and export to another file or to an electronic spreadsheet]. Sort by SO2 emissions (Sorts in MS Access are done by placing the cursor in the SO2 column and clicking the descending sort icon on the toolbar). A descending sort puts the highest SO2 emitters at the top. Look closely at your top SO2 emitters for incongruities. Since SO2 is primarily a by-product of combustion, you should not see hospitals or restaurants near the top of the list. In most states, the largest SO2 emitters will be EGU's that burn coal. Scan the list for non-EGU's. You can do that by SIC (SIC for EGUs is 4911, so you are looking for an SIC other than 4911) or you can look at the name and description of the facility. Also, EGU's should have an ORIS facility ID. If you see a large SO2 emitter that is not an EGU, check it out. Is the record correct, or is there an error? For example, if you see a 10,000 ton SO2 emitter that has the name "Thompson County Hospital", then you probably have an error in the emissions. Flag all suspicious records for investigation. Check the detailed NIF records for more detail on the emissions. Check your permitting files or other appropriate records to account for all seeming discrepancies.

You should have now convinced yourself that all high SO2 emitters are EGU's or if they are not, you know why. Next, visually cross check the SO2 emitters with the other pollutants. Does the mix of emissions make sense? Large SO2 emitters are usually large NOx emitters too, since combustion processes typically emit NOx, but, they are typically *not* large PM, CO, or VOC emitters. There can be exceptions to this of course. Do you see a large SO2 emitter with low NOx emissions? Might be a problem. Look at the facility name and facility description. Check the SIC or the NAICS. Do the emissions make sense now? High NOx emissions with relatively low SO2 emissions might be natural gas

fired turbines. Do you see high SO2 emissions and high VOC, PM, or CO emissions? Might be a problem. Check applicable records, or if you know someone in permitting, they may be able to help with your questions regarding the facility.

Next, run a query that shows all of the facilities in your state that are NOT EGU's (run the query for facilities where the SIC is "NOT 4911", or where the ORIS ID field is "null"). Sort again with the SO2 emissions in descending order. Study the table. As before, look for things out of place. For example, are the large emitters at the top, as they should be? There should be no EGUs on the list. If you see something that sounds like an EGU, you may have an error. Restaurants are not significant emitters of SO2. Large manufacturing facilities should be near the top.

Run this same analysis for NOx and repeat the logic. Since NOx is primarily produced as a by-product of combustion, you should see the same pattern. The top emitters should also be EGU's, etc. You can run this in reverse by looking at the smallest emitters and checking to make sure none of the larger emitting facilities is at the bottom.

Next, you can sort on the facility VOC emissions. Typical large VOC point sources are chemical manufacturing companies and refineries. Combustion sources are not usually big VOC emitters. Study the list for your state or county. Look at the plant names, plant descriptions, and NAISCs . Do the facilities at the top of the list seem right to you? Conversely, are the facilities you expect to be near the top, in fact near the top? Follow up on the inconsistencies you think you see. Continue this analysis with the other pollutants.

Some other things you can do are to sort on stack height. Do the large stacks match up with the correct sources? Sort on the "difference x coordinate" and the "difference y coordinate column". Both of these columns compares all the xy coordinates within the facility and gives the largest difference. Stack locations within a plant should not be too large, so look for large differences. Do you see anything odd?

Missing Facilities

Sometimes facilities are missing in the NEI. Do facility counts, emission sums, and compare to another database or an earlier year inventory. We recommend never changing facility ID. The EPA uses the same facility ID that the S/L/T uses plus we assign a federal ID to each facility, but if a state changes the state ID, it makes matching facilities from older years extremely difficult.

REVIEW COMPLETED

You have now completed the common sense top-down facility emissions summary check on your state or county. You have examined the emission summaries for your facilities and found all the obvious inconsistencies in the point source inventory. You have convinced yourself that all obvious outliers have been eliminated. You have checked the NEI to see if the biggest emitters are present and accounted for. You have reviewed and corrected codes, stack parameters, locations, etc.

Still have time? Look at the other summary files. There is a county summary file that sums emissions to the county by sector (point, area, onroad, nonroad). As before, query the file various ways and look for gross errors and inconsistencies. Are the farming counties the highest NH3 emitters in the area source sector? Are the most populated counties the highest emitters in the mobile sector? What county has the highest emissions for each pollutant? Does this seem right to you? If you spot some strange numbers, you have the NIF EI data and you should be able to dig through that and find what you need.

SUBMITTING REVISIONS

To notify EPA of any additions, deletions, or revisions to the EI, refer to the procedures in the README file. Remember to use the NIF submittal flags and the Central Data Exchange to transfer data electronically to EPA. Questions about using these procedures should be directed to EPA at 919 541-1000.

REFERENCES

National Emission Inventory, US Environmental Protection Agency, CHIEF website, http://www.epa.gov/ttn/chief/net/index.html

Keywords

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