RTI INTERNATIONAL | Memorandum

Date: November 11, 2011

Subject: Inputs to the Pulp and Paper Industry October 2011 Residual Risk Modeling
EPA Contract No. EP-D-07-019; Work Assignment No. 4-09

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I. Introduction

Section 112(f)(2) of the Clean Air Act (CAA) directs the U.S. Environmental Protection Agency (EPA) to conduct risk assessments on each source category subject to maximum achievable control technology (MACT) standards and determine if additional standards are needed to reduce residual risks. Section 112(d)(6) of the CAA requires EPA to review and revise the MACT standards, as necessary, taking into account developments in practices, processes, and control technologies. The section 112(f)(2) residual risk review and section 112(d)(6) technology review are to be done 8 years after promulgation of the original standards. The national emissions standards for hazardous air pollutants (NESHAP) for the pulp and paper industry (40 CFR part 63, subpart S) were promulgated in 1998 and are due for review under CAA sections 112(f)(2) and 112(d)(6).

In February 2011, the EPA initiated a three-part Information Collection Request (ICR) to gather information from U.S. pulp and paper manufacturers needed to conduct the CAA-required regulatory reviews. The second part of the ICR (Part II), which concluded in June 2011, was targeted towards facilities that are major sources of HAP emissions, and involved an update of pre-populated National Emissions Inventory (NEI) data spreadsheets (or creation of new NEI data sets). The response rate for Part II of EPA's ICR was 100 percent, with respondents submitting NEI spreadsheets for 171 major sources (2 of which were new NEI data sets for mills not previously included in the NEI).

Two substantial quality assurance (QA) efforts were conducted on the Part II data in order to create the modeling files needed for the residual risk assessment: (1) QA of the spreadsheets submitted by each mill prior to import into the compiled database, and (2) QA and standardization of the compiled database. These QA efforts are discussed in sections II and III of this memo. (Note: Modeling files were needed for both the subpart S category and the whole facility, so QA efforts focused on data for all emission sources at pulp and paper facilities.)

The purpose of this memorandum is to document the inputs to the residual risk modeling file, specifically (1) QA and standardization of the NEI data for the pulp and paper industry including the default parameters used (Sections II and III), (2) pollutant speciation and apportionment factors (Section IV), (3) emission process groups assigned to the pulp and paper source classification codes (SCCs) (Section V), (4) allowable emissions multipliers (Section VI), (5) acute emissions multipliers (Section VII), and (6) information relating to acrolein emissions estimation (Section VIII).

II. QA of Part II NEI Update Spreadsheets

A. Review Checklist

The first step in preparing the inputs to the residual risk modeling file was to QA the individual NEI update spreadsheets received from each of the pulp and paper mills in response to Part II of the February 2011 survey sent to the pulp and paper industry. NEI update spreadsheets for 171 major sources were reviewed.

We began our QA of the pulp and paper NEI update spreadsheets using a checklist, which is provided in Appendix A to this memorandum. The checklist looked at consistency in facility name, information in the wrong column, equipment we expected to see, pollutants we expected to see, missing stack and fugitive parameters, missing latitude/longitude values, and any other observations, such as recommendations for follow-up with the mills (e.g., if the spreadsheets were missing the information we expected to see). Associated tables of the subpart S equipment we expected to see are also provided in Appendix A.

In addition to providing recommendations for follow-up, the checklists were also useful in informing the later, more in-depth review and revision of each inventory spreadsheet. If we found any obvious errors (e.g., providing text in code columns), we corrected them. If any information was provided in the wrong column (e.g., new data placed in revision columns), we moved it to the correct column. Because some columns in the inventory files did not have revision columns (e.g., facility name, emission unit ID, etc.), we included an “RTI Notes” column in the revised files that noted any changes to those columns. Revisions to the inventory files were highlighted in yellow. Several mills were contacted with follow-up questions, and these clarifications were incorporated into the Part II spreadsheets before further processing.

The revised inventory files were transferred to the NEI team for compilation into a database file. Prior to transferring the files, we also made any necessary formatting changes to facilitate the compilation (e.g., eliminating merged cells, merging/copying notes that had been spread across rows).

The following sections discuss in greater detail the in-depth QA we conducted of the inventory spreadsheets. It should be noted that, over the course of reviewing the many inventory spreadsheets, the scope of the QA evolved (increased), such that some of the QA activities discussed below were only conducted in the later reviews.

B. Recommended Inventory Deletions

At the start of each in-depth QA, we evaluated the acceptability of each mill's recommended inventory deletions to ensure that the mills did not mark for deletion something that was not replaced and would be needed for subpart S modeling or whole-facility modeling. If the file included detailed reasons for why certain records were deleted (e.g., equipment no longer in operation, replacement data provided in specified rows, emissions vented to a vent gas collection system) we evaluated those reasons and provided our recommendation regarding those deletions in the "RTI Notes" column. If the file did not include detailed reasons, we determined the acceptability of the deletions by first filtering on the rows selected for deletion and noting the SCCs included in that dataset, and then filtering on the replacement rows and noting which SCCs in the deletion dataset were included in the replacement dataset. (This approach was necessary because mills often used emission unit IDs in their replacement inventories that were completely different from the emission unit IDs in the inventories marked for deletion.)

If an SCC was not included in the replacement dataset, we attempted to determine the reason why (e.g., equipment no longer in operation, emissions vented to a vent gas collection system, not a source of hazardous air pollutant [HAP] emissions, a different SCC was used for the same process, etc.). In most cases, we found the deletions to be reasonable, and noted "OK to delete" in the "RTI Notes" column. If we could find no reason why a particular SCC was selected for deletion, we included a note in the "RTI Notes" column stating that the emission unit associated with that SCC should not be deleted and explaining why. Where necessary, we followed up with mills regarding these suggested deletions.

Some of the emission units consistently marked for deletion and not replaced include methanol storage tanks, chlorine dioxide generators, coating operations, boilers, landfills, saltcake mix tanks, etc., presumably because these equipment are not regulated under subparts S or MM or were not specifically required to be reported in the Part II survey. (Note: We only kept the HAP data for these emission units, since only those data are needed for risk modeling.)

Once we had decided which records to keep (i.e., not delete), we reviewed those records to ensure that they would be consistent with the replacement inventory (e.g., same facility name, facility ID, etc.). If we found additional records that needed deletion (e.g., not emission points), we marked those rows for deletion (with the rows highlighted in yellow in the spreadsheet) and noted the reasons for the deletion in the "RTI Notes" column. After reviewing all recommended deletions, we filtered the inventory spreadsheets to view only the accepted records, and we conducted the rest of our review looking at just the filtered (accepted) data.

C. ID Fields

After filtering the data, we checked each inventory spreadsheet for gaps in the various ID fields—emission unit ID, process ID, and emission release point ID. Where there were gaps, we filled them where possible, consistent with the numbering approach used in each file. If the gaps were significant and no clear way was found to determine the IDs, we followed up with the mill to obtain the IDs. We also checked the process ID against the SCC to ensure that there was only one SCC per process ID. If there was more than one SCC (e.g., for a different boiler fuel type), we added more process IDs (one for each SCC for a given emission unit). We also checked the emission release point ID against the stack and fugitive parameters to ensure that there was only one set of parameters per emission release point ID. If there was more than one set of parameters, we added more emission release point IDs (one for each set of parameters for a given emission unit).

D. Source Classification Codes

After checking the IDs, we reviewed the SCCs to ensure that they reasonably matched the emission unit description, as well as the mill type (e.g., kraft, sulfite, non-sulfur semichemical, neutral sulfite semichemical (NSSC), thermomechanical, groundwood, secondary fiber, paper only) and were internally consistent within the spreadsheet. For boilers, we looked to see that the SCC was for industrial boilers (as opposed to commercial, institutional, or utility boilers) and matched the SCC to the fuel type (e.g., coal, wood, oil, natural gas) in the emission unit description. Where we determined the SCCs were incorrect, we replaced them with more appropriate SCCs from the SCC listing provided in the lookup spreadsheet file included with Part II of the survey.

We also tried to substitute a more precise SCC for any generic SCC (e.g., 30700199, 30700499, 39999999), where possible. We used emission unit descriptions to come up with more precise SCCs. If emission unit descriptions were missing, we checked the emission unit ID against the mill’s Part I survey response and/or permit to determine the identity of the emission unit and make a more precise SCC assignment.

E. Pollutants and Emissions

We then checked for gaps in the pollutant fields—pollutant code, pollutant description, and HAP category name. Where we found gaps in these fields, we filled them using the pollutant code table provided in the lookup spreadsheet file included with Part II of the pulp and paper survey. If a pollutant code was not provided in the lookup table, we found the CAS number for the pollutant online and entered that into the inventory file as the pollutant code. If a CAS number was not available for a particular pollutant (e.g., m,p-xylene), we left the cell blank (with the problem to be resolved later in the QA of the compiled database file).

We also checked for missing emissions data and, if we were not able to fill the data gaps easily (e.g., the data were not for an identical type of emission unit), we followed up with the mill to obtain the missing data. We did not check the reasonableness of the emissions data in the spreadsheets or whether there were any duplicate emissions data (that would be done in the QA of the compiled file), unless it was obvious. Where emissions data were obviously suspicious, we followed up with the mill regarding the data. Where there were obviously duplicate emissions data, our approach varied depending on the situation. We either followed up with the mill, added more process IDs or emission release point IDs to eliminate duplication for a given emission unit, or added a note to the “RTI Notes” column to combine or delete the duplicate data at a later time (during the QA of the compiled file). We also noted where HAP data were completely missing from a mill’s inventory of subpart S sources, but deferred any solution to that problem until the compiled file had been received.

F. MACT Codes

We compared the MACT codes to the SCCs in the inventory spreadsheets to determine whether they were reasonable and internally consistent within the spreadsheet, for example:

- Subpart S MACT code (1626-1) for SCCs associated with pulp and paper production
- Subpart MM MACT code (1626-2) for SCCs associated with pulp and paper chemical recovery
- Pulp and paper non-MACT facility MACT code (1626-3) for SCCs associated with landfills, wood handling, etc. at pulp and paper mills
- Boiler MACT codes (0107-1, -2, -3, -4) for SCCs associated with boilers at pulp and paper mills
- Paper and other web coating MACT code (0711) for SCCs associated with paper coating that was not specifically identified as on-machine coating.

If we determined that the MACT codes were incorrect, we replaced them with the correct MACT codes from the MACT code listing provided in the lookup spreadsheet file included with Part II of the survey.

G. Latitudes/Longitudes

After reviewing the MACT codes, we checked for gaps in the latitude and longitude data. If we found gaps, we checked the rest of the file to see if latitude and longitude data were provided elsewhere for that particular emission point and could be copied. Otherwise, we used the default latitude and longitude values for the entire mill. We did not check the accuracy of the latitude and longitude data in this step. That task was to be handled by EPA in the compiled file.

H. Stack and Fugitive Parameters

We also checked the stack and fugitive parameters against emission release point type to see whether they were consistent. If an emission point had stack parameters but was labeled as a fugitive emission source (emission release point type of “01”), we changed the emission release point type to “02,” consistent with a stack emission source. Similarly, if an emission point had fugitive parameters but was labeled as a stack emission source (emission release point type of “02” through“06”), we changed the emission release point type to “01,” consistent with a fugitive emission source. This check was performed by filtering on emission release point type (i.e., filtering on “01” to review fugitive parameters and filtering on the other emission release point types to review stack parameters).

Lastly, we checked the stack and fugitive parameters for data gaps and errors. Where there were data gaps for stack emission sources, we checked the rest of the file to see if stack parameter data were provided elsewhere for that particular emission point and could be copied. Where possible, we calculated the missing data. For example, if exit gas velocity was missing but we had exit gas flow rate and stack diameter, we calculated the velocity using the following equation:

Exit gas velocity = exit gas flow rate/stack area, where stack area = $\pi * (\text{diameter}/2)^2$

We also estimated missing gas flow rate and stack diameter data using this equation. Where the exit gas flow rate provided by the mill was suspiciously high, we used this equation to determine if the flow rate might be in units of actual cubic feet per minute (acfm), instead of actual cubic feet per second (acfs). If we determined that was the case, we divided the exit gas flow rate by 60.

If it appeared the mill had left the data blank deliberately (e.g., by indicating in a note that the data were unknown, by indicating in a note or stack default flag that they wanted stack defaults, or by leaving only certain columns blank), we added a note to the "RTI Notes" column to provide stack defaults for those missing parameters during the QA of the compiled database file. If the mill used the term "ambient" for exit gas temperature, we assumed a temperature of 72°F. If the mill used the term "NA" for exit gas flow rate, we assumed a flow rate of 0 acfs according to the NEI default for fugitive sources.

If it appeared the mill had left the data blank mistakenly (e.g., because this type of emission unit would typically have stack parameters, because the mill did not indicate they wanted stack defaults, or because all columns were left blank), we followed up with the mill to see if they had the stack parameters.

Where there were data gaps for fugitive emission sources (i.e., fugitive length, fugitive width, fugitive angle), we left the data gaps and did not follow up with the mill. (Measurements of some fugitive parameters may not be readily available or easy to obtain.) Instead, we decided to fill the data gaps with fugitive defaults during our QA of the compiled file. Because such data gaps were numerous in the individual inventory files, we did not include any notes about them in the "RTI Notes" column.

In the course of our QA, we also provided stack defaults for each fugitive emission source. If a mill provided release height and temperature values for a fugitive source, we kept those values and provided national default values for the rest of the stack parameters: 0.003 foot (ft) stack diameter, 0.0003 foot per second (ft/sec) exit gas velocity, and 0 acfs exit gas flow rate. If a mill provided release height but not temperature, we provided the national default temperature (72°F) for fugitive sources. If a mill provided neither release height nor temperature, we provided the national defaults for both (10 ft, 72°F). If a mill provided a release height of 0 ft (e.g., for a wastewater basin), we changed the release height to the closest whole number (1 ft), consistent with EPA guidance.

III. QA of Compiled NEI Database

Once the inventory spreadsheets had been compiled into an NEI database file, we conducted a second level of QA that could not have been effectively done on the individual inventory spreadsheets (e.g., comparing and standardizing SCCs, pollutant codes, emissions, etc. across the industry). The QA of the compiled database file was also designed to catch any errors or omissions that were missed in the previous level of QA (i.e., the QA of the individual inventory spreadsheets).

The intermediate draft compiled file for QA was composed of a *Facility* table which included detailed facility information and a *KEEP* table which included the emissions and parameter information that we had indicated should be kept, plus some limited facility information that could be linked back to the *Facility* table. (Note: There was another compiled file that also included all records from the inventory spreadsheets, including those we marked for deletion. We did not QA this file but used it for reference.) At the beginning of our QA, the *KEEP* table contained over 145,000 records covering HAP, criteria air pollutants (CAP), total reduced sulfur (TRS) and other pollutants. Columns were included to reflect original data from the pre-populated Part II NEI data spreadsheets, edited Part II data from respondents, and final data to be included in the NEI modeling file.

Any additional records identified for deletion in the course of our QA of the compiled file were moved to a *Deleted_items* table in the file. We entered line-by-line review notes in the "RTI Notes" and "Delete Comment" columns as needed to reflect changes made to the data. We inserted a few "QAd" columns in the database as needed to reflect our changes. However, due to Access table width constraints, in some cases we just entered revisions into the "FINAL" column (e.g., for MACT code).

A. Facility/Emission Unit Information

Number of facilities. We first checked the *Facility* and *KEEP* tables in the compiled file to ensure that both tables included all the mills we expected to see. No issues were found.

Major/area source status. We double-checked the major/area status of each mill and concluded that all were major sources, with the exception of NEIWI4430444 - ST Paper, LLC, Oconto Falls, WI. Our Part I survey records indicate this is a synthetic area source that should be removed from the Part II inventory prior to risk modeling. The facility did not make any updates to their Part II survey (but instead indicated all the data were okay as is).

There were a handful of facilities that left their inventory labeled as "area" source, but whose Part I survey response indicates they are a major source. We updated the FINAL Facility Category Code to reflect major source status for these facilities.

Facility name. We checked to ensure the facility name used by each facility was consistent throughout the database. A few instances of different names being used for the same mill were detected (a carryover from a few spreadsheets that were not complete inventory replacements). We corrected the facility names in the *KEEP* table where necessary to match the names in the *Facility* table.

Emission unit description. We noted that some of the facility records for emission unit description were blank. If other fields contained descriptive information, we copied that to the emission unit description column for convenience. However, some blanks remain.

B. Codes, IDs, and Dates

Emission unit/process/emission release point IDs. Gaps in these IDs were resolved first before we did any further work in the database. Next, we added the following concatenations to the beginning of the table to facilitate a review of records by unique emission unit:

RTI_Unit: NEI ID--Emission Unit ID--Process ID
RTI_EmPt: NEI ID--Emission Unit ID--Process ID--Emission Release Point ID

We also added the following concatenations to the end of the table to facilitate detection of duplicate and differing values for stack parameters and latitudes/longitudes:

Release_point_combo: State County FIPs--NEI ID--Emission Release Point ID
Process_combo: State County FIPs--NEI ID--Emission Unit ID

SIC/NAICS codes. Many Part II survey respondents used text different from the lookup table in their Standard Industrial Classification (SIC) code descriptions and North American Industry Classification System (NAICS) code descriptions. We reviewed the SIC and NAICS codes to ensure they were consistent with the text used by the respondents and made any appropriate corrections. The final codes reside in the corresponding "FINAL" columns. We deleted the column with respondents' SIC descriptions after reviewing the SIC and NAICS codes to save space due to database size limitations (e.g., character limitation across rows). The final SIC or NAICS descriptions can be linked from a standard lookup table, as needed.

SCC/MACT codes. We spent considerable time on standardizing SCCs and MACT codes to ensure consistency within in the database. First, we reviewed each SCC by the emission unit description (and other descriptive columns) to ensure they were consistent. Next, we cross-tabbed SCC vs. MACT code to look for inconsistencies. Except for the not-elsewhere classified SCC (39999999), each SCC is now affiliated with only one MACT code. We reduced the number of not-elsewhere classified SCCs (e.g., *****999s) by reviewing available process descriptions and assigning more specific SCCs where possible. Table 1 at the end of this memorandum lists the MACT codes used in the compiled file.

Once the MACT codes were standardized, we removed the lengthy un-standardized MACT code and SCC descriptions supplied by the respondents in order to save space. As with SIC and NAICS descriptions, final code descriptions can be linked from a standard lookup table, as needed.

Start and end dates. We reviewed the base year information that facilities provided in their Part II responses and corrected any obvious errors. Missing dates were populated with dates from the mill's NEI update spreadsheets.

Note: The Buckeye, Perry FL mill (NEI ID No. NEI47091) submitted data for a direct contact evaporator (DCE) recovery furnace that was converted to a non-direct contact evaporator (NDCE) recovery furnace mid-year. DCE data were supplied for January through June 2010, and NDCE data were provided for July through December 2010. Rather than model the now obsolete DCE data, we converted the NDCE data to reflect one year's worth of operation (i.e., multiplied by 2) from July 2010 through June 2011. The DCE data were flagged for deletion and moved to the *Deleted_items* table.

Data source code. We corrected any respondent misspellings and errors. Respondents were asked to enter "RTR09" for new records, but there were some obvious drag errors, misspellings, etc.

Control measure codes. We reviewed these codes for consistency with code definitions in the lookup table and standardized them. Since these columns are not critical for the modeling file, we did not copy all codes down where they appeared for just some rows for a given emission unit.

Emission release point type codes. Emission release point type codes were reviewed against the stack and fugitive parameters included in the database to ensure they were identified correctly. An emission release point type code of "01" indicates fugitive emissions, while all other emission release point type codes ("02" through "06") indicate stack emissions. Where it was obvious that the code was in error, the emission release point type code was revised accordingly.

C. Pollutants and Emissions

Pollutant codes. The pollutant codes and names received with the Part II survey responses required extensive QA and standardization. There were missing and invalid codes, various permutations of pollutant names, etc. We made several specific changes to pollutant codes where necessary (e.g., coding thallium as a radionuclide).

There were also many non-HAP pollutants included in the Part II responses that were not previously included in the NEI lookup table. For these "new" pollutants, we looked up their CAS numbers (either to verify the codes submitted by respondents or to obtain missing pollutant codes) and ensured the compiled database file included these pollutant codes. We created a lookup table for the compiled file that contains all of the old pollutant codes from the original NEI code lookup table and added to this table the "new" pollutants for pulp and paper (giving standardized names to the new pollutants, based generally on the most commonly reported name). The EPA NEI team reviewed and provided comments on the table, and we made the corresponding corrections. Table 2 presents the new non-HAP pollutants added to the NEI pollutant lookup table.

Actual Emissions. We reviewed the magnitude of emissions. We followed up with mills (as needed) for correction of obvious errors (e.g., 4.5 million tons per year [tpy] of chloroform). In many cases, there was a conversion error made by the respondent. We looked at HAP emissions from individual processes above 100 tpy to identify obvious errors.

The QA of emissions data focused more on HAP (particularly from 1626 MACT codes) than on CAP or TRS due to time constraints. Some potentially random high emissions remain for non-1626 processes and for CAP and TRS releases.

In a couple of cases where emissions were obviously in error, and where emission factors were used in creating the estimates, we used ratios of emission factors to revise the emissions estimates.

Duplicate pollutants. Numerous duplicate pollutants appeared in the database for each RTI_EmPt. The reasons for most of the duplicates appeared to be:

- Part II respondent error (e.g., respondents updating old data and including new data for the same pollutant but not necessarily the same emission rate, etc.).
- Pollutant coding issues where only one code applied for what respondents considered a separate pollutant (e.g., cresols, xylenes, synonyms of pollutants).
- Coding of emission units that was not detailed enough (e.g., multi-fuel-fired boilers with different emissions estimates for each fuel but only one RTI_EmPt).

We spent a considerable amount of time resolving these duplicate issues. We resolved duplication issues relating to xylene that resulted from the double-counting of mixed and individual xylene isomers (with several xylene rows being moved to the *Deleted_items* table). For example, some data for m,p–xylenes in the compiled file received pollutant code 1330207 [for "Xylenes (mixed isomers")], which resulted in a problem if there was already data for total xylenes with pollutant code 1330207 (resulting in two rows with the same pollutant code and different emissions).

In many cases, the solution to duplicate pollutants was to recode the emission units, processes, or emission release points, as applicable. In some cases, we found we needed to delete exact duplicate pollutants, or delete the lowest of two duplicates (e.g., if there was an order-of-magnitude difference in emissions such that the second duplicate didn't add much). We noted the problem and corrective action in a separate spreadsheet (and often in the "RTI Notes" or "Delete Comment" in the compiled database file). For a few mills, we found that we had to sum up emissions after contacting the respondent.

Hexachloroethane emissions from pulp storage tanks. We noted that some pulp storage tanks had hexachloroethane emissions estimates. During our QA of a prior preliminary risk modeling file, we learned that National Council for Air and Stream Improvement (NCASI)--the leading source of environmental data affecting the pulp and paper industry--had eliminated the emission factor for hexachloroethane for unbleached pulp mills. Upon review, we decided to keep the hexachloroethane emissions estimates as is because most were for bleached pulp mills, where hexachloroethane might be expected.

Routine maximum hourly emisisons. This database field was structured as a text field. We added a numeric-double field called "RoutineEmMaxHourly_lb/hr" so we could use the values in calculations.

We compared the maximum pound per hour (lb/hr) values with the actual tpy values and found wide discrepancies for many emission units (e.g., maximum lb/hr values resulting in less than the routine tpy; lb/hr and tpy values differing by more than a factor of 1000). Therefore, we concluded that extreme caution should be exercised when using the maximum hourly emissions field, and we do not recommend using the maximum hourly emissions field for acute risk modeling. Rather, we recommend considering this information in the development of acute multipliers, where out-of-range values can be discounted, as needed. (For further information, see the section on acute multipliers later in this memorandum.)

Startup and shutdown emissions. Very little data were provided by survey respondents for startup and shutdown. Less than 2 percent of respondents supplied startup and shutdown emission rates, and, in most cases, the startup and shutdown emission rates matched the maximum lb/hr emission rates for routine operation. These data were considered in development of acute multipliers, but ultimately were not useful.

Missing emissions. For several mills, HAP emissions data were not provided for their subpart S (1626-1) sources. In some cases, the volatile organic compound (VOC) emissions data that were provided were multiplied by HAP/VOC ratios to estimate the HAP emissions (where HAP emissions were expected). The HAP/VOC ratios were based on HAP and VOC emission factors in NCASI Technical Bulletin 973, which is a compilation of the latest HAP emission factors for the pulp and paper industry. We developed HAP estimates for both routine annual emissions and maximum hourly emissions, where VOC were available for both. Where no VOC data were provided, we estimated the HAP emissions using the HAP emission factors from the NCASI bulletin and the production information from the mills' Part I survey responses.

TRS. The NEI data submitted with Part II contained TRS in various forms:

- Individual speciated TRS compounds (e.g., hydrogen sulfide [H_2S], methyl mercaptan)
- Total TRS as sulfur (S)
- Total TRS as H_2S
- Total TRS (on an unspecified basis)

When standardizing pollutants in the NEI data file, we were careful to retain whether total TRS was labeled "as S" or "as H_2S." The individual speciated TRS compounds are not HAP, although there is a HAP listing petition for H_2S. There are several TRS compounds. These compounds are easily identifiable in the compiled NEI data file because they have a general HAP category name of "H_2S" or "TRS." However, the NSPS regulatory definition of TRS includes four compounds: H_2S, methyl mercaptan, dimethyl disulfide and dimethyl sulfide. For mills supplying only total TRS data (e.g., TRS, TRS as S, or TRS as H_2S), it was not possible to tell whether the total TRS were limited to the four TRS included in the regulatory definition or a larger number of TRS compounds.

D. Latitudes/Longitudes

We reviewed the latitudes and longitudes for individual stack and fugitive release points in the compiled file. Where we found gaps in latitude/longitude data, we populated the gaps with data (where available) from a prior draft residual risk modeling effort. Often, coordinates for the center of the mill were used. Once we had filled all of the data gaps, we exported the latitude/longitude data into a spreadsheet file and sent the file to EPA, where the data were reviewed using Google Earth. Any latitudes and longitudes that were off-property were brought to the center of the property (unless the location of the emission release point was obvious, in which case the latitudes and longitudes were moved to the emission release point). As discussed further below, EPA also used Google Earth to QA fugitive parameters, as needed. After EPA had completed its QA of the latitude/longitude data, we re-imported the data back into the database file.

We checked the latitudes and longitudes by using the Release_point_combo concatenated codes (State County FIPS--NEI ID--Emission Release Point ID). We found numerous duplicates where the same emission release point had multiple coordinates, which we corrected (typically by creating new emission release point IDs for the duplicate records).

E. Stack Parameters

Stack parameters for those records with an emission release point code of "01" for fugitives were set at the national fugitive defaults: 10 ft stack height, 72°F exit gas temperature, 0.003 ft stack diameter, 0.0003 ft/sec exit gas velocity, and 0 ft^3/sec exit gas flow rate. The reported fugitive release height and temperature (if different from the 10 ft and 72°F defaults) were retained.

Stack parameters for all other emission release point codes of "02" through "06" (i.e., stacks) were reviewed. Where possible, information supplied was used to populate missing fields (e.g., if diameter and flow rate were provided, this information was used to back-calculate velocity). Except for paper machines (SCC 30700401), unresolved blanks were populated with the 2002 NEI default parameters for each SCC, MACT code, and SIC.[1] The hierarchy applied for assigning the stack defaults was SCC > MACT code > SIC.

<u>Paper Machines</u>. For paper machines, a specific set of stack parameters was applied, consistent with guidance from industry (see Appendix B for documentation). We applied the following default stack parameters for paper machine SCC 30700401:

- Stack height: 70 feet (ft)
- Stack diameter: 4.6 ft
- Exit gas velocity: 30 feet per second (ft/sec)
- Exit gas flow rate: 499 cubic feet per second (acfs)

Note: Industry's guidance document on paper machine default stack parameters mentions applying these parameters to two SCCs: 30700401 and 30700405. SCC 30700405 is no longer in use for the pulp and paper industry and was replaced in the compiled file with SCC 30700401.

The default parameter we used for exit gas temperature varied, depending on whether the paper machine emission points were indicated in the NEI emission process description to be from the wet or dry end of the paper machine, or were not indicated:

- Wet end: 104°F
- Dry end: 149°F
- Not indicated: 125°F

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[1] See EPA website http://www.epa.gov/ttn/chief/net/2002inventory.html and click on "Stack parameter defaults" to download an Access database containing default stack parameters by SCC, MACT code, and SIC.

For paper machine emission release point types identified as stack (codes “02” through “06”), we kept the stack parameters determined to be actual data and replaced those determined to be NEI defaults for any facilities where NEI defaults had not already been resolved through the Part II survey process.

For those paper machine emission release point types identified as fugitive (code “01”), we looked to see whether they had fugitive parameters (length and width). If they did, we left those parameters in place. If they did not, we revised the emission release point type code to indicate stack emissions (code “02”) and then replaced the NEI national default stack parameters (10 ft height, 72°F temperature, 0.003 ft diameter, and 0.0003 ft/s velocity) with the industry-supplied default stack parameters noted above.

Other NEI stack parameter checks. We performed certain stack parameter checks that are typically done for NEI data. Flow rates were checked based on the aforementioned calculation using the stack exit diameter and velocity. Any flow rates varying by more than 10 percent from the calculated value were set to the calculated value.

The stack parameters were also checked against the Release_point_combo concatenated codes (State County FIPS--NEI ID--Emission Release Point ID) to resolve any duplicate or differing information (e.g., by adding new emission release point IDs, correcting stack parameters).

The stack parameters were also checked to ensure that the stack diameter was not greater than the stack height. Where this occurred, we reviewed each case individually to resolve the situation (e.g., replaced the stack height and/or diameter with correct information from the mill’s NEI update spreadsheet, replaced the stack diameter with a default value, back-calculated stack diameter based on exit gas velocity and flow rate). We also checked to determine if the emission release point type was consistent with the type of equipment (SCC) and type of release parameters provided.

F. Fugitive Parameters

After determining which emission release point types in the database were fugitive “01,” we reviewed the fugitive length, width, and angle. EPA plotted and measured several fugitive emission sources (e.g., wastewater, liquor ponds, some paper machine buildings coded as fugitive) to verify length and width and to check fugitive angle, particularly when no angle was provided. Numerous fugitive parameters were blank or zero. In some cases, EPA populated the blank fugitive dimensions with values measured using Google Earth where such measurements were possible. EPA also used Google Earth to resolve fugitive angles that were negative or greater than 180 degrees.

Non-wastewater fugitive parameters. With the exception of wastewater, we populated the remaining blanks for fugitive length and width with SCC-specific fugitive dimension defaults we created based on QA of the actual fugitive defaults provided for each SCC and engineering judgment. To be conservative, we erred on the side of underestimating the dimensions, while improving on the representativeness of the values (i.e., replacing the zeroes). The fugitive angle was considered to be zero. A table of the SCCs with affected fugitive emissions is provided in Appendix C.

Wastewater fugitive parameters. The following default fugitive parameters were supplied by industry representatives for wastewater (see Appendix D for industry documentation):

- Primary clarifiers: fugitive length and width = 177 ft; fugitive angle assumed to be zero
- Aeration stabilization basins (ASBs): fugitive length = 1500 ft; fugitive width = 1000 ft; fugitive angle assumed to be zero
- Activated sludge treatment (AST) systems: fugitive length = 829 ft; fugitive width = 166 ft; fugitive angle assumed to be zero

  Note: Length and width for AST systems were calculated based on the midpoint (27,500 ft^2) of the range of AST areas (20,000 to 35,000 ft^2) provided by industry, using the midpoint (5) of the length/width ratio provided by industry (2 to 8).

The information we received from industry does not speak to release height, but the NEI defaults (e.g., 1 ft, 10 ft) seem reasonable for these types of sources (since some clarifiers or concrete basins are elevated).

For those wastewater emission release point types identified as fugitive (code “01”), we added the industry-supplied fugitive parameters where site-specific fugitive parameters were not already available (e.g., through the Part II survey response or from a Google Earth measurement). We defaulted the release height to 10 ft for those records, if they had a higher release height. If the release height was 0 ft, we defaulted to 10 ft for clarifiers and 1 ft for ASBs and AST systems.

For those wastewater emission release point types identified as stack (codes “02” through “06”), where there were clearly NEI default stack parameters that carried through the Part II survey process, we changed the emission release point type to fugitive and added the industry-supplied fugitive parameters and default release height specified above. Where the stack parameters could not be identified as default, we left the emission release point type and stack parameters as reported.

IV. Pollutant Speciation and Apportionment

A. Chromium Speciation

Chromium compounds are a significant contributor to increased cancer risk, but the level of risk largely depends on the oxidation state (species) of the compounds. The two most common chromium species are hexavalent chromium (Cr^{+6}) and trivalent chromium (Cr^{+3}). EPA has classified Cr^{+6} and its compounds as known human carcinogens, while Cr^{+3} is not classified as to its human carcinogenicity. Consequently, determining the percentage of total chromium that is Cr^{+6} vs. Cr^{+3} is a major factor in estimating the level of risk from chromium exposure.

Table 3 at the end of this memorandum presents the default chromium speciation profiles that were used for the October 2011 risk modeling to generate estimates of Cr^{+6} (pollutant code

18540299) and Cr^{+3} (pollutant code 16065831). Speciation profiles are documented for each SCC applicable to the pulp and paper industry (and included in the October 2011 risk modeling). The chromium speciation profiles were applied where only total chromium estimates were provided (for pollutant code 7440473 or 136). Some mills provided estimates for both total chromium and Cr^{+6} for a particular source. In those cases, we subtracted the Cr^{+6} from the total chromium to calculate Cr^{+3} and then deleted the total chromium estimate.

B. Mercury Speciation

Like chromium, the different oxidation states of mercury compounds vary in toxicity, but also in exposure pathway (e.g., inhalation, ingestion). The most common mercury species are divalent mercury (Hg^{+2}) (including both particulate and gaseous forms) and elemental gaseous mercury (Hg^0). We recommend speciating mercury compounds (pollutant codes 7439976 and 199) using the NEI default multipliers of 0.2 for particulate divalent mercury (pollutant code 202), 0.3 for gaseous divalent mercury (pollutant code 201), and 0.5 for elemental gaseous mercury (pollutant code 200) for all sources in the compiled database file. (EPA 2006a) It should be noted that there are a few records in the compiled file that are already speciated as elemental mercury (pollutant code 200), and no further speciation is required for these records.

C. POM Speciation

Polycyclic organic matter (POM) is comprised of a large number of individual compounds (POM species), each with their own toxicity levels and exposure pathways. Within the pulp and paper production category (MACT code 1626-1), there were several listings for POM in the compiled file that were unspeciated (pollutant code 246). Most facilities that reported POM speciated the data into individual compounds. Unspeciated (total) POMs were reported for some paper machines and direct-fired paper machine dryers (SCC 30700401). Since many mills provided speciated POM compounds, POM speciation profiles were developed from those mills to speciate total POM for mills with unspeciated POM data. Table 4 at the end of this memorandum presents the POM speciation profiles used to replace unspeciated POM for paper machines and paper machine dryers (SCC 30700401).

D. Dioxin/Furan Speciation and Apportionment

The predominant sources of dioxin/furan emissions at pulp and paper mills are the power boilers used to provide steam and electricity for the mill and the chemical recovery combustion sources (i.e., recovery furnaces and lime kilns) at the mill. Most mills reported dioxin/furan emissions for specific SCCs and MACT codes. However, some dioxin/furan apportionment was needed for mill processes with an SCC of 39999999 (Misc Manuf/Indus Processes/Other Not Classified) and a MACT code of 1626-3 (Pulp and Paper Production - Non-MACT Facilities).

One mill (NEI ID NEI47077) had dioxin/furan emissions data listed for SCC 39999999 and MACT code 1626-3. The dioxin/furan data were already speciated (i.e., had TEQ congeners). Since the mill had both boilers and chemical recovery combustion sources, we apportioned the dioxin/furan data to the 0107 MACT code (boilers at the facility) and 1626-2

MACT code (chemical recovery combustion sources) using the following methodology--55 percent to boilers and 45 percent to chemical recovery combustion sources.

Two other mills (NEI IDs NEI33135 and NEI41252) had dioxin/furan emissions data listed for SCC 39999999 and MACT code 1626-2, but the data were unspeciated (i.e., reported as total dioxin, pollutant code 155), so we developed a congener profile for these sources. Because most dioxin/furan emissions from MACT code 1626-2 are expected to come from the recovery furnace, we used the dioxin/furan congener profile for recovery furnaces in Table 5-13 of EPA's dioxin/furan inventory report (EPA 2006b) to estimate the congener emissions. Table 5 at the end of this memorandum presents the dioxin/furan congener profile and toxic equivalency factors (TEFs) used to replace the unspeciated dioxin/furan estimates for these 1626-2 sources with individual congener estimates (expressed as 2,3,7,8-TCDD TEQ). The toxic equivalency factors are based on the latest EPA guidance.

The EPA plans to QA the entire dioxin/furan emissions database and do further evaluations during the RTR process planned for the subpart MM category (MACT code 1626-2) and anticipates further refinements in dioxin/furan emissions estimates when the Boiler MACT rule is finalized (subpart DDDDD). For these reasons and because dioxin/furan emissions are not part of the subpart S category, EPA did not model these emissions at this time.

E. Glycol Ether Speciation

There are some listings of total glycol ethers in the database for MACT codes 1626-1, 1626-2, and a few other MACT codes. We coded all total glycol ether records (identified as pollutant code 171) as 1,2-dimethoxyethane (pollutant code 110714). The pollutant 1,2-dimethoxyethane is the most commonly emitted glycol ether for pulp and paper. Consequently, we recommend using the risk benchmarks for 1,2-dimethoxyethane when performing risk modeling for these records.

V. Emission Process Group Assignments

Descriptive emission process groups were assigned to each SCC to group similar emission units and facilitate analysis of the risk results. Each SCC is affiliated with only one emission process group (but one emission process group can apply for multiple SCCs). Table 6A at the end of this memorandum provides a listing of the SCCs contained in the October 2011 risk modeling file and the emission process groups assigned. Through the use of emission process groups, we can focus our analyses of risk results and emissions on 82 consolidated emission process groups rather than on 225 SCCs. Some of the processes listed in Table 6A do not emit HAP or TRS and do not appear in the risk modeling file. To aid in analysis of the risk results, the emission process groups were developed to be more detailed for SCCs within the 1626-1 risk modeling category, but less detailed for emission units outside the category. (For example, we combined all boilers into one emission process group.) Allowable and acute multipliers for the pulp and paper subpart S category (MACT code 1626-1) are affiliated with the emission process groups. The basis for these multipliers is discussed in the sections below.

VI. Actual vs. Allowable Emissions

A. Background

In addition to evaluating the residual risks associated with actual emissions, EPA evaluates the risk associated with the emissions that would be allowed under the NESHAP, i.e., “allowable emissions,” since they reflect the maximum level that sources could emit and still comply with the national standards. Actual emissions are sometimes less than allowable emissions due to a compliance cushion, a more stringent state or local rule, or over-control due to the use of control technologies, equipment, or work practices that are significantly better than that required by MACT. Any over-control from pulp and paper processes, e.g., for mills using the subpart S clean condensate alternative or an equivalency-by-permit compliance option, would be site-specific and not estimable. The remainder of this section documents how multipliers were estimated to calculate allowable emissions.

B. Allowable Multipliers for October 2011 Risk Modeling

Appendix E at the end of this memorandum lists the standards in subpart S to which pulp and paper production sources are subject. The sources include:

- Kraft pulping vent gases
- Soda or semichemical pulping vent gases
- Sulfite pulping vent gases
- New and existing bleaching vent gases
- Kraft pulping process condensates

Under subpart S, these sources were given a series of compliance options to choose from, including equipment standards, work practice standards, numeric emission limits, and a clean condensate alternative. Appendix E identifies the standard format for each of these compliance options. Based on industry responses to the Part I survey, we looked at the most commonly chosen subpart S compliance options for each emission process group in determining how to estimate allowable multipliers for pulp and paper production sources.

Equipment or work practice standards. For equipment standards and work practice standards, it is generally assumed that allowable emissions equal actual emissions (because emissions typically are not measured when equipment or work practices are in effect). Based on the survey data we have received, we have determined that mills generally are not using equipment or work practices superior to that required by MACT. Therefore, we are assuming actual and allowable emissions are equivalent under the equipment and work practice standards, resulting in an allowable multiplier of 1.

Numeric emission limits. For numeric emission limits, certain information is needed to estimate allowable multipliers, which varies depending on the type of limit. The subpart S compliance options include three types of numeric emission limits, including performance limits (percent reduction), concentration limits (parts per million by volume [ppmv] or weight [ppmw]), and production-based emission limits (pounds per ton of oven-dried pulp [lb/ton

ODP]). Appendix E identifies the types of information that is needed to calculate allowable multipliers.

To calculate allowable multipliers based on performance limits (percent reduction), we would need to know the actual performance (percent reduction) level achieved, which is available from the survey responses for subpart S sources. To calculate allowable multipliers based on concentration limits (ppmv and ppmw), we would need to know the molecular weight of the pollutant, stack gas temperature, and stack gas flow rate. The numeric emission limits in subpart S use surrogate pollutants for total HAP, specifically methanol for pulping process vent gases and condensates and chlorine for bleaching processes. The molecular weights of methanol and chlorine could be used in allowable emissions calculations.

Based on our review of the survey responses for subpart S sources, most kraft mills have chosen to meet the equipment standards rather than the concentration limits for kraft pulping vent gases and kraft pulping process condensates. Also, calculating allowable multipliers based on concentration limits would be very site-specific and subject to considerable variability, depending on the stack gas temperature and flow rate data used in the calculations. Consequently, we have estimated allowable multipliers for kraft pulping vent gases and kraft pulping process condensates based on performance limits rather than concentration limits.

To calculate allowable multipliers for sulfite mills based on their production-based emission limits (lb/ton ODP emitted), we would need information on actual production levels (e.g., ton ODP per year), which is available from the survey responses for subpart S sources. Based on our review of the survey responses for subpart S sources, most sulfite mills have chosen to meet either the 0.89 lb/ton ODP limit (for Ca- and Na-based sulfite mills) or 2.2 lb/ton ODP limit (for NH_3-based sulfite mills). Although we have sufficient information from these mills' Part I survey responses to calculate their allowable emissions, we do not have sufficient information from the NEI on the actual pulping emissions for these mills to enable us to develop an allowable multiplier. Therefore, we instead used the equivalent 92 percent performance limit for Ca- and Na-based sulfite mills and 87 percent performance limit for NH_3-based sulfite mills to calculate the allowable multipliers. (Note that there are no longer any Mg-based sulfite mills in operation that would be subject to subpart S standards.)

To calculate allowable multipliers for kraft pulping process condensates based on their production-based "removal" emission limits (lb/ton ODP removed), we would need information on actual production levels (e.g., ton ODP per year) and uncontrolled emissions (from which the limits would be subtracted). However, we do not have uncontrolled emissions data for kraft pulping process condensates. Therefore, we instead used the equivalent 92 percent performance limit to calculate the allowable multiplier for kraft pulping process condensates.

Clean condensate alternative (CCA). Subpart S provides a clean condensate alternative, which is an emissions averaging approach to offset emissions from certain existing kraft pulping sources (e.g., high volume low concentration [HVLC] sources). Emissions reductions achieved under this compliance alternative are calculated on a site-specific basis and must be at least as great that those achieved through the kraft pulping HVLC system standards. Although the subpart S survey responses showed a number of mills using the CCA option, we are not evaluating this option for allowable emissions for the October 2011 risk modeling due to the site-specific nature of the emissions calculations.

Uncontrolled emission units. Actual and allowable emissions are equivalent for uncontrolled emission sources, resulting in an allowable multiplier of 1. Based on our analysis of the survey data, most emission sources within the subpart S source category that were not subject to subpart S standards are uncontrolled.

Emission units controlled under other emission standards. Permit limits requested in the pulp and paper survey were used to evaluate whether there are emission units in the pulp and paper industry with emission limitations more stringent than the pulp and paper standards (in which case allowable emissions would be lower than the "MACT allowable" emissions). We found no directly comparable information showing any HAP emission limitations more stringent than MACT are in place for subpart S sources.

Allowable multipliers. For the October 2011 risk modeling, analysis of actual vs. allowable emissions is focused on the subpart S performance (percent reduction) limits and equipment or work practice standards. This analysis relies on actual emissions reductions presented in the Part I survey results (including actual emissions data and specific compliance options used).

A summary of the allowable multipliers for each emission source type is provided in Table 7 at the end of this memorandum, and the allowable multipliers assigned to each emission process group for residual risk modeling are provided in Table 6B.

VII. Acute Exposure Estimation Approach

A. Background

In addition to the chronic, long-term exposures addressed under cancer risk, EPA also considers acute, short-term exposures in its risk-based decision-making. In the absence of short-term emissions data, EPA estimates peak, short-term emissions using available annual emissions data in the NEI. In previous RTR rulemakings, EPA has assumed that a facility's peak, 1-hour emission rate could exceed its annual average hourly emission rate by as much as a factor of 10, under worst-case meteorological conditions and the presence of a human receptor at the facility boundary. (EPA 2010) In meetings with pulp and paper industry representatives, we were told that a default peak-to-mean ratio of 10 was unrepresentative of some pulp and paper processes. The pulp and paper industry initiated a study of peak-to-mean ratios for two pulp and paper emission sources—papermaking and wastewater—for EPA's consideration.

In order to refine the default-10 assumption, peak hourly emission rates (lb/hr) (referred to in Part II of the pulp and paper survey as "routine emissions maximum hourly rate") were collected in the Part II survey (the results for which were received on June 6, 2011). These peak hourly emission rates were reviewed as part of the Part II data review. Under ideal circumstances, these data would be used directly to evaluate acute, short-term exposures. However, the data provided by respondents had considerable inconsistencies. When compared to the annual emissions (tpy) reported in the Part II survey (assuming 8,760 hours per year [hr/yr]) the primary outliers identified were:

- Underestimate of peak hourly emission rates – The peak hourly emission rate scaled to a peak annual emission rate did not exceed actual annual emissions.
- Overestimate of peak hourly emission rates – The peak hourly emission rate scaled to a peak annual emission rate excessively exceeded actual annual emissions.
- Zero emission rates – These emission rates were discarded from the analysis.

Various reasons are expected for these outliers, including lack of understanding of the data request, decimal place errors, typos, etc. Most of the discrepancies appeared to be independent of annual operating hours (e.g., the discrepancies remained discrepancies even when tested at annual operating hours other than 8,760 hr/yr). Given the number of outliers at both the high and low end, we recommend using the Part II survey data to calculate acute multipliers for broad groupings of equipment as opposed to directly modeling of the peak hourly emission rates provided in the Part II data set. Such acute multipliers would also be needed to fill data gaps where peak hourly rates were not provided. Acute multipliers are often referred to as peak-to-mean ratios. Acute multipliers can be developed by various methods. A summary of the methodology used to develop the acute multipliers for the October 2011 modeling is provided below. Table 8 presents the acute multipliers.

B. Acute Multipliers for October 2011 Risk Modeling

Papermaking and wastewater. Pulp and paper industry representatives provided the following peak-to-mean ratios (acute multipliers):

- Paper machines--1.6
- Wastewater--2

Analyses from the industry to support these ratios are provided in Appendices F and G at the end of this memorandum. We have reviewed the papers and, through our own independent analysis of survey data, found the rationale acceptable. We recommend using these ratios for the October 2011 risk modeling.

The paper machine peak-to-mean ratio of 1.6 was developed considering peak-to-mean paper production rates. Emissions from all equipment in the paper mill are expected to be uncontrolled and have emissions somewhat related (either directly or indirectly) to paper machine production rate. Therefore, for purposes of the October 2011 modeling, we recommend using the paper machine peak-to-mean ratio of 1.6 for all equipment in the paper mill that is related to papermaking (e.g., stock preparation, repulping, dryers, etc.).

The wastewater peak-to-mean factor of 2 was developed considering wastewater from primary clarifiers and aeration stabilization basins (ASBs) at kraft mills, but, for purposes of the October 2011 modeling, we recommend applying it to all wastewater treatment units (not just primary clarifiers and ASBs at kraft mills).

Other processes. Part II of the pulp and paper survey (received June 6, 2011) requested information on annual emission rates (referred to in Part II as “routine emissions”) and peak hourly emission rates (discussed above). Peak-to-mean (acute) ratios were derived from the Part II survey data as follows:

- Mean = Average annual lb/hr = Routine emissions (tpy) / (8760 hr/yr) x (2000 lb/ton)
- Peak = Routine emissions maximum hourly rate (lb/hr)
- Peak/Mean = [Routine emissions maximum hourly rate (lb/hr)] / (Average annual lb/hr)

As detailed above, the peak hourly emission rates provided by industry had outliers in the data set. Although these values were precluded from direct input into the short-term risk model, they can be used to develop more realistic acute multipliers, as industry has indicated that a default peak-to-mean ratio of 10 is unrepresentative. The following approach was used.

All 1626-1 HAP emissions data from the Part II survey (57,281 records) were compiled. A peak-to-mean ratio was calculated for each HAP or TRS compound from each emission source type. Zero emission rates and all peak-to-mean ratios less than one were removed from the data set. A peak-to-mean ratio less than one indicates that the peak value provided is incorrect (does not exceed the average hourly emission rate and is, therefore, not a peak). The median peak-to-mean ratio for each general equipment type was then determined. Removing peak-to-mean values less than one and using the median value reduced the effects of excessively low and unusually high outliers.

It should be noted that we considered the startup and shutdown hourly rates collected in Part II in this analysis. However, the startup and shutdown data were sparse and, in all cases, the startup and shutdown hourly rates were the same as the rates provided for peak hourly emission rate. Therefore, these data ultimately were not useful for analysis of peak-to-mean ratios.

Acute multipliers. A summary of median peak-to-mean ratios (acute multipliers) for each emission source type is provided in Table 8 at the end of this memorandum, and the acute multipliers assigned to each emission process group for residual risk modeling are provided in Table 6B.

VIII. Acrolein Data

Appendix H provides EPA’s conclusions regarding use of the acrolein data provided in the Part II survey responses.

IX. References

EPA 2006a U.S. Environmental Protection Agency. *2005 National Emissions Inventory Data & Documentation, Inventory Documentation, Mercury Speciation*. Web site: http://www.epa.gov/ttn/chief/net/2005inventory.html. December 19, 2006.

EPA 2006b U.S. Environmental Protection Agency. *An Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States for the Years 1987, 1995, and 2000*. EPA/600/P-03/002F. November 2006.

EPA 2010 U.S. Environmental Protection Agency. *Draft Residual Risk Assessment for the Chromic Acid Anodizing, Decorative Chromium Electroplating, and Hard Chromium Electroplating Source Categories*. Appendix 4: Analysis of data on short-term emission rates relative to long-term emission rates. July 2010.

Table 1. MACT Codes Used for the October 2011 Pulp and Paper Risk Modeling

MACT code	MACT source category
0105-1	Stationary Reciprocating Internal Combustion Engines – Natural Gas
0105-2	Stationary Reciprocating Internal Combustion Engines – Oil
0107-1	Industrial/Commercial/ Institutional Boilers & Process Heaters – coal
0107-2	Industrial/Commercial/ Institutional Boilers & Process Heaters – gas
0107-3	Industrial/Commercial/ Institutional Boilers & Process Heaters – oil
0107-4	Industrial/Commercial/ Institutional Boilers & Process Heaters – wood or waste
0108-1	Stationary Combustion Turbines – Natural Gas
0108-2	Stationary Combustion Turbines – Oil
0601	Gasoline Distribution (Stage I)
0602	Organic Liquids Distribution (Non-Gasoline)
0711	Paper & Other Webs (Surface Coating)
0714	Printing/Publishing (Surface Coating)
1626-1	Pulp & Paper Production – Pulping and Bleaching Systems at Kraft, Soda, Sulfite, and Semichemical Pulping Mills (Subpart S)
1626-2	Pulp & Paper Production – Chemical Recovery Combustion Sources at Kraft, Soda, Sulfite, and Stand-alone Semichemical Pulping Mills (Subpart MM)
1626-3	Pulp and Paper Production – NonMACT Facilities

Table 2. New Pollutants Added to NEI Pollutant List

Pollutant code	Description	Pollutant type[a]	Pollutant Category Name
10049044	Chlorine Dioxide		Chlorine Dioxide
100516	Benzyl Alcohol		Benzyl Alcohol
100527	Benzaldehyde		Benzaldehyde
107039	n-Propyl Mercaptan		TRS
108601	Bis(2-Chloroisopropyl) ether		Bis(2-Chloroisopropyl) ether
108941	Cyclohexanone		Cyclohexanone
109795	n-Butyl Mercaptan		TRS
110009	Furan		Furan
110010	Tetrahydro-Thiophene		Tetrahydro-Thiophene
110021	Thiophene		Thiophene
110623	Valeraldehyde		Valeraldehyde
110816	Diethyl Disulfide		TRS
117840	Di-n-octyl phthalate		Di-n-octyl phthalate
120832	2,4-Dichlorophenol		2,4-Dichlorophenol
123728	Butyraldehyde/n-Butyraldehyde		Butyraldehyde/n-Butyraldehyde
124481	dibromochloromethane		dibromochloromethane
127913	Beta-Pinene		Beta-Pinene
1334787	m,p-Tolualdehyde		m,p-Tolualdehyde
13466789	3-Carene		3-Carene
156592	1,2-Dichloroethylene		1,2-Dichloroethylene
27323188	Monochlorobiphenyl		Monochlorobiphenyl
352932	Diethyl Sulfide		TRS
37680685	Trichlorobiphenyl		Polychlorinated Biphenyls
513440	Isobutyl Mercaptan		TRS
529204	o-Tolualdehyde		o-Tolualdehyde
540498	1,2-Dibromoethene		1,2-Dibromoethene
540590	1,2-Dichloroethylene		1,2-Dichloroethylene
5779942	2,5-Dimethyl Benzaldehyde		2,5-Dimethyl Benzaldehyde
590863	Isovaleraldehyde		Isovaleraldehyde
5989275	Limonene		Limonene
616444	Methyl Thiophene		Methyl Thiophene
624895	Ethyl Methyl Sulfide		TRS
624920	Dimethyl Disulfide		TRS
638028	2,5-Dimethyl thiophene		2,5-Dimethyl thiophene
64175	Ethanol		Ethanol
65850	Benzoic Acid		Benzoic Acid
66251	Hexaldehyde		Hexaldehyde
67630	Isopropanol [Isopropyl Alcohol]		Isopropanol [Isopropyl Alcohol]
67641	Acetone		Acetone
7429905	Aluminum		Aluminum
7439896	Iron		Iron
7439932	Lithium		Lithium

Pollutant code	Description	Pollutant type[a]	Pollutant Category Name
7439954	Magnesium		Magnesium
7439987	Molybdenum		Molybdenum Compounds
7440097	Potassium		Potassium
7440213	Silicon		Silicon
7440224	Silver		Silver Compounds
7440235	Sodium		Sodium
7440246	Strontium		Strontium Compounds
7440280	thallium		Thallium Compounds
7440315	Tin		Tin Compounds
7440326	Titanium		Titanium Compounds
7440393	Barium		Barium Compounds
7440428	Boron		Boron
7440508	Copper		Copper Compounds
7440622	Vanadium		Vanadium Compounds
7440655	Yttrium		Yttrium Compounds
7440666	Zinc		Zinc Compounds
7440699	Bismuth		Bismuth
7440702	Calcium		Calcium
74840	Ethane		Ethane
74931	Methyl Mercaptan		TRS
74953	Dibromomethane [methylene bromide]		Dibromomethane [methylene bromide]
75081	Ethyl Mercaptan		TRS
75183	Dimethyl Sulfide		TRS
75274	Bromodichloromethane		Bromodichloromethane
75332	Isopropyl Mercaptan		TRS
75661	Tert-Butyl Mercaptan		TRS
75694	Trichlorofluoromethane		Trichlorofluoromethane (CFC-11)
76222	Camphor		Camphor
7664939	Sulfuric Acid		Sulfuric Acid
7782414	Fluorine		Fluorine
78842	Isobutyraldehyde		Isobutyraldehyde
79925	Camphene		Camphene
80568	Alpha-Pinene		Alpha-Pinene
84662	Diethyl Phthalate		Diethyl Phthalate
85687	Butyl Benzyl Phthalate		Butyl Benzyl Phthalate
872559	2-Ethyl Thiophene		2-Ethyl Thiophene
88755	2-Nitrophenol		2-Nitrophenol
95578	Chlorophenol [2-Chlorophenol]		Chlorophenol [2-Chlorophenol]
95636	1,2,4-Trimethylbenzene		1,2,4-Trimethylbenzene
98555	Alpha-Terpineol		Alpha-Terpineol
99854	gamma-Terpinene		gamma-Terpinene
99876	p-Cymene		p-Cymene

Pollutant code	Description	Pollutant type[a]	Pollutant Category Name
CFC	Chlorofluorocarbons		CFC
Nitrate	Nitrate Compounds		Nitrate Compounds
TRS	Total Reduced Sulfur	OTH	TRS
TRS (H2S)	Total Reduced Sulfur (as H2S)	OTH	TRS
TRS as S	Total Reduced Sulfur (as S)	OTH	TRS

a. All are non-HAP pollutants.

Table 3. Chromium Speciation Approach for October 2011 Pulp and Paper Risk Modeling

SCCs included in October 2011 modeling			Cr^{+6} multiplier for October 2011 modeling[2]	Comment on use of Cr^{+6} multiplier for October 2011 modeling
SCC	Short name[1]	Process MACT code		
10200201	Ext Comb /Industrial /Bitum/Subbit Coal /Pulverized Coal: Wet Bottom	0107-1	0.12	
10200202	Ext Comb /Industrial /Bitum/Subbit Coal /Pulverized Coal: Dry Bottom	0107-1	0.12	
10200203	Ext Comb /Industrial /Bitum/Subbit Coal /Cyclone Furnace	0107-1	0.12	
10200204	Ext Comb /Industrial /Bitum/Subbit Coal /Spreader Stoker	0107-1	0.12	
10200212	Ext Comb /Industrial /Bitum/Subbit Coal /Pulverized Coal: Dry Bottom (Tangential)	0107-1	0.12	
10200218	Ext Comb /Industrial /Bituminous Coal /Atmospheric Fluidized Bed Combustion: Circulating Bed	0107-1	0.12	
10200219	Ext Comb /Industrial /Bituminous Coal /Cogeneration	0107-1	0.12	
10200222	Ext Comb /Industrial /Subbituminous Coal /Pulverized Coal: Dry Bottom	0107-1	0.12	
10200224	Ext Comb /Industrial /Subbituminous Coal /Spreader Stoker	0107-1	0.12	
10200401	Ext Comb /Industrial /Residual Oil /Grade 6 Oil	0107-3	0.18	
10200501	Ext Comb /Industrial /Distillate Oil /Grades 1 and 2 Oil	0107-3	0.18	
10200502	Ext Comb /Industrial /Distillate Oil /10-100 Million Btu/hr **	0107-3	0.18	
10200601	Ext Comb /Industrial /Natural Gas /> 100 Million Btu/hr	0107-2	0.04	
10200602	Ext Comb /Industrial /Natural Gas /10-100 Million Btu/hr	0107-2	0.04	
10200603	Ext Comb /Industrial /Natural Gas /< 10 Million Btu/hr	0107-2	0.04	
10200604	Ext Comb /Industrial /Natural Gas /Cogeneration	0107-2	0.04	
10200799	Ext Comb /Industrial /Process Gas /Other: Specify in Comments	0107-2	0.04	
10200804	Ext Comb /Industrial /Petroleum Coke /Cogeneration	0107-1	0.12	
10200901	Ext Comb /Industrial /Bark-fired Boiler	0107-4	0.56	

SCCs included in October 2011 modeling			Cr^{+6} multiplier for October 2011 modeling[2]	Comment on use of Cr^{+6} multiplier for October 2011 modeling
SCC	**Short name[1]**	**Process MACT code**		
10200902	Ext Comb /Industrial /Wood/Bark-fired Boiler	0107-4	0.56	
10200903	Ext Comb /Industrial /Wood-fired Boiler - Wet Wood (:=20% moisture)	0107-4	0.56	
10200907	Ext Comb /Industrial /Wood-fired Boiler - Wet Wood (:=20% moisture)	0107-4	0.56	
10200911	Ext Comb /Industrial /Wood/Bark Waste /Stoker boilers **	0107-4	0.56	
10200912	Ext Comb /Industrial /Wood/Bark Waste /Fluidized bed combustion boiler	0107-4	0.56	
10201002	Ext Comb /Industrial /LPG /Propane	0107-2	0.04	
10201201	Ext Comb /Industrial /Solid Waste /Specify Waste Material in Comments	0107-4	0.56	
10201202	Ext Comb /Industrial /Solid Waste /Refuse Derived Fuel	0107-4	0.56	
10500106	Ext Comb /Space Heater /Industrial /Natural Gas	0107-2	0.04	
20200102	Int Comb /Industrial /Distillate Oil (Diesel) /Reciprocating	0105-2	0.18	
20200203	Int Comb /Industrial /Natural Gas /Turbine: Cogeneration	0105-1	0.04	
20200401	Int Comb /Industrial /Large Bore Engine /Diesel	0105-2	0.18	
20201702	Int Comb /Industrial /Gasoline /Reciprocating Engine	0105-2	0.18	Cr^{+6} multiplier assumed to be same as for fuel oil.
20300101	Int Comb /Comm-Inst /Distillate Oil (Diesel) /Reciprocating	0105-2	0.18	
30700104	Sulfate (Kraft) Pulping /Recovery Furnace/Direct Contact Evaporator	1626-2	0.171	NCASI TB 973 (Table 4.22) contains Cr^{+6} and total Cr emissions test data for one DCE recovery furnace. Total Cr emissions were non-detect (3.5E-05 lb/ton BLS). Using 1/2 of the detection limit for total Cr, Cr^{+6} was approximately 17.1% of the total Cr.
30700105	Sulfate (Kraft) Pulping /Smelt Dissolving Tank	1626-2	0.148	NCASI TB 973 (Table 4.29) contains Cr^{+6} and total Cr emissions test data for one SDT. Total Cr emissions were 2.3E-05 lb/ton BLS, and Cr+6 emissions were 3.40E-06 lb/ton BLS, yielding a Cr^{+6} factor of 14.8%.

SCCs included in October 2011 modeling			Cr^{+6} multiplier for October 2011 modeling[2]	Comment on use of Cr^{+6} multiplier for October 2011 modeling
SCC	Short name[1]	Process MACT code		
30700106	Sulfate (Kraft) Pulping /Lime Kiln	1626-2	0.032	NCASI TB 973 (Table 4.27) contains Cr^{+6} and total Cr emissions test data for three lime kilns with wet scrubbers. The data were unable to be interpreted for two of the kilns because the Cr^{+6} data were non-detect, with detection limits higher than the corresponding detect data for the total Cr tests. A Cr^{+6} to total Cr ratio of 3.2% was observed for the third kiln.
30700110	Sulfate (Kraft) Pulping /Recovery Furnace/Indirect Contact Evaporator	1626-2	0.229	NCASI TB 973 (Table 4.24) contains Cr^{+6} and total Cr emissions test data for three NDCE recovery furnaces. The average Cr^{+6} to total Cr ratio was 22.9% (ranging from 1.5% to 50.0%).
30700127	Sulfate (Kraft) Pulping / Non-condensible Gases Incinerator	1626-1	0.04	NCGs are process gases. Most Cr^{+6} factors for process gas are 0.04, including for SCC 30790014 (Industrial Processes, Pulp and Paper and Wood Products, Fuel Fired Equipment, Process Gas: Incinerators). Only 6 records affected. Use Cr^{+6} = 0.04, same as "priority 2" default for SCC 30790014.
30700222	Sulfite Pulping /Recovery System: NH_3	1626-2	0.34	
30700353	Soda / lime kiln	1626-2	0.032	Assume same multiplier as kraft lime kiln.
30700401	Paper and Paperboard Manufacture / Paper Machine / Pulp Dryer	1626-1	0.04	This SCC represents paper machines (like SCC 30700405). Chromium from paper machines is likely attributed to combustion of natural gas in direct-fired dryers on the machine. Therefore, the Cr^{+6} factor should be 0.04 if we follow the convention for combustion of natural gas.
30900500	Fabricated Metal /Welding /General	1626-3	1	Cr^{+6} multiplier based on multiplier for SIC 2631 (priority 3).[3] 1 record. MACT code questionable.
40201301	Paper Coating /Coating Operation	0711	0	Chromium is not expected from this process (not a combustion process). Only 1 record (coater) - likely anomaly. Use 0 for Cr^{+6} factor.

[1] The marker "**" is part of the SCC description and indicates notes related to SCC assignment (not relevant for this table).

[2] The balance is considered Chromium III (Cr^{+3}). For example, if the Cr^{+6} multiplier is 0.04, then 4% of total chromium is considered to be Chromium VI, and 96% is considered to be Chromium III. Unless otherwise specified in the comments column, the Cr^{+6} multiplier is derived from EPA's priority 1 list of NEI default Cr^{+6} multipliers.[3]

[3] NEI Chromium profile priorities:

Priority	Hierarchy
1	Use MACT code speciation profiles. NOTE: For pulp and paper (MACT codes 1626-1, 1626-2, 1626-3), use MACT code and SCC.
2	Use SCC speciation profiles if MACT code speciation profiles are unavailable. NOTE: Nonroad SCCs are truncated in table.
3	Use SIC code speciation profiles if MACT code and SCC speciation profiles are unavailable.
4	Use default speciation multiplier of 0.34 if MACT code, SCC, and SIC code speciation profiles are unavailable.

Table 4. POM Speciation Approach for October 2011 Pulp and Paper Risk Modeling

Equipment	Pollutant code	POM species	POM multipliers
Paper machines	85018	Phenanthrene	0.612
	86737	Fluorene	0.101
	129000	Pyrene	0.18
	206440	Fluoranthene	0.108
Gas-fired paper machine dryers	85018	Phenanthrene	0.328
	86737	Fluorene	0.054
	91576	2-Methylnaphthalene	0.463
	129000	Pyrene	0.097
	206440	Fluoranthene	0.058
Oil-fired paper machine dryers	91576	2-Methylnaphthalene	1

Table 5. CDD/CDF Speciation Approach

Congener	CDD/CDF mean emission factors for recovery furnaces (ng/kg feed)	Congener profile	TEF	Annual emissions, tpy		
				NEI33135--1--1--1	NEI33135--1--2--2	NEI41252--1--2—2
Total CDD/CDF from file				1.27339E-07	1.15774E-06	7.99E-07
2,3,7,8-TCDD	0	0.00%	1	0	0	0
1,2,3,7,8-PeCDD	0	0.00%	1	0	0	0
1,2,3,4,7,8-HxCDD	0.001	0.03%	0.1	3.75963E-12	3.41817E-11	2.35902E-11
1,2,3,6,7,8-HxCDD	0.003	0.09%	0.1	1.13E-11	1.03E-10	7.07706E-11
1,2,3,7,8,9-HxCDD	0.006	0.18%	0.1	2.26E-11	2.05E-10	1.41541E-10
1,2,3,4,6,7,8-HpCDD	0.108	3.19%	0.01	4.06E-11	3.69E-10	2.54774E-10
OCDD	1.033	30.50%	0.0003	1.17E-11	1.06E-10	7.3106E-11
2,3,7,8-TCDF	0.04	1.18%	0.1	1.50E-10	1.37E-09	9.43608E-10
1,2,3,7,8-PeCDF	0.03	0.89%	0.03	3.38367E-11	3.07636E-10	2.12312E-10
2,3,4,7,8-PeCDF	0.033	0.97%	0.3	3.72204E-10	3.38399E-09	2.33543E-09
1,2,3,4,7,8-HxCDF	0.007	0.21%	0.1	2.63174E-11	2.39272E-10	1.65131E-10
1,2,3,6,7,8-HxCDF	0.012	0.35%	0.1	4.51156E-11	4.10181E-10	2.83082E-10
1,2,3,7,8,9-HxCDF	0.005	0.15%	0.1	1.87982E-11	1.70909E-10	1.17951E-10
2,3,4,6,7,8-HxCDF	0.01	0.30%	0.1	3.75963E-11	3.41817E-10	2.35902E-10
1,2,3,4,6,7,8-HpCDF	0.024	0.71%	0.01	9.02E-12	8.20E-11	5.66165E-11
1,2,3,4,7,8,9-HpCDF	0	0.00%	0.01	0.00E+00	0.00E+00	0
OCDF	0.113	3.34%	0.0003	1.27E-12	1.16E-11	7.99708E-12
Total TEQ				7.84E-10	7.13E-09	4.92E-09
Other TCDD	0.106	3.13%				
Other PeCDD	0.013	0.38%				
Other HxCDD	0.094	2.78%				
Other HpCDD	0.144	4.25%				
Other TCDF	1.23	36.32%				
Other PeCDF	0.307	9.06%				

Congener	CDD/CDF mean emission factors for recovery furnaces (ng/kg feed)	Congener profile	TEF	Annual emissions, tpy		
				NEI33135--1--1--1	NEI33135--1--2--2	NEI41252--1--2—2
Other HxCDF	0.068	2.01%				
Other HpCDF	0	0.00%				
Total CDD/CDF	3.39	100.00%				

Source:
U.S. Environmental Protection Agency. *An Inventory of Sources and Environmental Releases of Dioxin-like Compounds in the United States for the Years 1987, 1995, and 2000*. EPA/600/P-03/002F. November 2006. Page 5-44. Table 5-13: CDD/CDF mean emission factors (ng/kg feed) for black liquor recovery boilers; Column 4: NCASI (1995) (6 facilities); Nondetect set to zero.

Table 6A. Emission Process Groups Assigned for Each SCC in the October 2011 Risk Modeling

SCC	SCC Short Name	SCC EI Sector	Emission Process Group
10200201	Ext Comb /Industrial /Bitum/Subbit Coal /Pulverized Coal: Wet Bottom	Fuel Comb - Industrial Boilers, ICEs - Coal	ICI Boiler/PH
10200202	Ext Comb /Industrial /Bitum/Subbit Coal /Pulverized Coal: Dry Bottom	Fuel Comb - Industrial Boilers, ICEs - Coal	ICI Boiler/PH
10200203	Ext Comb /Industrial /Bitum/Subbit Coal /Cyclone Furnace	Fuel Comb - Industrial Boilers, ICEs - Coal	ICI Boiler/PH
10200204	Ext Comb /Industrial /Bitum/Subbit Coal /Spreader Stoker	Fuel Comb - Industrial Boilers, ICEs - Coal	ICI Boiler/PH
10200205	Ext Comb /Industrial /Bitum/Subbit Coal /Overfeed Stoker	Fuel Comb - Industrial Boilers, ICEs - Coal	ICI Boiler/PH
10200206	Ext Comb /Industrial /Bitum/Subbit Coal /Underfeed Stoker	Fuel Comb - Industrial Boilers, ICEs - Coal	ICI Boiler/PH
10200212	Ext Comb /Industrial /Bitum/Subbit Coal /Pulverized Coal: Dry Bottom (Tangential)	Fuel Comb - Industrial Boilers, ICEs - Coal	ICI Boiler/PH
10200218	Ext Comb /Industrial /Bituminous Coal /Atmospheric Fluidized Bed Combustion: Circulating Bed	Fuel Comb - Industrial Boilers, ICEs - Coal	ICI Boiler/PH
10200219	Ext Comb /Industrial /Bituminous Coal /Cogeneration	Fuel Comb - Industrial Boilers, ICEs - Coal	ICI Boiler/PH
10200222	Ext Comb /Industrial /Subbituminous Coal /Pulverized Coal: Dry Bottom	Fuel Comb - Industrial Boilers, ICEs - Coal	ICI Boiler/PH
10200224	Ext Comb /Industrial /Subbituminous Coal /Spreader Stoker	Fuel Comb - Industrial Boilers, ICEs - Coal	ICI Boiler/PH
10200401	Ext Comb /Industrial /Residual Oil /Grade 6 Oil	Fuel Comb - Industrial Boilers, ICEs - Oil	ICI Boiler/PH
10200402	Ext Comb /Industrial /Residual Oil /10-100 Million Btu/hr **	Fuel Comb - Industrial Boilers, ICEs - Oil	ICI Boiler/PH
10200404	Ext Comb /Industrial /Residual Oil /Grade 5 Oil	Fuel Comb - Industrial Boilers, ICEs - Oil	ICI Boiler/PH
10200405	Ext Comb /Industrial /Residual Oil /Cogeneration	Fuel Comb - Industrial Boilers, ICEs - Oil	ICI Boiler/PH
10200501	Ext Comb /Industrial /Distillate Oil /Grades 1 and 2 Oil	Fuel Comb - Industrial Boilers, ICEs - Oil	ICI Boiler/PH
10200502	Ext Comb /Industrial /Distillate Oil /10-100 Million Btu/hr **	Fuel Comb - Industrial Boilers, ICEs - Oil	ICI Boiler/PH
10200503	Ext Comb /Industrial /Distillate Oil /< 10 Million Btu/hr **	Fuel Comb - Industrial Boilers, ICEs - Oil	ICI Boiler/PH
10200601	Ext Comb /Industrial /Natural Gas /> 100 Million Btu/hr	Fuel Comb - Industrial Boilers, ICEs - Natural Gas	ICI Boiler/PH
10200602	Ext Comb /Industrial /Natural Gas /10-100 Million Btu/hr	Fuel Comb - Industrial Boilers, ICEs - Natural Gas	ICI Boiler/PH
10200603	Ext Comb /Industrial /Natural Gas /< 10 Million Btu/hr	Fuel Comb - Industrial Boilers, ICEs - Natural Gas	ICI Boiler/PH
10200604	Ext Comb /Industrial /Natural Gas /Cogeneration	Fuel Comb - Industrial Boilers, ICEs - Natural Gas	ICI Boiler/PH

SCC	SCC Short Name	SCC EI Sector	Emission Process Group
10200799	Ext Comb /Industrial /Process Gas /Other: Specify in Comments	Fuel Comb - Industrial Boilers, ICEs - Other	ICI Boiler/PH
10200802	Ext Comb /Industrial /Petroleum Coke /All Boiler Sizes	Fuel Comb - Industrial Boilers, ICEs - Other	ICI Boiler/PH
10200804	Ext Comb /Industrial /Petroleum Coke /Cogeneration	Fuel Comb - Industrial Boilers, ICEs - Other	ICI Boiler/PH
10200901	Ext Comb /Industrial /Bark-fired Boiler	Fuel Comb - Industrial Boilers, ICEs - Biomass	ICI Boiler/PH
10200902	Ext Comb /Industrial /Wood/Bark-fired Boiler	Fuel Comb - Industrial Boilers, ICEs - Biomass	ICI Boiler/PH
10200903	Ext Comb /Industrial /Wood-fired Boiler - Wet Wood (:=20% moisture)	Fuel Comb - Industrial Boilers, ICEs - Biomass	ICI Boiler/PH
10200904	Ext Comb /Industrial /Bark-fired Boiler (< 50,000 Lb Steam) **	Fuel Comb - Industrial Boilers, ICEs - Biomass	ICI Boiler/PH
10200905	Ext Comb /Industrial /Wood/Bark-fired Boiler (< 50,000 Lb Steam) **	Fuel Comb - Industrial Boilers, ICEs - Biomass	ICI Boiler/PH
10200907	Ext Comb /Industrial /Wood/Bark Waste /Wood Cogeneration	Fuel Comb - Industrial Boilers, ICEs - Biomass	ICI Boiler/PH
10200911	Ext Comb /Industrial /Wood/Bark Waste /Stoker boilers **	Fuel Comb - Industrial Boilers, ICEs - Biomass	ICI Boiler/PH
10200912	Ext Comb /Industrial /Wood/Bark Waste /Fluidized bed combustion boiler	Fuel Comb - Industrial Boilers, ICEs - Biomass	ICI Boiler/PH
10201002	Ext Comb /Industrial /LPG /Propane	Fuel Comb - Industrial Boilers, ICEs - Other	ICI Boiler/PH
10201201	Ext Comb /Industrial /Solid Waste /Specify Waste Material in Comments	Fuel Comb - Industrial Boilers, ICEs - Other	ICI Boiler/PH
10201202	Ext Comb /Industrial /Solid Waste /Refuse Derived Fuel	Fuel Comb - Industrial Boilers, ICEs - Other	ICI Boiler/PH
10201301	Ext Comb /Industrial /Liquid Waste /Specify Waste Material in Comments	Fuel Comb - Industrial Boilers, ICEs - Other	ICI Boiler/PH
10201302	Ext Comb /Industrial /Liquid Waste /Waste Oil	Fuel Comb - Industrial Boilers, ICEs - Other	ICI Boiler/PH
10201401	Ext Comb /Industrial /CO Boiler /Natural Gas	Fuel Comb - Industrial Boilers, ICEs - Other	ICI Boiler/PH
10500106	Ext Comb /Space Heater /Industrial /Natural Gas	Fuel Comb - Industrial Boilers, ICEs - Natural Gas	ICI Boiler/PH
10500110	Ext Comb /Space Heater /Industrial /Liquified Petroleum Gas (LPG)	Fuel Comb - Industrial Boilers, ICEs - Other	ICI Boiler/PH
20200101	Int Comb /Industrial /Distillate Oil (Diesel) /Turbine	Fuel Comb - Industrial Boilers, ICEs - Oil	Turbine
20200102	Int Comb /Industrial /Distillate Oil (Diesel) /Reciprocating	Fuel Comb - Industrial Boilers, ICEs - Oil	RICE
20200201	Int Comb /Industrial /Natural Gas /Turbine	Fuel Comb - Industrial Boilers, ICEs - Natural Gas	Turbine
20200202	Int Comb /Industrial /Natural Gas /Reciprocating	Fuel Comb - Industrial Boilers, ICEs - Natural Gas	RICE

SCC	SCC Short Name	SCC EI Sector	Emission Process Group
20200203	Int Comb /Industrial /Natural Gas /Turbine: Cogeneration	Fuel Comb - Industrial Boilers, ICEs - Natural Gas	Turbine
20200209	Int Comb /Industrial /Natural Gas /Turbine: Exhaust	Fuel Comb - Industrial Boilers, ICEs - Natural Gas	Turbine
20200301	Int Comb /Industrial /Gasoline /Reciprocating Engine	Fuel Comb - Industrial Boilers, ICEs - Other	RICE
20200401	Int Comb /Industrial /Large Bore Engine /Diesel	Fuel Comb - Industrial Boilers, ICEs - Oil	RICE
20201001	Int Comb /Industrial /Liquified Petroleum Gas /Propane: Reciprocating	Fuel Comb - Industrial Boilers, ICEs - Other	RICE
20201702	Int Comb /Industrial /Gasoline /Reciprocating Engine	Fuel Comb - Industrial Boilers, ICEs - Other	RICE
20300101	Int Comb /Comm-Inst /Distillate Oil (Diesel) /Reciprocating	Fuel Comb - Comm/Institutional - Oil	RICE
30101814	Chem Manuf /Plastics Production /Extruder	Industrial Processes - Chemical Manuf	Chem Manuf
30101815	Chem Manuf /Plastics Production /Pellet Silo	Industrial Processes - Storage and Transfer	Chem Manuf
30187009	Chem Manuf /Inorganic Chem Stor (Fixed Roof Tanks) /Sulfuric Acid: Breathing Loss	Industrial Processes - Storage and Transfer	Chem Manuf
30187097	Chem Manuf /Inorganic Chem Stor (Fixed Roof Tanks) /Specify Liquid: Breathing Loss	Industrial Processes - Storage and Transfer	Chem Manuf
30190099	Chem Manuf /Fuel Fired Equipment /Specify in Comments Field	Industrial Processes - Chemical Manuf	Chem Manuf
30501009	Coal Mining, Cleaning & Material Handling /Raw Coal Storage	Industrial Processes - Mining	Coal Handling
30501010	Coal Mining, Cleaning & Material Handling /Crushing	Industrial Processes - Mining	Coal Handling
30501011	Coal Mining, Cleaning & Material Handling /Coal Transfer	Industrial Processes - Mining	Coal Handling
30501015	Coal Mining, Cleaning & Material Handling /Loading	Industrial Processes - Mining	Coal Handling
30501031	Coal Mining, Cleaning & Material Handling /Scrapers: Travel Mode	Industrial Processes - Mining	Coal Handling
30501040	Coal Mining, Cleaning & Material Handling /Truck Unloading: End Dump - Coal	Industrial Processes - Mining	Coal Handling
30501043	Coal Mining, Cleaning & Material Handling /Open Storage Pile: Coal	Industrial Processes - Mining	Coal Handling
30501049	Coal Mining, Cleaning & Material Handling /Wind Erosion: Exposed Areas	Industrial Processes - Mining	Coal Handling
30501099	Coal Mining, Cleaning & Material Handling /Other Not Classified	Industrial Processes - Mining	Coal Handling
30502099	Stone Quarrying & Processing /Not Classified **	Industrial Processes - NEC	Mineral Handling

SCC	SCC Short Name	SCC EI Sector	Emission Process Group
30510199	Mineral Prods /Bulk Materials Conveyors /Other Not Classified	Industrial Processes - Storage and Transfer	Mineral Handling
30510203	Mineral Prods /Bulk Materials Storage Bins /Coal	Industrial Processes - Storage and Transfer	Mineral Handling
30510204	Mineral Prods /Bulk Materials Storage Bins /Coke	Industrial Processes - Storage and Transfer	Mineral Handling
30510205	Mineral Prods /Bulk Materials Storage Bins /Limestone	Industrial Processes - Storage and Transfer	Mineral Handling
30510298	Mineral Prods /Bulk Materials Storage Bins /Mineral: Specify in Comments	Industrial Processes - Storage and Transfer	Mineral Handling
30510299	Mineral Prods /Bulk Materials Storage Bins /Other Not Classified	Industrial Processes - Storage and Transfer	Mineral Handling
30510303	Mineral Prods /Bulk Materials Open Stockpiles /Coal	Industrial Processes - Storage and Transfer	Mineral Handling
30510499	Mineral Prods /Bulk Materials Unloading Op /Other Not Classified	Industrial Processes - Storage and Transfer	Mineral Handling
30531008	Coal Mining, Cleaning & Material Handling /Unloading	Industrial Processes - Mining	Coal Handling
30700101	Sulfate (Kraft) Pulping /Digester System - Continuous or Batch	Industrial Processes - Pulp & Paper	Kraft Pulping: Digester LVHC
30700102	Sulfate (Kraft) Pulping /Brown Stock Washing System	Industrial Processes - Pulp & Paper	Kraft Pulping: Washing
30700103	Sulfate (Kraft) Pulping /Multi-effect Evaporators and Concentrators	Industrial Processes - Pulp & Paper	Kraft Pulping: Evaporator LVHC
30700104	Sulfate (Kraft) Pulping /Recovery Furnace/Direct Contact Evaporator	Industrial Processes - Pulp & Paper	DCE
30700105	Sulfate (Kraft) Pulping /Smelt Dissolving Tank	Industrial Processes - Pulp & Paper	SDT (Kraft)
30700106	Sulfate (Kraft) Pulping /Lime Kiln	Industrial Processes - Pulp & Paper	Lime Kiln
30700107	Sulfate (Kraft) Pulping /Turpentine Condenser	Industrial Processes - Pulp & Paper	Kraft Pulping: Turpentine LVHC
30700108	Sulfate (Kraft) Pulping /Fluid Bed Calciner	Industrial Processes - Pulp & Paper	Calciner
30700109	Sulfate (Kraft) Pulping /Black Liquor Oxidation System	Industrial Processes - Pulp & Paper	BLO
30700110	Sulfate (Kraft) Pulping /Recovery Furnace/Indirect Contact Evaporator	Industrial Processes - Pulp & Paper	NDCE
30700112	Sulfate (Kraft) Pulping /Lime Mud Washers	Industrial Processes - Pulp & Paper	Causticizing: Lime Mud
30700113	Sulfate (Kraft) Pulping /Lime Mud Filter System	Industrial Processes - Pulp & Paper	Causticizing: Lime Mud
30700114	Sulfate (Kraft) Pulping /Bleach Plant	Industrial Processes - Pulp & Paper	Bleaching: Kraft
30700115	Sulfate (Kraft) Pulping /Chlorine Dioxide Generator	Industrial Processes - Pulp & Paper	Bleaching: ClO2 Generator
30700116	Sulfate (Kraft) Pulping /Turpentine Loading Facilities	Industrial Processes - Pulp & Paper	Kraft Pulping: Turpentine LVHC

SCC	SCC Short Name	SCC EI Sector	Emission Process Group
30700117	Sulfate (Kraft) Pulping /Venting of condensate stripper off-gases	Industrial Processes - Pulp & Paper	Condensate Stripper
30700119	Sulfate (Kraft) Pulping /Salt Cake Mix Tank (Boiler Ash Handling)	Industrial Processes - Pulp & Paper	Salt Cake Tank
30700120	Sulfate (Kraft) Pulping /Stock Washing/Screening	Industrial Processes - Pulp & Paper	Kraft Stock Washing
30700121	Sulfate (Kraft) Pulping /Wastewater: General	Industrial Processes - Pulp & Paper	Wastewater (Kraft)
30700122	Sulfate (Kraft) Pulping /Causticizing: Miscellaneous	Industrial Processes - Pulp & Paper	Causticizing: Misc
30700123	Sulfate (Kraft) Pulping / Lime Slaker Vent	Industrial Processes - Pulp & Paper	Causticizing: Slaker
30700124	Sulfate (Kraft) Pulping / Black Liquor Storage Tanks	Industrial Processes - Pulp & Paper	Kraft Pulping: BL Tanks HVLC
30700125	Sulfate (Kraft) Pulping / Low Volume High Concentration System Venting of Non-condensible Gases	Industrial Processes - Pulp & Paper	Kraft Pulping: LVHC
30700126	Sulfate (Kraft) Pulping / High Volume Low Concentration System Venting of Non-condensible Gases	Industrial Processes - Pulp & Paper	Kraft Pulping: HVLC
30700127	Sulfate (Kraft) Pulping / Non-condensible Gases Incinerator	Industrial Processes - Pulp & Paper	Kraft Pulping: Incinerator
30700128	Sulfate (Kraft) Pulping / Total Reduced Sulfur Thermal Oxidizer	Industrial Processes - Pulp & Paper	Kraft Pulping: Incinerator
30700129	Sulfate (Kraft) Pulping / Enclosed secondary wastewater treatment system vents	Industrial Processes - Pulp & Paper	Wastewater (Kraft)
30700130	Sulfate (Kraft) Pulping / Decker system	Industrial Processes - Pulp & Paper	Kraft Pulping: Decker
30700131	Sulfate (Kraft) Pulping / Knotter / Deknotter System	Industrial Processes - Pulp & Paper	Kraft Pulping: Knotter
30700132	Sulfate (Kraft) Pulping / Green Liquor Processing	Industrial Processes - Pulp & Paper	Causticizing: Green Liquor
30700133	Sulfate (Kraft) Pulping / White Liquor Processing	Industrial Processes - Pulp & Paper	Causticizing: White Liquor
30700134	Sulfate (Kraft) Pulping / Oxygen delignification system	Industrial Processes - Pulp & Paper	Kraft Pulping: O2 Delig HVLC
30700135	Sulfate (Kraft) Pulping / Pulp Storage - Bleached and Unbleached	Industrial Processes - Pulp & Paper	Kraft Pulp Storage
30700136	Sulfate (Kraft) Pulping / Tall Oil System	Industrial Processes - Pulp & Paper	Tall Oil
30700199	Sulfate (Kraft) Pulping /Other Not Classified	Industrial Processes - Pulp & Paper	Kraft Misc
30700211	Sulfite Pulping /Digester/Blow Pit/Dump Tank: Calcium	Industrial Processes - Pulp & Paper	Sulfite Pulping (Ca)
30700214	Sulfite Pulping /Digester/Blow Pit/Dump Tank: NH3 with Process Change	Industrial Processes - Pulp & Paper	Sulfite Pulping (NH3)
30700216	Sulfite Pulping / Bleach Plant	Industrial Processes - Pulp & Paper	Bleaching: Sulfite
30700222	Sulfite Pulping /Recovery System: NH3	Industrial Processes - Pulp & Paper	Sulfite Recovery

SCC	SCC Short Name	SCC EI Sector	Emission Process Group
30700224	Sulfite Pulping /Wastewater: General	Industrial Processes - Pulp & Paper	Wastewater (Sulfite)
30700231	Sulfite Pulping /Acid Plant: NH3	Industrial Processes - Pulp & Paper	Sulfite Pulping (NH3)
30700233	Sulfite Pulping /Acid Plant: Ca	Industrial Processes - Pulp & Paper	Sulfite Pulping (Ca)
30700234	Sulfite Pulping /Knotters/Washers/Screens/etc.	Industrial Processes - Pulp & Paper	Sulfite Pulping
30700299	Sulfite Pulping /See Comment **	Industrial Processes - Pulp & Paper	Sulfite Pulping
30700301	Neutral Sulfite Semichemical Pulping /Digester/Blow Pit/Dump Tank	Industrial Processes - Pulp & Paper	NSSC Pulping
30700305	Neutral Sulfite Semichemical Pulping / Liquor Combustion	Industrial Processes - Pulp & Paper	NSSC Recovery
30700306	Neutral Sulfite Semichemical Pulping /Wastewater: General	Industrial Processes - Pulp & Paper	Wastewater (NSSC)
30700307	Neutral Sulfite Semichemical Pulping / Pulp washing system	Industrial Processes - Pulp & Paper	NSSC Pulping
30700308	Neutral Sulfite Semichemical Pulping / Pulp storage tanks/stock chests	Industrial Processes - Pulp & Paper	NSSC Pulping
30700309	Neutral Sulfite Semichemical Pulping / Liquor storage tanks	Industrial Processes - Pulp & Paper	NSSC Misc
30700320	Semi-chemical (non-sulfur) / Pulp washing system	Industrial Processes - Pulp & Paper	Semichem Pulping
30700321	Semi-chemical (non-sulfur) / Pulp storage tanks/stock chests	Industrial Processes - Pulp & Paper	Semichem Pulping
30700322	Semi-chemical (non-sulfur) / Liquor making system	Industrial Processes - Pulp & Paper	Semichem Pulping
30700323	Semi-chemical (non-sulfur) / Liquor evaporator system	Industrial Processes - Pulp & Paper	Semichem Pulping
30700324	Semi-chemical (non-sulfur) / Liquor combustion	Industrial Processes - Pulp & Paper	Semichem Recovery
30700325	Semi-chemical (non-sulfur) / Liquor storage tanks	Industrial Processes - Pulp & Paper	Semichem Pulping
30700326	Semi-chemical (non-sulfur) / Digesters/refiners/blow tanks/blow heat recovery system	Industrial Processes - Pulp & Paper	Semichem Pulping
30700327	Semi-chemical (non-sulfur) / Smelt tank	Industrial Processes - Pulp & Paper	SDT (Semichem)
30700328	Semi-chemical (non-sulfur) /Wastewater: General	Industrial Processes - Pulp & Paper	Wastewater (Semichem)
30700329	Semi-chemical (non-sulfur) /Other Not Classified	Industrial Processes - Pulp & Paper	Semichem Misc
30700351	Soda / recovery furnace	Industrial Processes - Pulp & Paper	Soda Recovery
30700352	Soda / smelt tank	Industrial Processes - Pulp & Paper	SDT (Soda)
30700353	Soda / lime kiln	Industrial Processes - Pulp & Paper	Lime Kiln
30700354	Soda /Other Not Classified	Industrial Processes - Pulp & Paper	Soda Misc
30700399	Neutral Sulfite Semichemical Pulping /Other Not Classified	Industrial Processes - Pulp & Paper	NSSC Misc

SCC	SCC Short Name	SCC EI Sector	Emission Process Group
30700401	Paper and Paperboard Manufacture / Paper Machine / Pulp Dryer	Industrial Processes - Pulp & Paper	Papermaking
30700403	Pulpboard Manuf /Raw Material Storage and Handling	Industrial Processes - Storage and Transfer	Paper Misc
30700404	Secondary Fiber Pulping /Stock Preparation and Repulper	Industrial Processes - Pulp & Paper	Paper Stock Prep
30700407	Paper and Paperboard Manufacture /Coating Operations: On-Machine	Industrial Processes - Pulp & Paper	Coating: On Machine
30700408	Secondary Fiber Pulping / Deinking operations	Industrial Processes - Pulp & Paper	Paper Stock Prep
30700409	Paper and Paperboard Manufacture / Coating Operations: Off-Machine	Industrial Processes - Pulp & Paper	Coating: Off Machine
30700410	Secondary Fiber Pulping / Bleaching / Brightening / Decoloring	Industrial Processes - Pulp & Paper	Bleaching: Sec Fiber
30700499	Paper and Paperboard Manuf /See Comment **	Industrial Processes - Pulp & Paper	Paper Misc
30700501	Wood Pressure Treating /Creosote	Industrial Processes - Pulp & Paper	Wood Handling
30700801	Sawmill Operations /Log Debarking	Industrial Processes - Pulp & Paper	Wood Handling
30700820	Sawmill Operations /Chipping and Screening	Industrial Processes - Pulp & Paper	Wood Handling
30701199	Paper Coating & Glazing /Extrusion Coating Line with Solvent Free Resin/Wax	Industrial Processes - Pulp & Paper	Paper Coating
30701201	Misc Paper Processes /Cyclones	Industrial Processes - Pulp & Paper	Paper Misc
30701202	Miscellaneous Paper Processes /Wastewater: General	Industrial Processes - Pulp & Paper	Wastewater (General)
30701220	Mechanical Pulping Ops / Thermomechanical Process and Chemi-thermomechanical Pulping	Industrial Processes - Pulp & Paper	Mechanical Pulping
30701221	Mechanical Pulping Ops / Pressurized Groundwood / Stone Groundwood	Industrial Processes - Pulp & Paper	Mechanical Pulping
30701222	Mechanical Pulping Ops/Bleaching / Brightening	Industrial Processes - Pulp & Paper	Bleaching: Mechanical
30701223	Mechanical and Recycle Paper Processes /Wastewater: General	Industrial Processes - Pulp & Paper	Wastewater (Mechanical)
30701224	Mechanical Pulping Ops / Refiner Pulping	Industrial Processes - Pulp & Paper	Mechanical Pulping
30701399	Misc Paper Products /Other Not Classified	Industrial Processes - Pulp & Paper	Paper Misc
30704001	Pulp&Paper&Wood /Bulk Handling&Stor: Wood-Bark /Storage Bins	Industrial Processes - Storage and Transfer	Wood Handling
30704002	Pulp&Paper&Wood /Bulk Handling&Stor: Wood-Bark /Stockpiles	Industrial Processes - Storage and Transfer	Wood Handling
30704003	Pulp&Paper&Wood /Bulk Handling&Stor: Wood-Bark /Unloading	Industrial Processes - Storage and Transfer	Wood Handling

SCC	SCC Short Name	SCC EI Sector	Emission Process Group
30704004	Pulp&Paper&Wood /Bulk Handling&Stor: Wood-Bark /Loading	Industrial Processes - Storage and Transfer	Wood Handling
30704005	Pulp&Paper&Wood /Bulk Handling&Stor: Wood-Bark /Conveyors	Industrial Processes - Storage and Transfer	Wood Handling
30788801	Pulp&Paper&Wood /Fugitive Emissions /Specify in Comments Field	Industrial Processes - Pulp & Paper	Fugitive Emissions - Misc
30799998	Pulp&Paper&Wood /Other Not Classified	Industrial Processes - Pulp & Paper	Paper Misc
30900500	Fabricated Metal /Welding /General	Industrial Processes - NEC	Welding
31299999	Misc Machinery Manuf /Other Not Classified	Industrial Processes - NEC	Misc Machinery Manuf
38500101	Industrial Process Cooling Tower /Mechanical Draft	Industrial Processes - NEC	Cooling Tower
38500110	Industrial Process Cooling Tower /Other Not Specified	Industrial Processes - NEC	Cooling Tower
39090003	Fuel Storage - Fixed Roof Tanks /Distillate Oil (No. 2): Breathing Loss	Industrial Processes - Storage and Transfer	Petrol Storage-Transfer
39999999	Misc Manuf / Indus Processes /Other Not Classified	Industrial Processes - NEC	Manuf Misc
40100251	Degreasing : Stoddard (Petroleum Solvent): General Degreasing Units	Solvent - Degreasing	Solvent Use
40100299	Degreasing : Other Not Classified: Open-top Vapor Degreasing	Solvent - Degreasing	Solvent Use
40100301	Solvent Evap /Cold Solvent Cleaning/Stripping /Methanol	Solvent - Degreasing	Solvent Use
40100303	Solvent Evap /Cold Solvent Cleaning/Stripping /Stoddard (Petroleum Solvent)	Solvent - Degreasing	Solvent Use
40100307	Solvent Evap /Cold Solvent Cleaning/Stripping /Isopropyl Alcohol	Solvent - Degreasing	Solvent Use
40100399	Solvent Evap /Cold Solvent Cleaning/Stripping /Other Not Classified	Solvent - Degreasing	Solvent Use
40188898	Solvent Evap /Fugitive Emissions /Specify in Comments Field	Solvent - Degreasing	Solvent Use
40200101	Surface Coating Application - General /Paint: Solvent-base	Solvent - Industrial Surface Coating & Solvent Use	Coating Misc
40200601	Surface Coating Application - General /Primer	Solvent - Industrial Surface Coating & Solvent Use	Coating Misc
40200701	Surface Coating Application - General /Adhesive Application	Solvent - Industrial Surface Coating & Solvent Use	Coating Misc
40200710	Surface Coating Application - General /Adhesive: General	Solvent - Industrial Surface Coating & Solvent Use	Coating Misc

SCC	SCC Short Name	SCC EI Sector	Emission Process Group
40200801	Surface Coating Oven - General /General	Solvent - Industrial Surface Coating & Solvent Use	Coating Misc
40200901	Surface Coating /Thinning Solvents - General /General: Specify in Comments	Solvent - Industrial Surface Coating & Solvent Use	Coating Misc
40201001	Surface Coating Oven Heater /Natural Gas	Solvent - Industrial Surface Coating & Solvent Use	Coating Misc
40201301	Paper Coating /Coating Operation	Solvent - Industrial Surface Coating & Solvent Use	Paper Coating
40201303	Paper Coating /Coating Mixing	Solvent - Industrial Surface Coating & Solvent Use	Paper Coating
40201304	Paper Coating /Coating Storage	Industrial Processes - Storage and Transfer	Paper Coating
40201305	Paper Coating /Equipment Cleanup	Solvent - Industrial Surface Coating & Solvent Use	Paper Coating
40201399	Paper Coating /Other Not Classified	Solvent - Industrial Surface Coating & Solvent Use	Paper Coating
40202605	Surface Coating /Steel Drums /Equipment Cleanup	Solvent - Industrial Surface Coating & Solvent Use	Coating Misc
40204435	Fabric Coating, Transfer Coating /Lamination: Laminating Device	Solvent - Industrial Surface Coating & Solvent Use	Coating Misc
40288824	Surface Coating /Fugitive Emissions /Clean-up	Solvent - Industrial Surface Coating & Solvent Use	Coating Misc
40299998	Surface Coating /Miscellaneous /Specify in Comments Field	Solvent - Industrial Surface Coating & Solvent Use	Coating Misc
40400102	Petrol Prod Stor-Bulk Terminals /Gasoline RVP 10: Breathing Loss (67000 BBL) - Fixed Roof Tank	Bulk Gasoline Terminals	Petrol Storage-Transfer
40400104	Petrol Prod Stor-Bulk Terminals /Gasoline RVP 13: Breathing Loss (250000 BBL)-Fixed Roof Tank	Bulk Gasoline Terminals	Petrol Storage-Transfer
40400107	Petrol Prod Stor-Bulk Terminals /Gasoline RVP 13: Working Loss (Diam Independent) - Fixed Roof Tank	Bulk Gasoline Terminals	Petrol Storage-Transfer
40400108	Petrol Prod Stor-Bulk Terminals /Gasoline RVP 10: Working Loss (Diam Independent) - Fixed Roof Tank	Bulk Gasoline Terminals	Petrol Storage-Transfer
40400121	Petrol Prod Stor-Bulk Terminals /Diesel Fuel: Standing Loss (Diam Independent) - Fixed Roof Tank	Bulk Gasoline Terminals	Petrol Storage-Transfer
40400199	Petrol Prod Stor-Bulk Terminals /See Comment **	Bulk Gasoline Terminals	Petrol Storage-Transfer
40400316	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank, Diesel, working+breathing+flashing losses	Industrial Processes - Storage and Transfer	Petrol Storage-Transfer

SCC	SCC Short Name	SCC EI Sector	Emission Process Group
40400403	Petrol Prod Stor-Underground Tanks /Gasoline RVP 10: Breathing Loss	Bulk Gasoline Terminals	Petrol Storage-Transfer
40400404	Petrol Prod Stor-Underground Tanks /Gasoline RVP 10: Working Loss	Bulk Gasoline Terminals	Petrol Storage-Transfer
40400413	Petrol Prod Stor-Underground Tanks /Distillate Fuel #2: Breathing Loss	Bulk Gasoline Terminals	Petrol Storage-Transfer
40500201	Print-Publish /General /Letter Press: 2751	Solvent - Graphic Arts	Print-Publish
40500215	Print-Publish /General /Letterpress: Cleaning Solution	Solvent - Graphic Arts	Print-Publish
40500301	Print-Publish /General /Printing: Flexographic	Solvent - Graphic Arts	Print-Publish
40600401	Petrol Trans & Marketg /Filling Vehicle Gas Tanks - Stage II /Vapor Loss w/o Controls	Gas Stations	Petrol Storage-Transfer
40688801	Petrol Trans & Marketg /Fugitive Emissions /Specify in Comments Field	Industrial Processes - Storage and Transfer	Petrol Storage-Transfer
40700814	Organic Chem Storage - Fixed Roof Tanks - Isopropyl Alcohol: Working Loss	Industrial Processes - Storage and Transfer	Storage Tanks - Alcohol
40700815	Organic Chem Storage - Fixed Roof Tanks - Methyl Alcohol: Breathing Loss	Industrial Processes - Storage and Transfer	Storage Tanks - Methanol
40700816	Organic Chem Storage - Fixed Roof Tanks - Methyl Alcohol: Working Loss	Industrial Processes - Storage and Transfer	Storage Tanks - Methanol
40701698	Organic Chem Storage - Fixed Roof Tanks - Specify Alkane: Working Loss	Industrial Processes - Storage and Transfer	Storage Tanks - Organic
40708098	Organic Chem Storage - Fixed Roof Tanks - Specify Nitro Compound in Comments: Working Loss	Industrial Processes - Storage and Transfer	Storage Tanks - Organic
40799997	Organic Chem Storage - Miscellaneous /Specify in Comments	Industrial Processes - Storage and Transfer	Storage Tanks - Organic
49099998	Solvent Evap /Misc Volatile Organic Evaporation /Identify the Process and Solvent in Comments	Solvent - Industrial Surface Coating & Solvent Use	Solvent Use
50300101	Waste Disp-Indus /Incineration /Multiple Chamber	Waste Disposal	Waste Disposal - Incineration
50300602	Waste Disp-Indus /Landfill Dump /Liquid Waste Disposal	Waste Disposal	Landfill
50300801	Waste Disp-Indus /Treatment, Storage, Disp /Surface Impoundment: Fugitive Emissions	Waste Disposal	Waste Disposal - Fugitive Emissions
50300810	Waste Disp-Indus /Treatment, Storage, Disp /Waste Piles: Fugitive Emissions	Waste Disposal	Waste Disposal - Fugitive Emissions
50300899	Waste Disp-Indus /Treatment, Storage, Disp /General: Fugitive Emissions	Waste Disposal	Landfill
50390006	Waste Disp-Indus /Auxillary Fuel-No Emissions /Natural Gas	Waste Disposal	Waste Disposal - Incineration

Table 6B. Allowable and Acute Multipliers for Emission Process Groups for the October 2011 Pulp and Paper Risk Modeling

Emission process group	Process MACT code	Allowable multiplier	Acute multiplier
Bleaching: ClO_2 Generator	1626-1	1.4 for chlorinated HAP; 1 for chloroform or non-chlorinated HAP	1.4
Bleaching: Kraft	1626-1	1.4 for chlorinated HAP; 1 for chloroform or non-chlorinated HAP	1.4
Bleaching: Mechanical	1626-1	1.4 for chlorinated HAP; 1 for chloroform or non-chlorinated HAP	1.4
Bleaching: Sec Fiber	1626-1	1.4 for chlorinated HAP; 1 for chloroform or non-chlorinated HAP	1.4
Bleaching: Sulfite	1626-1	1.4 for chlorinated HAP; 1 for chloroform or non-chlorinated HAP	1.4
BLO	1626-2		
Calciner	1626-2		
Causticizing: Green Liquor	1626-1	1	1.5
Causticizing: Lime Mud	1626-1	1	1.5
Causticizing: Misc	1626-1	1	1.5
Causticizing: Slaker	1626-1	1	1.5
Causticizing: White Liquor	1626-1	1	1.5
Chem Manuf [1]	1626-1, -3		
Coal Handling	1626-3		
Coating Misc	0711		
Coating: Off Machine	0711		
Coating: On Machine	0711		
Condensate Stripper	1626-1	1.6	1.2
Cooling Tower	1626-3		
DCE	1626-2		
Fugitive Emissions - Misc	1626-3		
ICI Boiler/PH	0107-1, -2, -3, -4		
Kraft Misc	1626-1	1	1.2
Kraft Pulp Storage	1626-1	1	1.2
Kraft Pulping: BL Tanks HVLC	1626-1	1	1.2
Kraft Pulping: Decker	1626-1	1	1.2
Kraft Pulping: Digester LVHC	1626-1	1	1.2
Kraft Pulping: Evaporator LVHC	1626-1	1	1.2
Kraft Pulping: HVLC	1626-1	1	1.2
Kraft Pulping: Incinerator	1626-1	1	1.2

Emission process group	Process MACT code	Allowable multiplier	Acute multiplier
Kraft Pulping: Knotter	1626-1	1	1.2
Kraft Pulping: LVHC	1626-1	1	1.2
Kraft Pulping: O_2 Delig HVLC	1626-1	1	1.2
Kraft Pulping: Turpentine LVHC	1626-1	1	1.2
Kraft Pulping: Washing	1626-1	1	1.2
Kraft Stock Washing	1626-1	1	1.2
Landfill	1626-3		
Lime Kiln	1626-2		
Manuf Misc [2]	1626-1, -3, 0107-4	1	1.4
Mechanical Pulping	1626-1	1	3.1
Mineral Handling	1626-3		
Misc Machinery Manuf	1626-3		
NDCE	1626-2		
NSSC Misc	1626-1	1	1
NSSC Pulping	1626-1	1	1
NSSC Recovery	1626-2		
Paper Coating	0711		
Paper Misc [2]	1626-1, -3	1	1.6
Paper Stock Prep	1626-1	1	1.6
Papermaking	1626-1	1	1.6
Petrol Storage-Transfer	0601, 0602		
Print-Publish	0714		
RICE	0105-1, -2		
Salt Cake Tank	1626-2		
SDT (Kraft)	1626-2		
SDT (Semichem)	1626-2		
SDT (Soda)	1626-2		
Semichem Misc	1626-1	1	1
Semichem Pulping	1626-1	1	1
Semichem Recovery	1626-2		
Soda Misc	1626-1	1	1.2
Soda Recovery	1626-2		
Solvent Use [1]	1626-1, -3		
Storage Tanks - Alcohol	1626-1	1	1.6
Storage Tanks - Methanol	1626-1	1	1.6
Storage Tanks – Organic [1]	0602, 1626-1		
Sulfite Pulping	1626-1	2.7	1.6

Emission process group	Process MACT code	Allowable multiplier	Acute multiplier
Sulfite Pulping (Ca)	1626-1	2.7	1.6
Sulfite Pulping (NH_3)	1626-1	1.6	1.6
Sulfite Recovery	1626-2		
Tall Oil	1626-1	1	1.2
Turbine	0108-1, -2		
Waste Disposal - Fugitive Emissions	1626-3		
Waste Disposal – Incineration	1626-3		
Wastewater (General)	1626-1	1	2
Wastewater (Kraft)	1626-1	1.6	2
Wastewater (Mechanical)	1626-1	1	2
Wastewater (NSSC)	1626-1	1	2
Wastewater (Semichem)	1626-1	1	2
Wastewater (Sulfite)	1626-1	1	2
Welding	1626-3		
Wood Handling	1626-3		

[1] No multipliers needed for these 1626-1 sources; only criteria air pollutant emissions.

[2] Multipliers apply to 1626-1 sources only.

Table 7. Allowable Multipliers by Emission Source Type for Risk Modeling for Subpart S (MACT Code 1626-1)

Emission source type	Subpart S performance level (percent reduction)	Reported actual performance level (percent reduction) [1]	October 2011 allowable multiplier [2]
Bleaching			
Chlorinated HAP	99%	99.3%	1.4
Chloroform	work practice	NA	1
Non-chlorinated HAP	NA	NA	1
Kraft pulping			
Performance limit	98%	99%	2
Equipment standards	NA	NA	1[3]
Kraft pulping process condensates [4]	92%	95%	1.6
Soda or semichemical pulping			
Performance limit	98%	99%	2
Equipment standards	NA	NA	1[3]
Sulfite pulping			
Ca or Na sulfite	92%	97%	2.7
NH_3 or Mg sulfite	87%	92%	1.6
Uncontrolled emission units [5]	NA	NA	1

[1] These reported values for percent reduction are based on survey data received.

[2] The allowable multiplier is calculated as follows (using kraft pulping vent gases as an example and canceling out uncontrolled tpy):

$$\text{Allowable multiplier} = \frac{\text{Allowable}}{\text{Actual}} = \frac{(1 - \text{subpart S limit \% reduction})}{(1 - \text{actual \% reduction})} = \frac{(1 - 0.98)}{(1 - 0.99)} = \frac{0.02}{0.01} = 2$$

[3] The multiplier for equipment standards is recommended for use in the October 2011 risk modeling because most kraft, soda, and semichemical mills are demonstrating compliance with subpart S by meeting one of the three equipment standards for kraft, soda, and semichemical pulping.

[4] The allowable multiplier would apply for emissions from kraft pulping process condensates, which would typically either be treated by steam stripping or biological treatment (i.e., wastewater treatment). This value is recommended for application to kraft pulping wastewater for the October 2011 risk modeling.

[5] For example, causticizing, mechanical pulping, papermaking, storage tanks, non-kraft wastewater, and miscellaneous manufacturing.

Table 8. Acute Multipliers by Emission Source Type for Risk Modeling for Subpart S (MACT Code 1626-1)

Emission source type	Median peak-to-mean ratio (acute multiplier)	Notes
Bleaching	1.4	
Causticizing	1.5	
Kraft pulping	1.2	
Mechanical pulping	3.1	
Miscellaneous manufacturing	1.4	No data; assigned based on median of other values
Neutral sulfite semichemical pulping	1.0	
Non-sulfur semichemical pulping	1.0	
Papermaking	1.6	Industry value used; data confirmed by our analysis
Soda pulping	1.2	
Storage tanks	1.6	
Sulfite pulping	1.6	
Wastewater	2.0	Industry value used; data confirmed by our analysis

Appendix A
Checklist to Review NEI Update Spreadsheets

Checklist to Review NEI Update Spreadsheets

Name of reviewer ________
Date of review ________
NEI ID ________
RTI ID (in tracking spreadsheet) ________

Mill type (in tracking spreadsheet; check all that apply)	☐ kraft	☐ soda	☐ sulfite	☐ semi-chemical	☐ mechanical (TMP, RMP, SGW, PGW)	☐ non-wood	☐ secondary fiber (incl. de-inking)	☐ NA (paper only)

Is Facility Name consistent between Facility tab and Inventory tab?	☐ yes	☐ no	____
Is there any information in the wrong column?	☐ yes	☐ no	____
Are the equipment (SCCs) what we expect to see for this mill type?	☐ yes	☐ no	____
Kraft: 30700101-199, and 401			____
Soda: 30700101-199, 351-354, and 401			
Sulfite: 30700214-299, and 401			
Semichemical: 30700301-329, and 401			____
Mechanical: 30701220-224, and 401			
Secondary fiber: 30700401-410 and 30701202			____
Paper only: 30700401-410, and 30701202			
Are the pollutants what we expect to see?	☐ yes	☐ no	____
E.g., acetaldehyde, cresols, formaldehyde, methanol, phenol, styrene, toluene, xylenes, TRS, VOC			____
Are there any missing stack or fugitive parameters?	☐ yes	☐ no	____
Are there any missing latitude/longitude data?	☐ yes	☐ no	____
Any other observations? Any recommended changes?			____ ____

List of Subpart S Equipment to Check in Review of NEI Update Spreadsheets[1]

Pulping process	Subpart S equipment	SCC
Kraft	Bleaching system	30700114, 30700115
	Causticizing system	30700112, 30700113, 30700122, 30700123, 30700132, 30700133
	Decker system	30700130
	Digester system	30700101
	Evaporator system	30700103
	HVLC system	30700126
	Knotter system	30700131
	LVHC system	30700125
	Incinerator/thermal oxidizer	30700127, 30700128
	Oxygen delignification system	30700134
	Papermaking system	30700401
	Process wastewater treatment system	30700121
	Pulp washing system	30700102
	Screen system	30700120
	Tall oil reactor system	30700136
	Turpentine recovery system	30700107, 30700116
	Weak liquor storage tank	30700124
Soda	Bleaching system	30700114, 30700115, 30700354
	LVHC system	30700125, 30700354
	Papermaking system	30700401, 30700354
	Process wastewater treatment system	30700121, 30700354
	Pulp washing system	30700102, 30700354
Semichemical (NSSC)	LVHC system	30700301, 30700302
	Papermaking system	30700401
	Process wastewater treatment system	30700306
	Pulp washing system	30700307

Pulping process	Subpart S equipment	SCC
Semichemical (non-sulfur)	LVHC system	30700323, 30700326
	Papermaking system	30700401
	Process wastewater treatment system	30700328
	Pulp washing system	30700320
Sulfite	Acid condensate storage tank	30700231
	Bleaching system	30700216
	Digester system	30700214
	Evaporator system	30700222
	Papermaking system	30700401
	Process wastewater treatment system	30700224
	Pulp washing system	30700234
	Strong liquor storage tank	30700234
	Weak liquor storage tank	30700234
Mechanical	Bleaching system	30701222
	Papermaking system	30700401
	Process wastewater treatment system	30701223
	Pulping system	30701220, 30701221, 30701224
Secondary fiber	Bleaching system	30700410
	Papermaking system	30700401
	Process wastewater treatment system	30701202
	Repulping system	30700404
None (paper production only)	Bleaching system	30700410
	Papermaking system	30700401
	Process wastewater treatment system	30701202

[1] HVLC = high-volume, low-concentration; LVHC = low-volume, high-concentration; NSSC = neutral sulfite semichemical.

Appendix B

Parameters for Modeling of Paper Machine Emissions

ncasi

P.O. Box 13318, Research Triangle Park, NC 27709-3318 919-941-6400

MEMORANDUM

DATE: January 18, 2011

TO: Bill Schrock, EPA

FROM: John Pinkerton

SUBJECT: Parameters for Modeling of Paper Machine Emissions

During the January 13 working session, there was some discussion of how paper machine emissions were being modeled. Apparently if a paper machine source is coded in the NEI as a fugitive source, the default parameters for a fugitive source are assigned unless building dimensions (height, length, width, orientation) have been entered. The default parameters are a height of 10 feet, temperature of 72°F, exit velocity of 0.0003 ft/sec, and a diameter of 0.003 ft. These fugitive default parameters are not reflective of paper machine emission sources.

Where paper machine sources are coded as stack emission points, the EPA default parameters for SCC 30700401 (paper machine/pulp dryer), 30700405 (paper/board forming), and 30700407 (coating operations: on-machine) are as follows:

SCC	Type	Height	Temperature	Exit Velocity	Flow Rate
30700401	Stack	56 ft	50ºC	19.4 ft/sec	13,560 acfm
30700405	Stack	62 ft	60ºC	34.3 ft/sec	32,220 acfm
30700407	Stack	45 ft	78ºC	33.7 ft/sec	233,000 acfm

Paper machines are typically located in a long, rectangular building with a flat roof. There are multiple roof vents above the paper machine, many of which have fans to exhaust the building air. The number and type of vents, and vent gas characteristics (flow rate, exit velocity, gas temperature, moisture level), vary considerably from machine to machine. The total amount of air exhausted from a paper machine building is not necessarily related to the production capacity of the paper machine. Thus it is difficult to develop a 'default' set of parameters representing a 'typical' paper machine.

NCASI has performed sampling at a number of paper machines over the last 20 years. The following averages are based on information contained in various NCASI reports and company-provided permitting materials. Obviously values for any given paper machine could depart significantly from these averages.

Number of vents on wet end (with bulk of exhaust gas) – 6
Number of vents on dry end (with bulk of exhaust gas) – 6
Vent height – 70 ft above grade
Average vent gas exit velocity – 30 ft/sec
Average vent gas flow rate – 30,000 dscfm
Wet end vent gas parameters – 40ºC, 5% moisture (33650 acfm/vent)
Dry end vent gas parameters – 65ºC, 12% moisture (36470 acfm/vent)
50% of emissions of gaseous organic hazardous air pollutants are from wet end, 50% from dry end
Building length – 200 m
Building width – 30 m

These averages for dry end sources do not include vents associated with on-machine coaters that have direct-fired dryers, nor do they include vents for direct-fired Yankee dryers (both of which have relatively high flow rates and temperatures).

Where detailed paper machine source characteristics are not contained in the NEI files, the above average values represent reasonable choices for dispersion modeling purposes. It is suggested that EPA replace any NEI default parameters for SCCs 30700401 and 30700405 with these averages, and model them as stack sources.

Further, in Part I of the upcoming survey, we suggest the instructions indicate that the above values will be used for all paper machines in future EPA modeling and risk assessments unless the mill is able to provide more detailed site-specific parameters.

Appendix C

Engineering Estimates for Fugitive Length and Width Parameters for Pulp and Paper Fugitive Emission Sources

Engineering Estimates for Fugitive Length and Width Parameters for Pulp and Paper Fugitive Emission Sources

SCC	Short Name	Notes[1]	Fugitive Length (ft)	Fugitive Width (ft)	Fugitive Angle (deg)
10200503	Ext Comb /Industrial /Distillate Oil /< 10 Million Btu/hr **	Based on parameters for similar SCCs.	20	20	0
20200301	Int Comb /Industrial /Gasoline /Reciprocating Engine	Based on parameters for similar SCCs.	20	20	0
30187009	Chem Manuf /Inorganic Chem Stor (Fixed Roof Tanks) /Sulfuric Acid: Breathing Loss	Assumed.	8	8	0
30187097	Chem Manuf /Inorganic Chem Stor (Fixed Roof Tanks) /Specify Liquid: Breathing Loss	Assumed.	8	8	0
30700101	Sulfate (Kraft) Pulping /Digester System - Continuous or Batch	Digesters are generally the same size regardless of pulping operations. Capacity is generally increased by adding an additional digester, not expanding one's size.	20	20	0
30700102	Sulfate (Kraft) Pulping /Brown Stock Washing System	Brownstock washers are usually about the same size. Brownstock washing capacity is generally increased with the addition of a new washer(s). Washing capacity is relative to the bleaching capacity (via simple mass balance). Some backup pulp is stored before bleaching to prevent downtime. These estimates are per washer.	8	18	0
30700103	Sulfate (Kraft) Pulping /Multi-effect Evaporators and Concentrators		110	110	0
30700106	Sulfate (Kraft) Pulping /Lime Kiln		300	20	0
30700107	Sulfate (Kraft) Pulping /Turpentine Condenser	Basic reaction vessel. These are per vessel.	5	5	0
30700110	Sulfate (Kraft) Pulping /Recovery Furnace/Indirect Contact Evaporator		50	50	0
30700111	Sulfate (Kraft) Pulping /Filtrate Tanks	These are smaller stationary storage tanks. These are per tank.	8	8	0
30700112	Sulfate (Kraft) Pulping /Lime Mud Washers	These are almost the same as a lime mud filter in capacity and design. These are per washer.	10	10	0
30700113	Sulfate (Kraft) Pulping /Lime Mud Filter System	Lime mud filters are relative to the size of the recovery operation. These are usually similar in size to a washer. These estimates are per filter.	10	18	0
30700114	Sulfate (Kraft) Pulping /Bleach Plant	Modern bleach plants could be confined to roughly a 2-acre footprint. This includes all additional equipment.	300	300	0
30700115	Sulfate (Kraft) Pulping /Chlorine Dioxide Generator	This estimate is based on one reaction vessel, not the entire processing site.	15	25	0
30700116	Sulfate (Kraft) Pulping /Turpentine Loading Facilities	This is a covered pad or building for trucks or tankers to receive turpentine byproducts.	8	40	0
30700117	Sulfate (Kraft) Pulping /Venting of condensate stripper off-gases	This is a smaller a stack. These are per stack.	2	2	0
30700118	Sulfate (Kraft) Pulping /Liquor Clarifiers	Liquor clarifiers are relative to the size of the pulping operation. These are usually similar to a tank/holding vessel. These estimates are per clarifier.	25	25	0
30700119	Sulfate (Kraft) Pulping /Salt Cake Mix Tank (Boiler Ash Handling)		25	25	0
30700120	Sulfate (Kraft) Pulping /Stock Washing/Screening	Same basic idea as brownstock washers. Washers are generally the same in a pulping operation.	8	18	0
30700121	Sulfate (Kraft) Pulping /Wastewater: General	Used the fugitive parameters from section III of this memo.	829	166	0
30700122	Sulfate (Kraft) Pulping /Causticizing: Miscellaneous	Assumptions were made based on the size of one causticizing vessel. These estimates are per causticizer.	20	20	0
30700123	Sulfate (Kraft) Pulping / Lime Slaker Vent		2	2	0

SCC	Short Name	Notes[1]	Fugitive Length (ft)	Fugitive Width (ft)	Fugitive Angle (deg)
30700124	Sulfate (Kraft) Pulping / Black Liquor Storage Tanks	These are usually large holding tanks. I would estimate that smaller units are typically 100k-250k gallons. Most tanks today are 1 million gallon capacity. These estimates are per tank.	35	35	0
30700125	Sulfate (Kraft) Pulping / Low Volume High Concentration System Venting of Non-condensible Gases	These are similar to pressure relief valves. These are on a per vent basis (multiple vents are likely).	1	1	0
30700126	Sulfate (Kraft) Pulping / High Volume Low Concentration System Venting of Non-condensible Gases	These are similar to pressure relief valves. These are on a per vent basis (multiple vents are likely).	1	1	0
30700127	Sulfate (Kraft) Pulping / Non-condensible Gases Incinerator	These are a basic incinerator vessel with a stack. These are per stack.	3	3	0
30700130	Sulfate (Kraft) Pulping / Decker system	Same basic idea as brownstock washers. Washers are generally the same in a pulping operation. The only difference--instead of letting gravity separate the pulp and liquid, the pulp is pressed for dewatering. These are per decker.	8	18	0
30700131	Sulfate (Kraft) Pulping / Knotter / Deknotter System		3	3	0
30700132	Sulfate (Kraft) Pulping / Green Liquor Processing	Green liquor processing is similar to liquor clarifiers and lime mud washers.	10	10	0
30700133	Sulfate (Kraft) Pulping / White Liquor Processing	Based on descriptions from the SCC descriptions tab, these items appear to be individual units, not an entire white liquor processing site. This is why the values may appear small. These estimates are per unit.	10	20	0
30700134	Sulfate (Kraft) Pulping / Oxygen delignification system	These are pulping reaction vessels before the bleaching operations. These are tall cylinders. These are per O_2 delig vessel.	20	20	0
30700135	Sulfate (Kraft) Pulping / Pulp Storage - Bleached and Unbleached	These are just large storage tanks. These are per storage tank.	30	30	0
30700136	Sulfate (Kraft) Pulping / Tall Oil System	Large holding vessel. Usually just a tall tank sitting on its end. These are per vessel.	10	10	0
30700199	Sulfate (Kraft) Pulping /Other Not Classified	No indications were available to aid in developing length and width estimates. Used assumed values.	20	20	0
30700211	Sulfite Pulping /Digester/Blow Pit/Dump Tank: Calcium	The one SCC record without length and width values was listed as a drain.	1	1	0
30700212	Sulfite Pulping /Digester/Blow Pit/Dump Tank: MgO with Recovery System	Blow tanks must have the capacity to contain the pulp and the black liquor leaving the digester. These are per blow tank/digester.	20	20	0
30700224	Sulfite Pulping /Wastewater: General	Used the fugitive parameters from section III of this memo.	829	166	0
30700299	Sulfite Pulping /See Comment **	These are usually drainage systems that may be found in the floor. These are based on a 10-ft section of drainage grate.	10	1	0
30700301	Neutral Sulfite Semichemical Pulping /Digester/Blow Pit/Dump Tank	Blow tanks must have the capacity to contain the pulp and the black liquor leaving the digester. These are per blow tank/digester.	20	20	0
30700306	Neutral Sulfite Semichemical Pulping /Wastewater: General	This was assumed to be floor grates.	10	1	0
30700307	Neutral Sulfite Semichemical Pulping / Pulp washing system	Same basic idea as brownstock washers. Washers are generally the same in a pulping operation.	8	18	0
30700308	Neutral Sulfite Semichemical Pulping / Pulp storage tanks/stock chests	These are just large storage tanks. These are per storage tank.	30	30	0
30700309	Neutral Sulfite Semichemical Pulping / Liquor storage tanks	These are usually large holding tanks. I would estimate that smaller units are typically 100k-250k gallons. Most tanks today are 1 million gallon capacity. These estimates are per tank.	35	35	0
30700320	Semi-chemical (non-sulfur) / Pulp washing system	Same basic idea as brownstock washers. Washers are generally the same in a pulping operation. These are per washer.	8	18	0
30700321	Semi-chemical (non-sulfur) / Pulp storage tanks/stock chests		15	15	0
30700322	Semi-chemical (non-sulfur) / Liquor making system		10	10	0

SCC	Short Name	Notes [1]	Fugitive Length (ft)	Fugitive Width (ft)	Fugitive Angle (deg)
30700325	Semi-chemical (non-sulfur) / Liquor storage tanks	These are just large storage tanks. These are per storage tank.	30	30	0
30700326	Semi-chemical (non-sulfur) / Digesters/refiners/blow tanks/blow heat recovery system	Blow tanks must have the capacity to contain the pulp and the black liquor leaving the digester. These are per blow tank/digester.	20	20	0
30700328	Semi-chemical (non-sulfur) /Wastewater: General	This was assumed to be floor grates.	10	1	0
30700401	Paper and Paperboard Manufacture / Paper Machine / Pulp Dryer		150	60	0
30700403	Pulpboard Manuf /Raw Material Storage and Handling	These appear to be tanks. The same parameters as the SCC 407 tanks were used.	12	20	0
30700404	Secondary Fiber Pulping /Stock Preparation and Repulper	Repulpers are generally one size. Again, capacity is increased by adding an additional repulper, not expanding one's size. These are per repulper.	10	10	0
30700407	Paper and Paperboard Manufacture /Coating Operations: On-Machine	These are the same width as a paper machine. Lengths vary slightly.	3	20	0
30700408	Secondary Fiber Pulping / Deinking operations	Deinking operations are generally one size. Again, capacity is increased by adding an additional deinking vessel, not expanding one's size. These are per vessel.	30	30	0
30700499	Paper and Paperboard Manuf /See Comment **		35	36	0
30700801	Sawmill Operations /Log Debarking		80	12	0
30700820	Sawmill Operations /Chipping and Screening		20	20	0
30701199	Paper Coating & Glazing /Extrusion Coating Line with Solvent Free Resin/Wax	This was assumed to be an extruder.	8	8	0
30701201	Misc Paper Processes /Cyclones	This was assumed to be a set of cyclones.	10	2	0
30701202	Miscellaneous Paper Processes /Wastewater: General	Used the fugitive parameters from section III of this memo.	1000	1500	0
30701221	Mechanical Pulping Ops / Pressurized Groundwood / Stone Groundwood	These are heavy-duty refiners, without dilute pulp slurry, that physically separate fiber.	5	5	0
30701223	Mechanical and Recycle Paper Processes /Wastewater: General	This was assumed to be floor grates.	10	1	0
30701224	Mechanical Pulping Ops / Refiner Pulping	This was assumed to be a typical refiner foot print.	10	10	0
30701399	Misc Paper Products /Other Not Classified	Using the descriptions provided, an estimate was made. This process would occur within some type of building.	50	50	0
30704001	Pulp&Paper&Wood /Bulk Handling&Stor: Wood-Bark /Storage Bins		100	100	0
30704002	Pulp&Paper&Wood /Bulk Handling&Stor: Wood-Bark /Stockpiles		200	200	0
30704003	Pulp&Paper&Wood /Bulk Handling&Stor: Wood-Bark /Unloading	This was assumed to be truck or rail car size.	50	10	0
30704004	Pulp&Paper&Wood /Bulk Handling&Stor: Wood-Bark /Loading	This was assumed to be truck or rail car size.	50	10	0
30704005	Pulp&Paper&Wood /Bulk Handling&Stor: Wood-Bark /Conveyors	This assumption was based on belt style conveyors.	250	5	0
30788801	Pulp&Paper&Wood /Fugitive Emissions /Specify in Comments Field	No indications were available to aid in developing length and width estimates. Used assumed values.	200	200	0
30799999	Pulp&Paper&Wood /Other Not Classified /See Comment **	Descriptions indicated these were deinking operations. The same values as SCC 30700408 were used.	10	10	0
39999999	Misc Manuf / Indus Processes /Other Not Classified	No indications were available to aid in developing length and width estimates. Used assumed values.	20	20	0
40700814	Organic Chem Storage - Fixed Roof Tanks - Isopropyl Alcohol: Working Loss	The averages of actual lengths and widths were used.	12	20	0
40700815	Organic Chem Storage - Fixed Roof Tanks - Methyl Alcohol: Breathing Loss	These are usually just large polyethylene tanks. These are per tank.	5	5	0
40700816	Organic Chem Storage - Fixed Roof Tanks - Methyl Alcohol: Working Loss	These are usually just large polyethylene tanks. These are per tank.	5	5	0
40708098	Organic Chem Storage - Fixed Roof Tanks - Specify Nitro	The averages of actual lengths and widths were used.	12	20	0

SCC	Short Name	Notes [1]	Fugitive Length (ft)	Fugitive Width (ft)	Fugitive Angle (deg)
	Compound in Comments: Working Loss				
40799997	Organic Chem Storage - Miscellaneous /Specify in Comments	The averages of actual lengths and widths were used.	12	20	0
49099998	Solvent Evap /Misc Volatile Organic Evaporation /Identify the Process and Solvent in Comments	Used the averages from the other 407 SCC codes.	12	20	0

[1] Items were based on a per unit basis. All sizes are based on 1 piece of that type of equipment.

[2] For modeling purposes, fugitive parameters had to be rounded to whole numbers, so for any values less than 0.5 ft (e.g., 0.25 ft), we rounded them up to 1 ft.

Appendix D

Wastewater Treatment Plant (WWTP) Emissions Variability and Default Areas

From: Pinkerton, John [mailto:JPinkerton@NCASI.org]
Sent: Thursday, February 17, 2011 4:13 PM
To: Schrock.Bill@epamail.epa.gov
Cc: Bradfield.John@epamail.epa.gov; Hanks, Katie P.; hirtz.james@epamail.epa.gov; palma.ted@epamail.epa.gov; Hunt, Tim; Jain, Ashok (SRC); Emerson, Zack (SRC); Crapo, Ann (SRC); Palumbo, James (Gmail)
Subject: Wastewater Treatment Plant (WWTP) Emissions Variability and Default Areas

Bill,

Attached is a write-up on variability of WWTP emissions. We believe the effluent loading data and WATER9 sensitivity analysis support a peak-to-mean ratio (maximum short-term emission rate to annual average emission rate) of two or less.

We have also gathered some dimensional information for primary clarifiers and aerated stabilization basins (ASBs) for the purpose of setting defaults for dispersion modeling whenever the NEI does not contain values (length, width, orientation angle relative to north) for these wastewater fugitive emission sources. We are trying to get more information on the dimensions of activated sludge treatment systems, since we only have information on three of these at present.

1. Primary clarifiers. The most common shape for a primary clarifier is circular. The average diameter for clarifiers at 25 mills for which NCASI has information was 190 ft. In WATER9 modeling, NCASI uses a default value of 200 ft if a site-specific diameter is not available. Since HEM-3 does not accept circular area sources, Jim Hirtz suggested that the length and width for a circular source be set such that the area of a square source is equal to the area of the circular source. A circle with a 200 ft diameter would have the same area as a square with sides of 177 ft. It isn't clear what orientation angle should be specified for the square.
2. ASBs. When performing WATER9 modeling to estimate emissions of volatile organic compounds from an ASB, the ASB is typically divided into zones. Emissions from a zone depend on many factors, but generally the first zone (where the effluent enters the basin and normally has the most surface aeration) has the highest emission rates. For 10 ASBs that have recently been modeled, the average size of the first zone is 13.4 acres (1.46 x 10^6 ft^2), and the first zone represented an average of 28% of the total ASB area. Although the first zone could have various shapes, a reasonable assumption would be a length to width ratio of 1.5, which would give a length of 1500 ft and width of 1000 ft for a zone with an area of 1.5 x 10^6 ft^2. It could be conservatively assumed all ASB emissions come from the first zone if site-specific WATER9 modeling has not been conducted.
3. Activated sludge treatment (AST) systems. These are generally rectangular concrete basins. The size will depend on effluent flow rates, required treatment efficiency, and necessary retention time. For 3 such systems, the areas ranged from 20,000 to 35,000 ft^2 . Length-to-width ratios ranged from 2 to 8.

It is expected the majority of emissions from most chemical pulp mill wastewater treatment operations will come from the secondary treatment basins (ASB or AST), with relatively little from primary clarifiers and post-secondary treatment basins.

Give me a call if there are questions.

Sincerely,
John

John Pinkerton
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Appendix E

Information Needed to Calculate Allowable Multipliers for Subpart S Risk Modeling (MACT Code 1626-1)

Information Needed to Calculate Allowable Multipliers for Subpart S Risk Modeling (MACT Code 1626-1)

Source limit details	Typical source control systems	Gaseous organic HAP standard	Standard format	Allowable multiplier calculation	Needed to calculate allowable multiplier
<u>Kraft pulping vent gases</u>: Existing sources: LVHC system[1]; knotter or screen (above HAP cutoffs), pulp washing, decker (using contaminated water), and O_2 delignification. New sources: Same as existing, except applies for <u>all</u> knotters, screens, and deckers plus weak liquor storage tanks.	Route through a closed vent collection system to a boiler, lime kiln, recovery furnace, or thermal oxidizer	(1) Reduce total HAP emissions by ≥98 wt%; or	Numeric emission limit (performance limit)	Allowable multiplier = $\frac{\text{(1- 98\% reduction limit)}}{\text{(1-actual \% reduction)}}$	Need actual % reduction from Part I response.
		(2) Reduce total HAP concentration at the outlet of thermal oxidizer to ≤20 ppmv @ 10% O_2 (dry basis); or	Numeric emission limit (concentration limit)	Allowable multiplier = $\frac{\text{Allowable emissions}}{\text{Actual emissions (NEI)}}$ Allowable emissions = 20 ppmv * MW g/g-mol * g-mol-K/0.08206 l-atm * 1 atm * 1/temp (C+273) * 1000 l-ug/g-m^3 * 0.028316847 m^3/ft^3 * g/10^6 ug * lb/453.59237 g * cfm * 60 min/hr * 24 hr/d * 365 d/yr	Need MW, temp, and flow from Part I response and actual emissions from NEI. Use MW for surrogate pollutant (methanol) in allowable calculation.
		(3) Reduce total HAP emissions using a thermal oxidizer operating ≥1600°F and ≥0.75 sec residence time; or	Equipment standard	As equipment standard, actual = allowable, so allowable multiplier = 1	--
		(4) Use a boiler, LK, or RF in which the HAP gas stream in introduced with the primary fuel into the flame zone; or	Equipment standard	As equipment standard, actual = allowable, so allowable multiplier = 1	--
		(5) Use a boiler or RF with a heat input capacity ≥150 MMBtu/hr (44 MW) in which the HAP gas stream is introduced with the combustion air.	Equipment standard	As equipment standard, actual = allowable, so allowable multiplier = 1	--

Source limit details	Typical source control systems	Gaseous organic HAP standard	Standard format	Allowable multiplier calculation	Needed to calculate allowable multiplier
Soda or semichemical pulping vent gases: Existing sources: LVHC system[1] New sources: Same as existing, plus pulp washing system.	Route through a closed vent collection system to a boiler, lime kiln, recovery furnace, or thermal oxidizer	(1) Reduce total HAP emissions by ≥98 wt%; or	Numeric emission limit (performance limit)	Allowable multiplier = (1- 98% reduction limit) (1-actual % reduction)	Need actual % reduction from Part I response.
		(2) Reduce total HAP concentration at the outlet of thermal oxidizer to ≤20 ppmv @ 10% O_2 (dry basis); or	Numeric emission limit (concentration limit)	Allowable multiplier = Allowable emissions Actual emissions (NEI) Allowable emissions = 20 ppmv * MW g/g-mol * g-mol-K/0.08206 l-atm * 1 atm * 1/temp (C+273) * 1000 l-ug/g-m^3 * 0.028316847 m^3/ft^3 * g/10^6 ug * lb/453.59237 g * cfm * 60 min/hr * 24 hr/d * 365 d/yr	Need MW, temp, and flow from Part I response and actual emissions from NEI. Use MW for surrogate pollutant (methanol) in allowable calculation.
		(3) Reduce total HAP emissions using a thermal oxidizer operating ≥1600°F and ≥0.75 secs residence time; or	Equipment standard	As equipment standard, actual = allowable, so allowable multiplier = 1	--
		(4) Use a boiler, LK, or RF in which the HAP gas stream in introduced with the primary fuel into the flame zone; or	Equipment standard	As equipment standard, actual = allowable, so allowable multiplier = 1	--
		(5) Use a boiler or RF with a heat input capacity ≥150 MMBtu/hr (44 MW) in which the HAP gas stream is introduced with the combustion air.	Equipment standard	As equipment standard, actual = allowable, so allowable multiplier = 1	--

Source limit details	Typical source control systems	Gaseous organic HAP standard	Standard format	Allowable multiplier calculation	Needed to calculate allowable multiplier
Sulfite pulping vent gases: Existing sources: Digester vent, evaporator vent, and pulp washing. New sources: Same as existing, plus strong and weak liquor storage tanks, and acid condensate storage tanks.	Route through a closed vent collection system to a scrubber or other control device (emission limits apply to combined emissions from vents, control device wastewater, and condensates)	(1a) Ca- or Na-based: Emit total HAP (as methanol) ≤0.89 lb/ton ODP, or	Numeric emission limit (production-based limit)	Allowable multiplier = Allowable emissions Actual emissions (NEI) Allowable emissions = 0.89 lb/ton ODP * ton ODP/yr	Need actual ton ODP/yr from Part I response and actual emissions from NEI.
		(1b) Ca- or Na-based: Reduce total HAP (as methanol) by ≥92%;	Numeric emission limit (performance limit)	Allowable multiplier = (1- 92% reduction limit) (1-actual % reduction)	Need actual % reduction from Part I response.
		(2a) NH_3- or Mg-based: Emit total HAP (as methanol) ≤2.2 lb/ton ODP, or	Numeric emission limit (production-based limit)	Allowable multiplier = Allowable emissions Actual emissions (NEI) Allowable emissions = 2.2 lb/ton ODP * ton ODP/yr	Need actual ton ODP/yr from Part I response and actual emissions from NEI.
		(2b) NH_3- or Mg-based: Reduce total HAP (as methanol) by ≥87%.	Numeric emission limit (performance limit)	Allowable multiplier = (1- 87% reduction limit) (1-actual % reduction)	Need actual % reduction from Part I response.
New and existing bleaching vent gases: Chlorine bleaching systems, kraft/sulfite/soda bleaching with any chlorinated compounds, and mechanical/secondary fiber/non-wood bleaching with ClO_2.	Route through a closed vent collection system to a caustic scrubber or similar device	(1) Reduce total chlorinated HAP (except chloroform) limit: ≥99 wt%, or	Numeric emission limit (performance limit)	Allowable multiplier = (1- 99% reduction limit) (1-actual % reduction)	Need actual % reduction from Part I response.
		(2) Meet ≤10 ppmv of total chlorinated HAP (except chloroform) at control device outlet, or	Numeric emission limit (concentration limit)	Allowable multiplier = Allowable emissions Actual emissions (NEI) Allowable emissions = 10 ppmv * MW g/g-mol * g-mol-K/0.08206 l-atm * 1 atm * 1/temp (C+273) * 1000 l-ug/g-m^3 * 0.028316847 m^3/ft^3 * g/10^6 ug * lb/453.59237 g * cfm * 60 min/hr * 24 hr/d * 365 d/yr	Need MW, temp, and flow from Part I response and actual emissions from NEI. Use MW for surrogate pollutant (chlorine) in allowable calculation.

Source limit details	Typical source control systems	Gaseous organic HAP standard	Standard format	Allowable multiplier calculation	Needed to calculate allowable multiplier
		(3) Meet ≤0.002 lb total chlorinated HAP (except chloroform)/ton ODP at control device outlet.	Numeric emission limit (production-based limit)	Allowable multiplier = Allowable emissions Actual emissions (NEI) Allowable emissions = 0.002 lb/ton ODP * ton ODP/yr	Need actual ton ODP/yr from Part I response and actual emissions from NEI.
		(4) Work practice for chloroform - either meet effluent guidelines or use no hypochlorite or chlorine for bleaching.	Work practice standard	As work practice standard, actual = allowable, so allowable multiplier = 1	--
Kraft pulping process condensates (process liquids) from digester, turpentine recovery, evaporator, LVHC system[1], and HVLC system [2] (some exceptions)	Route through a closed vent collection systems to pulping equipment	(1) Reduce total HAP emissions by ≥98 wt%; or	Numeric emission limit (performance limit)	Allowable multiplier = (1- 98% reduction limit) (1-actual % reduction)	Need actual % reduction from Part I response.
		(2) Reduce total HAP concentration at the outlet of thermal oxidizer to ≤20 ppmv @ 10% O_2 (dry basis); or	Numeric emission limit (concentration limit)	Allowable multiplier = Allowable emissions Actual emissions (NEI) Allowable emissions = 20 ppmv * MW g/g-mol * g-mol-K/0.08206 l-atm * 1 atm * 1/temp (C+273) * 1000 l-ug/g-m^3 * 0.028316847 m^3/ft^3 * g/10^6 ug * lb/453.59237 g * cfm * 60 min/hr * 24 hr/d * 365 d/yr	Need MW, temp, and flow from Part I response and actual emissions from NEI. Use MW for surrogate pollutant (methanol) in allowable calculation.
		(3) Reduce total HAP emissions using a thermal oxidizer operating ≥1600°F and ≥0.75 secs residence time; or	Equipment standard	As equipment standard, actual = allowable, so allowable multiplier = 1	--
		(4) Use a boiler, LK, or RF in which the HAP gas stream in introduced with the primary fuel into the flame zone; or	Equipment standard	As equipment standard, actual = allowable, so allowable multiplier = 1	--

Source limit details	Typical source control systems	Gaseous organic HAP standard	Standard format	Allowable multiplier calculation	Needed to calculate allowable multiplier
		(5) Use a boiler or RF with a heat input capacity ≥150 MMBtu/hr (44 MW) in which the HAP gas stream is introduced with the combustion air.	Equipment standard	As equipment standard, actual = allowable, so allowable multiplier = 1	--
	Route to biological treatment/steam stripper or other control device	(1) Reduce total HAP ≥92 wt%; or	Numeric emission limit (performance limit)	Allowable multiplier = (1- 92% reduction limit) (1-actual % reduction)	Need actual % reduction from Part I response.
		(2a) For mills without bleaching, remove ≥6.6 lb total HAP/ton ODP, or	Numeric emission limit (production-based removal limit)	Allowable multiplier = Allowable emissions Actual emissions (NEI) Allowable emissions = Uncontrolled emissions (tpy) – 6.6 lb/ton ODP * ton ODP/yr * 1 ton/2000 lb	Need uncontrolled emissions (not available) and actual emissions from NEI.
		(2b) For mills without bleaching, meet ≤210 ppmw total HAP at control device outlet; or	Numeric emission limit (concentration limit)	Allowable multiplier = Allowable emissions Actual emissions (NEI) Allowable emissions = 210 ppmw * MW g/g-mol * g-mol-K/0.08206 l-atm * 1 atm * 1/temp (C+273) * 1000 l-ug/g-m^3 * 0.028316847 m^3/ft^3 * g/10^6 ug * lb/453.59237 g * cfm * 60 min/hr * 24 hr/d * 365 d/yr	Need MW, temp, flow from Part I response and actual emissions from NEI. Use MWs for surrogate pollutants (acetaldehyde, methanol, MEK, and propionaldehyde) in allowable calculation.
		(3a) For mills with bleaching, remove ≥10.2 lb total HAP/ton ODP, or	Numeric emission limit (production-based removal limit)	Allowable multiplier = Allowable emissions Actual emissions (NEI) Allowable emissions = Uncontrolled emissions (tpy) –	Need uncontrolled emissions (not available) and actual emissions from NEI.

Source limit details	Typical source control systems	Gaseous organic HAP standard	Standard format	Allowable multiplier calculation	Needed to calculate allowable multiplier
				10.2 lb/ton ODP * ton ODP/yr * 1 ton/2000 lb	
		(3b) For mills with bleaching, meet ≤330 ppmw total HAP at control device outlet.	Numeric emission limit (concentration limit)	Allowable multiplier = Allowable emissions Actual emissions (NEI) Allowable emissions = 330 ppmw * MW g/g-mol * g-mol-K/0.08206 l-atm * 1 atm * 1/temp (C+273) * 1000 l-ug/g-m^3 * 0.028316847 m^3/ft^3 * g/10^6 ug * lb/453.59237 g * cfm * 60 min/hr * 24 hr/d * 365 d/yr	Need MW, temp, flow from Part I response and actual emissions from NEI. Use MWs for surrogate pollutants (acetaldehyde, methanol, MEK, and propionaldehyde) in allowable calculation.
Clean condensate alternative (CCA) is an emissions averaging approach to offset emissions from certain existing kraft pulping sources.	Install and operate clean condensate alternative technology.	Emissions reductions from CCA ≥ emissions reductions achieved through kraft pulping HVLC system standards	Emission averaging limit	Site-specific approach	Need site-specific data.

[1] The LVHC system includes digester, turpentine recovery, evaporator, and steam strippers.

[2] The HVLC system includes pulp washing, knotter, screen, decker, O_2 delignification, weak liquor storage tanks.

Appendix F

Peak-to-Mean HAP Emissions Ratios for Paper Machine Sources
AECOM Technical Services
February 15, 2011

Peak-to-Mean HAP Emissions Ratios for Paper Machine Sources

Prepared by David W. Heinold, CCM

AECOM Technical Services, Westford, Massachusetts

on behalf of the American Forest and Paper Association

February 15, 2011

In characterizing acute inhalation risk, the method outlined in EPA's Risk Assessment and Modeling - Air Toxics Risk Assessment Reference Library: Volume 2 - Facility-Specific Assessment (EPA-453-K-04-001B, http://www.epa.gov/ttn/fera/risk_atra_vol2.html) is to apply HEM-3 to estimate maximum off-site concentrations due to a facility's emissions. Because emissions from some sources are more variable than others, EPA's guidance indicates that to provide a conservative estimate of acute exposure and risk, the upper-limit short-term emissions from all hazardous air pollutant (HAP) sources should be simultaneously modeled. The resultant maximum 1-hour modeled off-site concentrations are then compared to acute health effects benchmarks. In the absence of direct estimates of maximum hourly emissions EPA's guidance provides a default peak-to-mean emissions ratio of 10 to all HAP sources at a facility. This means that the annual average emission rates which are used in HEM-3 to estimate cancer risks and chronic hazard indices are all multiplied by ten for the acute risk assessment along with the maximum modeled 1-hour average concentration. Especially for many sources at paper mills this is a highly conservative method of estimating acute risk because it implies that operating conditions that result in a 10-fold increase in emissions occur simultaneously for all mill sources and that these conditions are also coincident with worst-case dispersion meteorology. Given that modeling conducted by EPA has indicated that emissions from paper machines sources may substantially contribute to maximum 1-hour average HAP concentrations, an investigation has been undertaken by AF&PA to identify a peak-to-mean emission ratio that is more appropriate for paper machines than the generic factor of 10.

In the absence of direct measurements, it is standard practice for HAP emissions from paper machines sources to be computed by multiplying the air dried ton of finished product (ADTFP) by an emission factor, e.g. those developed by NCASI for various types of paper products. Using emission factors to estimate emissions, inherently assumes that emissions are proportional to the production rate, which is a reasonable assumption based on available sampling data. This implies hourly emission rates are determined by the production rate.

In addition to considering the variability in paper machine emission rates associated with production rate fluctuations, the possibility that emission rates of gaseous organic compounds may vary due to changes in process-related conditions has been considered. It would be desirable to have continuous emission monitoring data or repeated manual stack sampling data to address this possibility, but obtaining such data is extremely difficult because paper machines have multiple vents, and the concentrations of organic compounds of concern to acute risks (acetaldehyde, acrolein, formaldehyde) are typically near or below instrumental or manual method detection limits in the majority of these vents.

To help evaluate the degree to which paper-machine emissions vary due production rate and other factors NCASI has provided data for a mill that it had in its possession in which methanol sampling was conducted on multiple days on a paper machine to support the mill's Clean Condensate Alternative demonstration. In the Cluster Rule, methanol is considered to be the surrogate for all volatile organic hazardous air pollutants emitted from pulping, bleaching, papermaking and wastewater treatment operations (MACT I sources). Tests were conducted on five days for the 18 paper machine vents. Table 1 provides the results of this testing on this paper machine.

Table 1. Measurements of Paper Machine Methanol Emissions and Production

Date	Production (tons/hr)	Methanol Emission Rate (lb/hr)	Methanol Emission Factor (lb/ton)
09/06/08	35	28.3	0.81
09/10/08	43.5	28.1	0.65
09/12/08	49.9	31.5	0.63
09/18/08	54.8	30.8	0.56
09/20/08	34.8	18.4	0.53
Mean	43.6	27.4	0.64
Peak/Mean	1.26	1.15	1.26

The peak-to-mean production ratios for this machine for the five-day period were similar to those for other machines over much longer periods of time. For this set of measurements, the data indicate that the methanol emissions are highly correlated with production (correlation coefficient of 0.73) and the computed emission factors are slightly negatively correlated with production (correlation coefficient of -0.36). Thus, the peak-to-mean ratio for methanol emission rate (1.15) is less than the peak-to-mean ratio for paper machine production rate, indicating that using paper machine production rate to evaluate variability of HAP emissions from paper machines is suitably conservative.

In relation to production rate, other process-related factors that might affect emission rates are relatively constant – roof vent exhaust gas flow rates, dryer temperatures, pulp characteristics, whitewater recirculation rates, as evidenced by with Table 1 which indicates that the variability of the methanol emission rate is comparable and somewhat less than the variability in production rate. There is also no reason to suspect emission rates from paper machines would be higher during startup or shutdown conditions, and paper machine malfunctions, which are extremely rare, require prompt shutdown. Typically, paper machine upsets correspond to lack of production (lowering average production value). Worst case scenario is pulp continues to go to machine, then back in a loop and no paper is being made. Since HAP emissions from paper machines are a function of the water carrying the pulp (HAPs are contained in solution), if there is no pulp (water) going to the paper machine, there are no corresponding paper machine emissions.

Paper machines are typically operated at the maximum production possible for that specific grade (unless limited by permit). Given that paper machines typically operate at a steady production rate for up to several days, the daily variability of production rate for a mill throughout a year is considered a reliable measure of the variability of the hourly production rate. As it is common for mills to retain records of daily production, the peak-to-mean HAP emission ratio for each paper machine can be readily computed as the ratio of the maximum daily production rate for the paper machine to its annual production rate.

Several paper companies surveyed their production records and computed the peak-to-mean production ratio for each paper machine for twenty mills over the past three years (2008, 2009 and 2010). The results of this survey are provided in Table 2. Figure 1 shows the variation of the data over the last three years and the distribution of peak-to-mean ratios among all paper machines is provided in Figure 2. The median peak-to-mean ratio is 1.3, the maximum ratio is 2.1 and the 95th percent of the ratio values is less than 1.6.

The consistency of these paper machine production data and the evidence provided by NCASI in Table 1 that the variability of HAP emissions from paper machines is comparable or less than the variability in the production rate, supports a generic application of a peak-to-mean ratio for paper machines that is much less than EPA's default factor of 10. Based on the variability in daily production rate AF&PA recommends that EPA use a factor of 1.6 as it represents a highly conservative estimate for the peak to mean ratio for the vast majority of paper machines.

Table 2 Daily Peak to Annual Average Paper Machine Production Ratios

Mill	Year	PM1	PM2	PM3	PM4	PM5
1	2008	1.30	1.31			
1	2009	1.39	1.61			
1	2010	1.27	1.20			
2	2008	1.30	1.28	1.39	2.11	
2	2009	1.19	1.32	1.30	1.74	
2	2010	1.34	1.26	1.30	1.76	
3	2008	1.43	1.41			
3	2009	1.55	1.43			
3	2010	1.56	1.97			
4	2008	1.25				
4	2009	1.26				
4	2010	1.26				
5	2008	1.27				
5	2009	1.24				
5	2010	1.32				
6	2008	1.44	1.31			
6	2009	1.37	1.35			
6	2010	1.35	1.30			
7	2008					
7	2009			1.31	1.39	1.49
7	2010	1.96	1.99			
8	2008	1.38	1.33	1.28	1.21	
8	2009	1.28	1.49	1.31	1.49	
8	2010	1.31	1.48	1.30	1.24	
9	2008	1.22	1.27			
9	2009	1.19	1.29			
9	2010	1.16	1.30			
10	2008	1.36	1.35	1.42		
10	2009	1.41	1.30	1.29		

Table 2 (cont'd) Daily Peak to Annual Average Paper Machine Production Ratios

10	2010	1.24	1.31	1.27		
11	2008	1.29				
11	2009	1.31				
11	2010	1.24				
12	2008	1.28	1.40			
12	2009	1.35	1.46			
12	2010	1.29	1.32			
13	2008	1.16	1.43			
13	2009	1.24	NA			
13	2010	1.19	1.32			
14	2008	1.34	1.28			
14	2009	1.32	1.27			
14	2010	1.27	1.31			
15	2008	1.33	1.47			
15	2009	1.21	1.30			
15	2010	1.35	1.31			
16	2008	NA	1.18	1.19		
16	2009	1.21	1.24	1.28		
16	2010	1.19	1.24	1.33		
17	2008	1.25				
17	2009	1.32				
17	2010	1.32				
18	2008	1.22	1.15			
18	2009	1.30	1.23			
18	2010	1.26	1.19			
19	2008	1.20	1.22			
19	2009	1.09	1.08			
19	2010	NA	NA			
20	2008	1.48	1.41	1.28		
20	2009	1.55	1.49	1.56		
20	2010	1.56	1.40	1.34		

Note: NA indicates data not available

Figure 1: Peak-to-Mean Production Ratios for Each Year

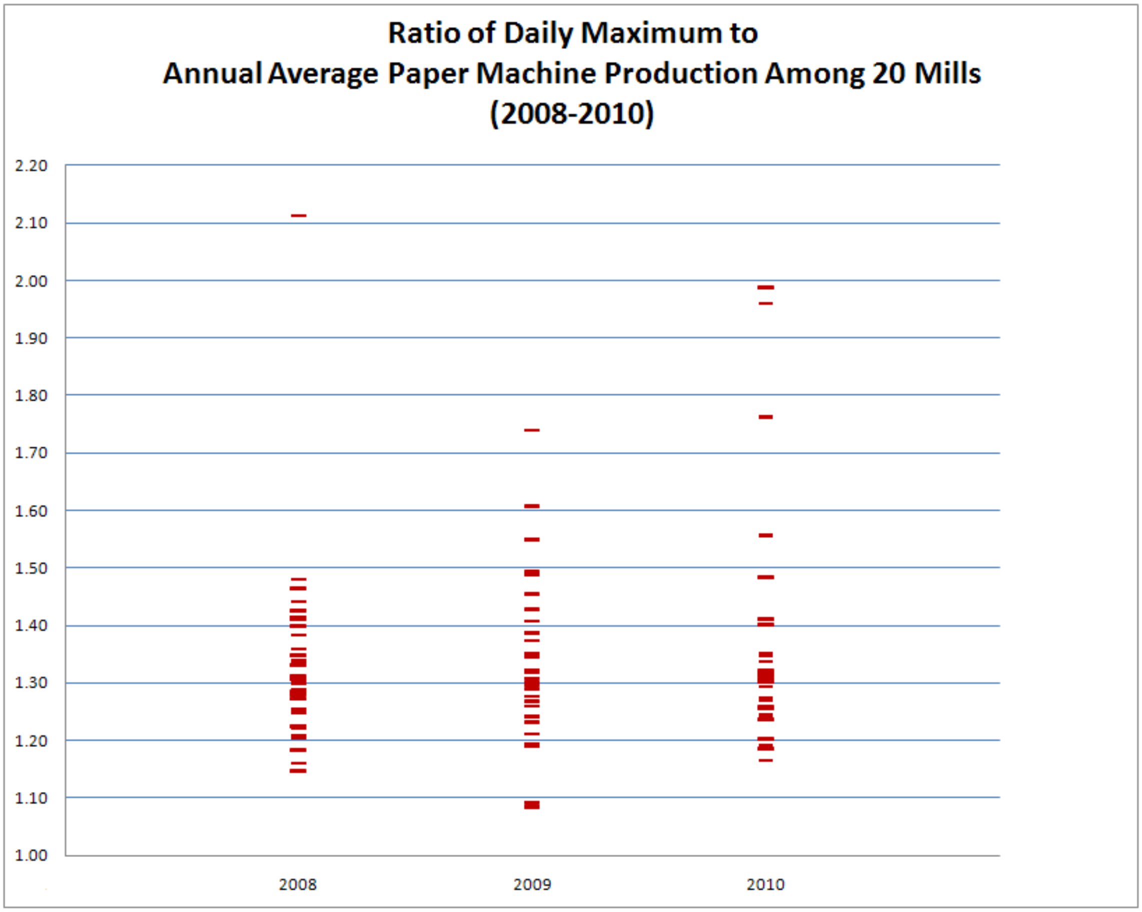
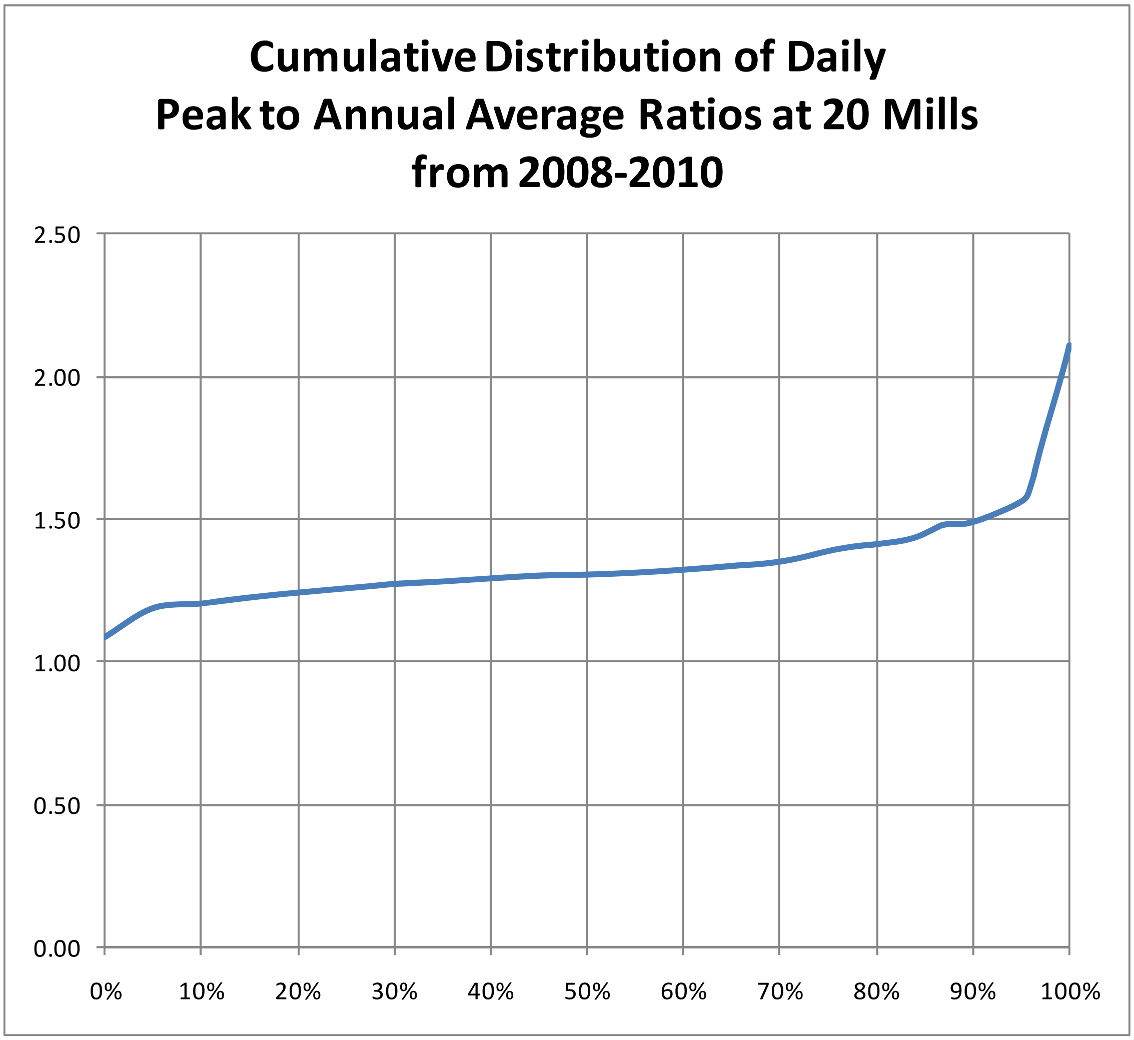


Figure 2: Distribution of Peak-to-Mean Production Ratios



Appendix G

Peak-to-Mean HAP Emissions Ratios for Waste Water Treatment Systems
NCASI
February 17, 2011

Peak-to-Mean HAP Emissions Ratios for Waste Water Treatment Systems

NCASI
February 17, 2011

EPA's most recent dispersion modeling results suggest acrolein, formaldehyde, chloroform and methanol released to the air from a few pulp and paper mill wastewater treatment systems may result in elevated acute risks of concern. The acute modeling results discussed with industry representatives on January 13, 2011 indicate the mills with elevated acute risks due to wastewater emissions (identified by SCC 30700121, although some coded as 'miscellaneous' fugitive sources may have included wastewater emissions) were kraft mills with aerated stabilization basins (ASBs) for secondary treatment. It should be noted these ASBs were all modeled as point sources rather than area sources. Modeling them as area sources would significantly lower predicted concentrations at most off-site receptors.

The hourly emission rates used in the modeling were derived from the NEI emission inventory database, which contained a number for the total annual emissions. This number was divided by 8760 and then multiplied by 10, a standard default factor used by EPA to estimate a peak hourly rate that might occur sometime during the year. EPA has acknowledged the factor of 10 may not be applicable in all situations, and indicated a more realistic factor could be used if suitable documentation were provided to justify an alternative.

Emissions of a volatile organic compound from an ASB depend upon the amount of the compound in the entering wastewater, wastewater chemical and physical properties, design and operating characteristics of the ASB, and ambient atmospheric conditions. Emissions are estimated with a model such as WATER9, which requires several input parameters including wastewater flow rate, wastewater temperature, compound concentration, basin area and depth, aeration rate, compound biorate, ambient temperature, and ambient wind speed.

To estimate the variability in emissions that might be expected from an ASB, one needs to first determine the variability in the amount of the organic compound entering the ASB. This requires information on the wastewater flow rate and compound concentration. Flow rates, when measured, are typically reported in gallons/day. Concentrations are most often obtained from daily grab samples, but most mills do not make such measurements. The exception is kraft mills that use an ASB to satisfy the Cluster Rule condensate treatment requirement. These mills are required to conduct an annual performance test which involves collection of daily samples over a period that may range from one to 15 days, depending on the averaging time specified in the Title V permit. These samples are collected in the so-called hard-pipe, which transfers the collected condensates directly to the ASB. These condensates will contain a significant portion of the organic hazardous air pollutants (methanol, acetaldehyde, propionaldehyde, formaldehyde, acrolein) being sent to the ASB. Thus, the hard-pipe flow and concentration data should provide an indication of the variability in loadings experienced over several days.

Table 1 shows the peak-to-mean ratios for hard-pipe loadings (lb/day; obtained from flow and concentration measurements) of methanol (6 mills) and acetaldehyde (3 mills). Daily samples were collected over periods ranging from 12 to 16 days, once per year, with the exception of the 360 days of samples collected over a consecutive 13-month period at Mill A. Mill C had two annual tests, and Mill F had four annual tests. The peak-to-mean ratios range from 1.2 to 2.1, much less than the default factor of 10. Similar ratios would be expected for loadings of acrolein and formaldehyde, also present in condensates.

Table 1. Hard-Pipe Loadings of Methanol and Acetaldehyde

	Methanol						Acetaldehyde		
Mill	A	B	C	D	E	F	B	C	F
Peak/Mean	1.7	1.5	1.3	1.2	1.5	1.3	1.6	1.3	1.5
Number of daily samples	360	16	15	16	12	16	16	15	16
Peak/Mean			1.4			1.6			2.1
Number of daily samples			26			16			16
Peak/Mean						1.3			1.9
Number of daily samples						16			16
Peak/Mean						1.1			1.9
Number of daily samples						16			16

Repeated sampling for volatile organic hazardous air pollutants in raw wastewater streams other than hard-piped condensates is rare. Mill D also sampled the raw wastewater entering the primary clarifier (hard-pipe condensates bypass the clarifier) for the same 16-day period as the hard piped condensates were sampled. The peak-to-mean ratio for methanol loadings (lb/day) was 1.3. Mill G collected random grab samples for methanol analysis from a primary clarifier outlet (prior to entering an ASB) over a five year period. This mill has a steam stripper and does not hard-pipe. Table 2 summarizes testing information from this mill. The peak-to-mean ratios for methanol concentrations ranged from 1.2 to 1.5, very similar to the ratios in methanol loadings observed for hard-piped condensates at other mills.

Table 2. Methanol Concentration Variability at a Primary Clarifier Outlet

Year	2010	2009	2008	2007	2006
Mean, mg/L	82	89	99	94	79
Peak, mg/L	97	110	148	130	95
Peak/Mean	1.2	1.2	1.5	1.4	1.2

As mentioned earlier, emissions of a volatile organic compound from an ASB are estimated with a fate model that takes other factors into account besides compound loading. To examine the effect on emissions of certain parameters which may vary in time, a sensitivity analysis using EPA's WATER9 model was performed. Emission calculations were made for an ASB with a surface area of 44 acres and depth of eight feet. The ASB was subdivided into 3 zones, two with areas of 11 acres each with 950 hp of surface aeration each, and a third zone of 22 acres with 450 hp of surface aeration. Flow to the ASB was assumed to be 34 million gallons per day, with a methanol concentration of 80 mg/L, and acetaldehyde and formaldehyde concentrations of 0.15 mg/L. A "baseline" set of conditions was first used to predict emission rates, and then these conditions were varied to see the effect on the emission predictions. The conditions were changed in a direction that would lead to increased emission rates. Table 3 shows modeled emission rates for this typical basin are most sensitive to the assumed biological activity rate, although it should be noted a 50% reduction would be a catastrophic event unlikely to occur on an annual basis. None of the four factors increase emission rates over a factor of two.

Considering the number of factors affecting the WATER9 emission estimates, and the inherent uncertainties in this simulation model, it seems reasonable to conclude the peak-to-mean ratio is no more than a factor of two for emissions of volatile organic hazardous air pollutants, which would include methanol, acetaldehyde, formaldehyde, acrolein and chloroform.

Table 3. WATER9 Sensitivity Analysis

		Change from baseline emission rate			
	Baseline emission rate for ASB, g/s	Lower basin temperatures by 10°C	Increase wind speed from 5 to 10 mph	Lower ambient air temperature by 10°C	Lower biological activity rate by 50%
Methanol	7.28	-3%	+24%	0	+79%
Acetaldehyde	0.065	+5%	+5%	0	+46%
Formaldehyde	0.00045	+9%	+32%	0	+86%

Appendix H

EPA's Conclusions Regarding Use of the Part II Acrolein Data

MEMORANDUM

FROM: Project Team (EPA/OAR/OAQPS/SPPD/NRG)

TO: Docket EPA-HQ-OAR-2007-0544

DATE: November 30, 2011

SUBJECT: Acrolein Emissions from Paper Machines and Mechanical Pulping
(Non-Combustion Sources)

The production of paper involves the processing of raw wood into pulp, chemical recovery, bleaching, paper making, and waste water treatment; the kraft process is shown in Figure 1. The subpart S (MACT 1 and 3) standard from the Pulp and Paper NESHAP applies to major sources of HAP emissions from the pulp production areas at chemical, mechanical, secondary fiber, and non-wood pulp mills, bleaching operations, and papermaking systems. These processes are shown in blue and green in Figure 1. A separate standard (MACT 2), subpart MM, applies to chemical recovery processes at kraft, soda, sulfite, and stand-alone semi-chemical mills. These processes are shown in yellow in Figure 1. Boiler MACT and NSPS are also regulations applied to systems within an integrated pulp and paper mill, shown in figure as gray and red outline, respectively.

Acrolein emissions are commonly formed by combustion sources at pulp and paper facilities through the burning of organic materials. Emissions were reported in response to the ICR from power boilers, recovery furnaces, and lime kilns, all of which are combustion sources; emissions were also reported from paper machines and mechanical pulping, which are not combustion sources. The reported acrolein emissions for both types of sources were based on emission factors, developed by NCASI.

Acrolein emissions from non-combustion sources, such as paper machines and mechanical pulping, are not completely understood. In the case of mechanical pulping, it is thought that acrolein is formed and released when the wood is heated during the pulping process. Wood chips or logs are processed by grinding against metal plates, generating heat and, in the case of thermo-mechanical pulping, steam is introduced to heat the wood as a pretreatment to reduce processing energy requirements. In papermaking, water is removed from the pulp on a machine utilizing gravity draining, vacuum filtration, pressing, and drying. One hypothesis is that the acrolein is formed and released when the pulp sheet is dried, as the majority of test detects occurred at the paper machine dryer. Neither of these processes, mechanical pulping or papermaking, are combustion sources, but acrolein appears to be emitted from them based on limited testing.

The formation of acrolein upon heating and drying of the wood products is unknown, as it is not an inherent compound found in wood. Acrolein is potentially formed by the breakdown of wood components (e.g., cellulose, hemicelluloses, or lignin) during the drying process; the chemical structure and quantity of the components vary between wood species, growing location, weather (including wind, sunlight, and rain), season harvested, and growing soil conditions. We do not currently understand the interplay of these parameters and specifically how the various factors impact the amount of acrolein generated during heating and drying of the pulp during paper making and mechanical pulping.

The emission factors for acrolein from paper machines and mechanical pulping were developed by NCASI using test data on a very limited number of machines with a set of specific operating conditions. Testing was performed using a test method developed by the trade association, as the EPA has not developed a test method for these sources; the EPA is currently evaluating the NCASI method as a reference test for acrolein. Acrolein testing of paper machines and mechanical pulping using this method has issues such as difficulty in capturing and quantifying acrolein due to fugitive background sources and building venting (instead of stacks) at large volumes with high moisture contents and low acrolein concentrations. These difficulties are apparent in the data set used to develop the emission factors, as it contained a majority of test run results below the method detection limit (MDL). NCASI followed the 1997 EPA protocol for the emission factor development, which recommended non-detect run data be reported as half of the method detection limit (Procedures for Preparing Emission Factor Documents, EPA-454/R-95-015, U.S. Environmental Protection Agency, Research Triangle Park, NC, May 1997). However, in the case of acrolein from Subpart S non-combustion sources, this protocol results in emission factors based primarily on assumed 1/2-MDL values from a majority of test runs where acrolein was not detected which introduced a large number of unknowns into the dataset, thereby multiplying the uncertainties outlined above to an unknown degree. The uncertainty in the initial data set is further magnified when the emission factors are applied across the industry, yielding a resultant acrolein emission inventory predicated primarily on assumed values and not actual emissions measurements. This magnified uncertainty is compounded with the additional uncertainty of acrolein emissions from different paper machine operating parameters and different wood species used in pulping, resulting in further exacerbation of the uncertainty.

In our judgment, we believe that the industry efforts to document and confirm acrolein emissions, though informative, highlight the current technological limits in the ability to capture and quantify acrolein emissions that are specific to paper machines and mechanical pulping processes. Based on the forgoing issues, we did not use this test data. EPA is working with industry to help refine and improve the test methods to capture this compound from these sources.

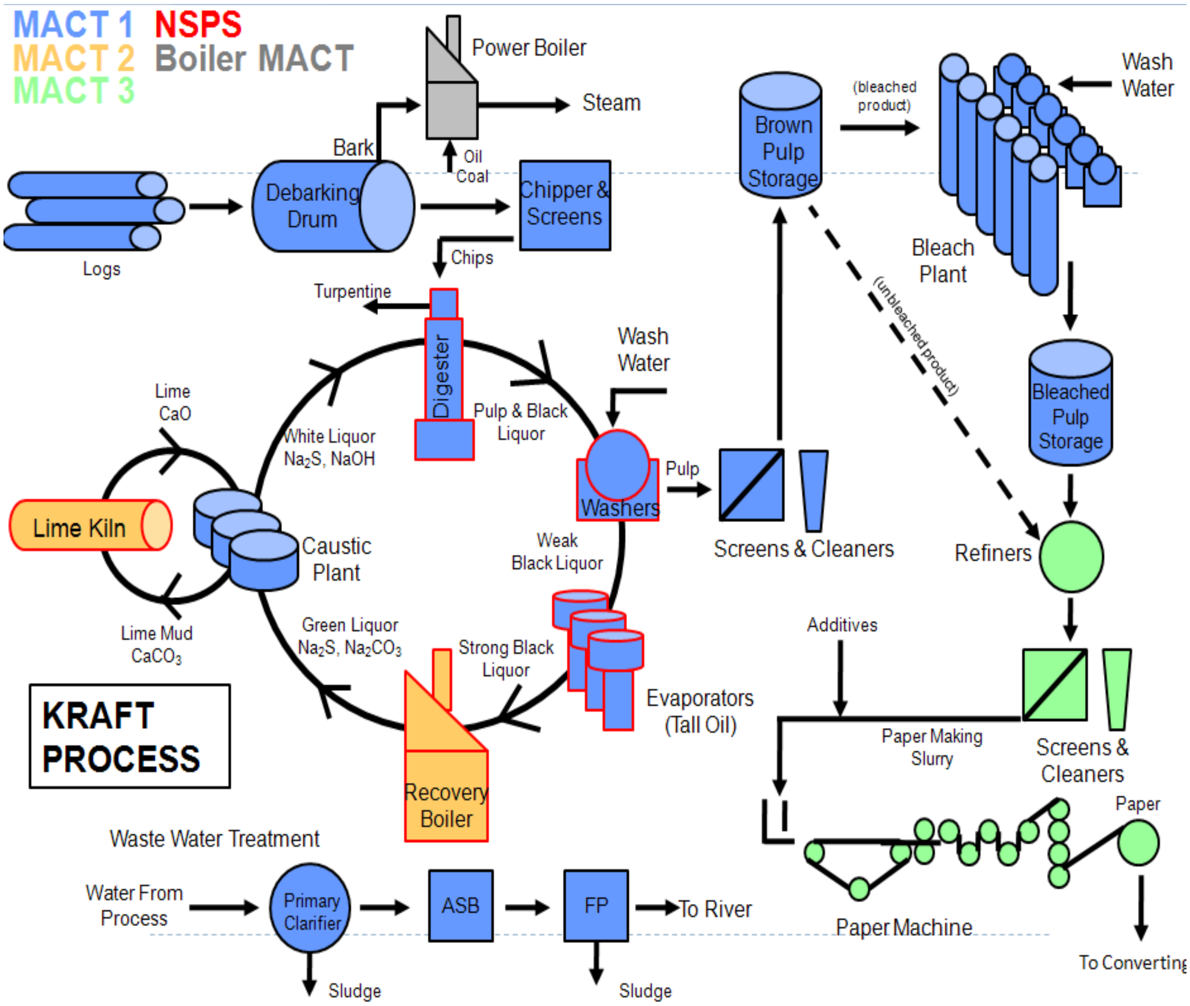


Figure 1: The Pulp and Paper Making Process