Emission Factor Documentation for AP-42
Section 10.6.2

Particleboard Manufacturing

Final Report

For U. S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Factor and Inventory Group

EPA Purchase Order No. 8D-1933-NANX

MRI Project No. 4945

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Research Triangle Park, NC 27711

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NOTICE

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PREFACE

This report was prepared by Midwest Research Institute (MRI) for the Office of Air Quality Planning and Standards (OAQPS), U. S. Environmental Protection Agency (EPA), under Contract No. 68-D2-0159, Work Assignment No. 4-05 and EPA Purchase Order No. 8D-1933-NANX. Mr. Dallas Safriet was the requester of the work.

Approved for:

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September 1998

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EMISSION FACTOR DOCUMENTATION FOR AP-42 SECTION 10.6.2
Particleboard Manufacturing

1. INTRODUCTION

The document *Compilation of Air Pollutant Emission Factors* (AP-42) has been published by the U. S. Environmental Protection Agency (EPA) since 1972. Supplements to AP-42 have been routinely published to add new emission source categories and to update existing emission factors. AP-42 is routinely updated by EPA to respond to new emission factor needs of EPA, state and local air pollution control programs, and industry.

An emission factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. Emission factors usually are expressed as the weight of pollutant divided by the unit weight, volume, distance, or duration of the activity that emits the pollutant. The emission factors presented in AP-42 may be appropriate to use in a number of situations, such as making source-specific emission estimates for areawide inventories for dispersion modeling, developing control strategies, screening sources for compliance purposes, establishing operating permit fees, and making permit applicability determinations. The purpose of this report is to provide background information from test reports and other information to support preparation of AP-42 Section 10.6.2, Particleboard Manufacturing.

This background report consists of five sections. Section 1 includes the introduction to the report. Section 2 gives a description of the particleboard manufacturing industry. It includes a characterization of the industry, a description of the different process operations, a characterization of emission sources and pollutants emitted, and a description of the technology used to control emissions resulting from these sources. Section 3 is a review of emission data collection (and emission measurement) procedures. It describes the literature search, the screening of emission data reports, and the quality rating system for both emission data and emission factors. Section 3 also discusses issues related to the testing and interpretation of emission data for wood products industry sources. Section 4 details how the new AP-42 section was developed. It includes the review of specific data sets and a description of how candidate emission factors were developed. Section 5 presents the AP-42 Section 10.6.2, Particleboard Manufacturing.

2. INDUSTRY DESCRIPTION

2.1 INDUSTRY CHARACTERIZATION[1-3]

Particleboard is defined as a panel product manufactured from lignocellulosic materials, primarily in the form of discrete particles, combined with a synthetic resin or other suitable binder and bonded together under heat and pressure. The primary difference between particleboard and other reconstituted wood products, such as waferboard, oriented strandboard, medium density fiberboard, and hardboard, is the material or particles used in its production. The major types of particles used to manufacture particleboard include wood shavings, flakes, wafers, chips, sawdust, strands, slivers, and wood wool. The term particleboard sometimes is used generically to include waferboard and oriented strandboard, which are manufactured primarily with wood flakes and wafers. However, for the purposes of this report, particleboard pertains only to panels manufactured from a mixture of wood particles or otherwise from wood particles other than wafers and flakes. Particleboard manufacturing falls under Standard Industrial Classification (SIC) Code 2493, reconstituted wood products, which includes hardboard, insulation board, medium density fiberboard, waferboard and oriented strandboard in addition to particleboard. The six-digit Source Classification Code (SCC) for particleboard manufacturing is 3-07-006.

There were 40 particleboard plants listed in the *1997 Directory of the Wood Products Industry*. Table 2-1 presents the name, location, and annual production capacity for the particleboard plants listed in the *1997 Directory of the Wood Products Industry*. Annual capacity for the plants that reported their capacities in the *1997 Directory of the Wood Products Industry* ranged from 1.9×10^6 to 3.3×10^7 square meters (m^2) (2.0×10^7 to 3.5×10^8 square feet [ft^2]) of particleboard on a 1.91-centimeter (cm) (3/4-inch [in.]) basis. Board densities at these plants ranged from 288 to 1,041 kilograms per cubic meter (kg/m^3) (18 to 65 pounds per cubic foot [lb/ft^3]), with most being in the range of 721 to 769 kg/m^3 (45 to 48 lb/ft^3).

Particleboard is produced in a wide range of densities. Particleboard with a density of less than 590 kilograms per cubic meter (kg/m^3) (37 pounds per cubic foot [lb/ft^3]), 590 to 800 kg/m^3 (37 to 50 lb/ft^3), and greater than 800 kg/m^3 (50 lb/ft^3) is classified as low-density, medium density, and high density particleboard, respectively. However, this report does not distinguish between particleboard densities relative to emissions from manufacturing operations.

Although some single-layer particleboard is produced, particleboard generally is manufactured in three or five layers. The outer layers are referred to as the surface or face layers, and the inner layers are termed the core layers. Face material generally is finer than core material. By altering the relative properties of the face and core layers, the bending strength and stiffness of the board can be increased.

2.2 PROCESS DESCRIPTION[1-2,4-7]

The general steps used to produce particleboard include raw material procurement or generation, classifying by size, drying, blending with resin and sometimes wax, forming the resinated material into a mat, hot pressing, and finishing. Figure 2-1 presents a process flow diagram for a typical particleboard plant.

The furnish or raw material for particleboard normally consists of wood particles, primarily wood chips, sawdust, and planer shavings. This material may be shipped to the facility or generated onsite and

TABLE 2-1. DOMESTIC PRODUCTION OF PARTICLEBOARD IN 1996[a]

Mill name/location	Annual capacity, millions of ft^2, 3/4-in. basis
Louisiana-Pacific Corp., Arcata, CA	Not available
Hambro Forest Products, Inc., Crescent City, CA	36
Georgia-Pacific Corp., Martell, CA	150
Weyerhaeuser, Adel, GA	103
Temple-Inland Forest Products Corp., Thomson, GA	110
Georgia-Pacific Corp., Vienna, GA	124
Swain Industries, Seymour, IN	30
Willamette Industries, Inc., Lillie, LA	105
Willamette Industries, Inc., Simsboro, LA	100
International Paper, Hanover, MD	Not available
Georgia-Pacific Corp., Gaylord, MI	250
Georgia-Pacific Corp., Eupora, MS	24
Industrial Wood Products, Louisville, MS	95
Georgia-Pacific Corp., Oxford, MS	200
Georgia-Pacific Corp., Taylorsville, MS	125
Louisiana-Pacific Corp., Missoula, MT	150
Amer-Ply, Newark, NJ	30
Ponderosa Products, Inc., Albuquerque, NM	45
Broyhill Furniture Industries, Lenoir, NC	35
Nu-Woods, Inc., Lenoir, NC	23
Burgess Manufacturing of Oklahoma, Inc., Guthrie, OK	Not available

Mill name/location	Annual capacity, millions of ft^2, 3/4-in. basis
Willamette Industries, Inc., Albany, OR	200
Willamette Industries, Inc., Bend, OR	157
Roseburg Forest Products Co., Dillard, OR	350
Willamette Industries, Inc., Eugene, OR	60
Boise Cascade Corp., La Grande, OR	181
Smurfit Newsprint Corp., Oregon City, OR	28
Smurfit Newsprint Corp., Sweet Home, OR	42
Allegheny Particleboard Limited Partnership, Kane, PA	Not available
Georgia-Pacific Corp., Russellville, SC	125
Merillat Industries, Inc., Rapid City, SD	95
Temple-Inland, Forest Products Corp., Diboll, TX	112
Triwood Inc., Bassett, VA	20
Forest Resource Group, Franklin, VA	90
Georgia-Pacific Corp., South Boston, VA	108
Masonite Corporation, Stuart, VA	79
Masonite Corporation, Waverly, VA	110
Rodman Industries, Marinette, WI	22
Weyerhaeuser Forest Products Co., Marshfield, WI	70
Fiberesin Industries, Inc., Oconomowoc, WI	Not available
TOTAL PLANT CAPACITY[b]	3,584

[a]Reference 3.
[b]Total plant capacity, less the five mills not reporting annual production capacity.

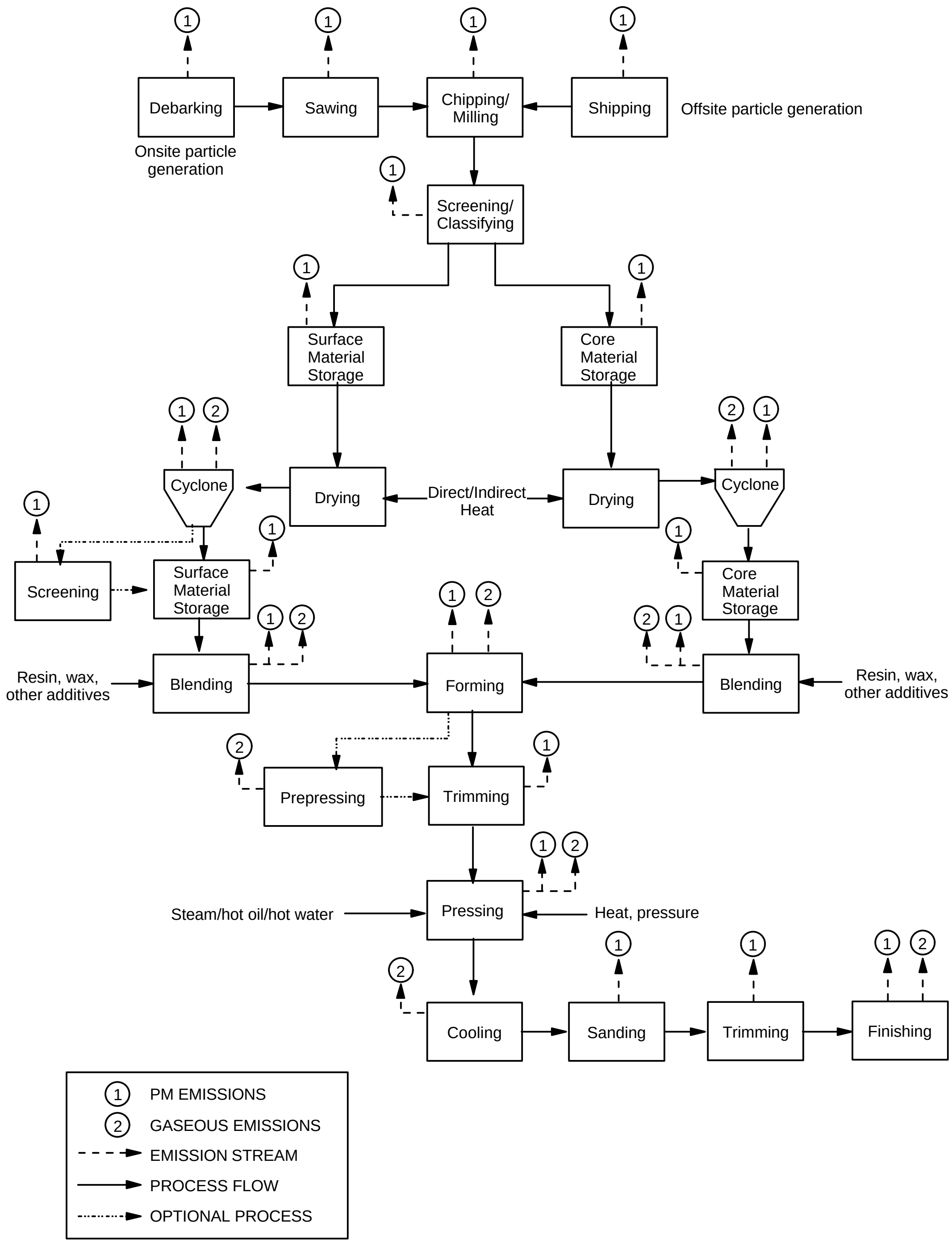

Figure 2-1. Process flow diagram for particleboard manufacturing.

stored until needed. In mills where chips are generated onsite, logs are debarked, sawn to proper length, and chipped. After shipping to the site or generation onsite, the furnish may be further reduced in size by means of hammermills, flakers, or refiners. After milling, the material is either screened using vibrating or gyratory screens, or the particles are air-classified. The purpose of this step is to remove the fines and to separate the core material from the surface material. The screened or classified material then is transported to storage bins. From the storage bins, the core and surface material are conveyed to dryers. Rotary dryers are the most commonly used dryer type in the particleboard industry. Both single and triple-pass dryers are used. In addition, some facilities use tube dryers to dry the furnish. Wood-fired dryers are used at most facilities. However, gas- and oil-fired dryers also are used. The moisture content of the particles entering the dryers may be as high as 50 percent on a wet basis. Drying reduces the moisture content to 2 to 8 percent. Dryer inlet temperatures may be as high as 871°C (1600°F) if the furnish is wet; for dry furnish, inlet temperatures generally are no higher than 260°C (500°F). Core dryers generally operate at higher temperatures than surface dryers operate due to differences in core and surface particle characteristics and because a lower moisture content is more desirable for core material.

A two-stage drying arrangement can be used when the mositure content of the incoming furnish is highly variable. The first stage (predryer) equalizes the moisture content in the furnish; the second stage (final dryer) is the main dryer. With this arrangement, tube dryers, rotary dryers, or a combination of dryer types (for example, a tube predryer followed by a rotary final dryer) may be used.

After drying, the particles pass through a primary cyclone for product recovery and then are transferred to holding bins. Face material sometimes is screened to remove the fines, which tend to absorb too much of the resin, prior to storage in the holding bins. From the holding bins, the core and surface materials are transferred to blenders, in which the particles are mixed with resin, wax, and other additives by means of spray nozzles, tubes, or atomizers. The most commonly used resins are phenol-formaldehyde and urea-formaldehyde. Generally, urea-formaldehyde resins are used in panels intended for interior applications and phenol-formaldehyde resins are used to manufacture particleboard for exterior applications.

Waxes are added to impart water resistance, increase the stability of the finished product under wet conditions, and to reduce the tendency for equipment plugging. For furnishes that are low in acidity, catalysts also may be blended with the particles to accelerate the resin cure and to reduce the press time. Formaldehyde scavengers also may be added in the blending step to reduce formaldehyde emissions from the process.

Blenders generally are designed to discharge the resinated particles into a plenum over a belt conveyor that feeds the blended material to the forming machine, which deposits the resinated material in the form of a continuous mat. Formers use air to convey the material, which is dropped or thrown into an air chamber above a moving caul, belt, or screen and floats down into position. To produce multilayer particleboard, several forming heads can be used in series, or air currents can produce a gradation of particle sizes from face to core. Figure 2-2 depicts two types of forming machines.

As it leaves the former, the mat may be prepressed prior to trimming and pressing. The mats then are cut into desired lengths and conveyed to the press. The press applies heat and pressure to activate the resin and bond the fibers into a solid panel. Although some single-opening presses are used, most domestic particleboard plants are equipped with multi-opening presses, which generally have 14 to 18 openings and platens that range in size from 1.2 meter (m) by 2.4 m to 2.4 m by 8.5 m (4 ft by 8 ft to 8 ft by 28 ft). Total

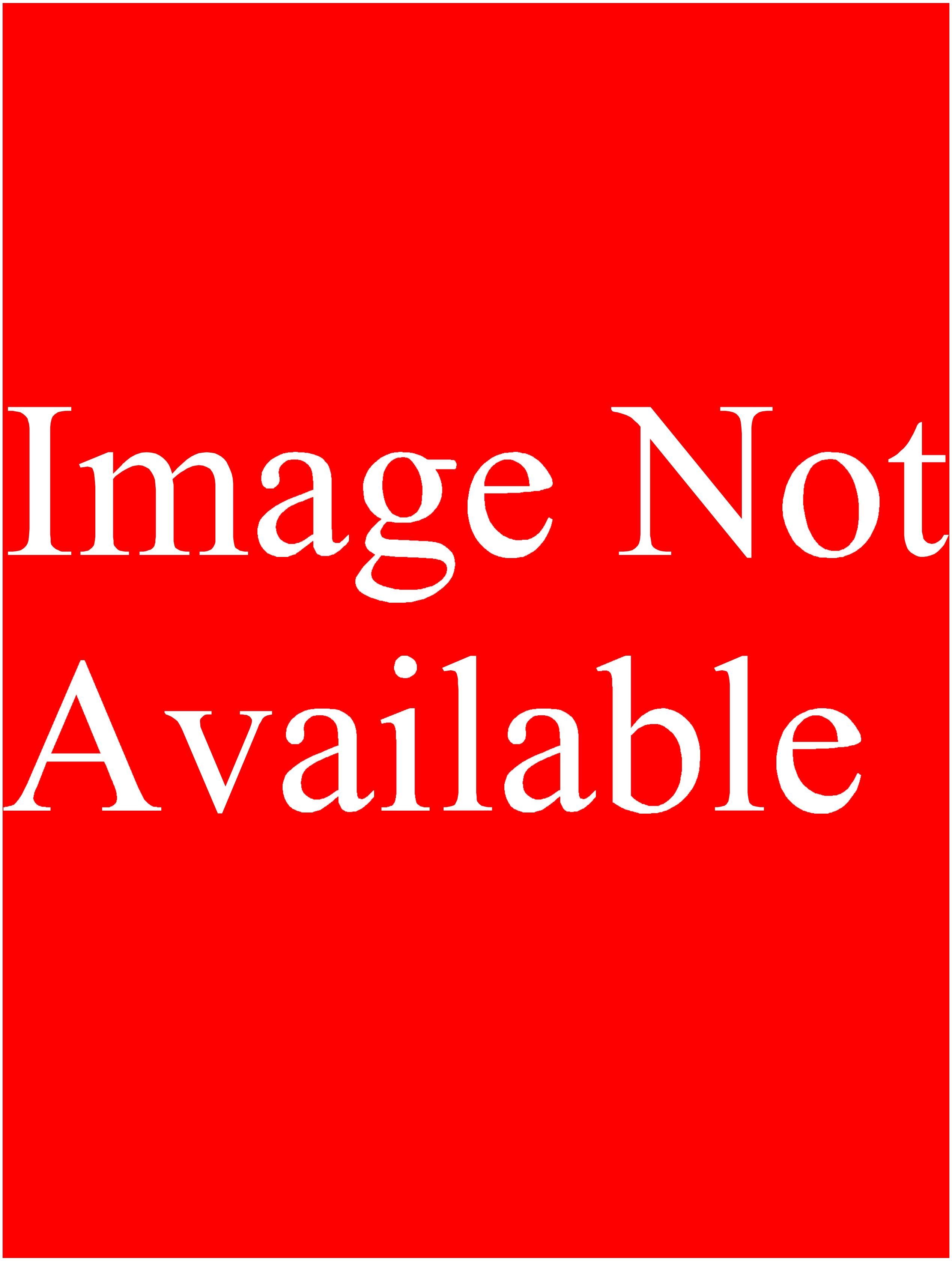

Figure 2-2. Particleboard forming machines.[2]

Image Not Available

Figure 2-3. Multi-opening particleboard press.[2]

press time is generally 2.5 minutes (min) for single-opening presses and 4.2 to 5.8 min for multi-opening presses. Typical production capacities are 260 to 325 megagrams per day (Mg/d) (286 to 358 ton/d) for single-opening presses and 520 to 1,180 Mg/d (572 to 1,300 ton/d) for multi-opening presses. Presses generally are steam-heated using steam generated by a boiler that burns wood residue. However, hot oil and hot water also are used to heat the press. The operating temperature for particleboard presses generally ranges from 149° to 182°C (300° to 360°F). Figure 2-3 depicts a particleboard multi-opening press.

After pressing, the boards generally are cooled prior to stacking. The particleboard panels then are sanded and trimmed to final dimensions, any other finishing operations (including edge painting, and laminate or veneer application) are done, and the finished product is packaged for shipment.

2.3 EMISSIONS[4-7]

The primary emission sources at particleboard mills are particle dryers and hot press vents. Other emission sources may include boilers, particle generation, blending, forming, board cooling, and finishing operations such as sanding, trimming, edge painting, and laminate or veneer application. Other potential emissions sources ancillary to the manufacturing process may include wood chip storage piles and bins (including wood fuel), chip handling systems, and resin storage and handling systems.

Although most particleboard mills have chips delivered from offsite locations, in mills where chips are generated onsite, operations such as log debarking and sawing, in addition to particle mills, screens, and classifiers generate particulate matter (PM) and PM less than 10 micrometers in aerodynamic diameter (PM-10) emissions in the form of sawdust and wood particles. In addition, these processes may be sources of PM less than 2.5 micrometers in aerodynamic diameter (PM-2.5) emissions.

Emissions from dryers that are exhausted from the primary recovery cyclone include wood dust and other solid PM, volatile organic compounds (VOC's), condensible PM, and products of combustion such as carbon monoxide (CO), carbon dioxide (CO_2), and nitrogen oxides (NO_x), if direct-fired units are used. The condensible PM and a portion of the VOC's leave the dryer stack as vapor but condense at normal atmospheric temperatures to form liquid particles or mist that creates a visible blue haze. Both the VOC's and condensible PM are primarily compounds evaporated from the wood, with a minor constituent being combustion products. Quantities emitted are dependent on wood species, dryer temperature, fuel used, and other factors including season of the year, time between logging and processing, and chip storage time.

Emissions from board hot presses are dependent on the type and amount of resin used to bind the wood fibers together, as well as wood species, wood moisture content, wax and catalyst application rates, and press conditions. When the press opens, vapors that may include resin ingredients such as formaldehyde, phenol, and other VOC's are released. The rate at which formaldehyde is emitted during pressing and board cooling operations is a function of the amount of excess formaldehyde in the resin, board thickness, press temperature, press cycle time, and catalyst application rates.

Emissions from finishing operations for particleboard are dependent on the type of products being finished. For most particleboard products, finishing involves trimming to size and, in some cases, painting or coating the edges. Other products may require sanding or the application of laminate surfaces or veneers with adhesives. Trimming and sanding operations are sources of PM and PM-10 emissions. In addition, these processes may be sources of PM less than 2.5 micrometers in aerodynamic diameter (PM-2.5) emissions. No data specific to particleboard trimming or sawing are available. However, emissions factors for general sawing operations may provide an order of magnitude estimate for similar particleboard sawing and trimming operations, bearing in mind that the sawing of dry particleboard panels may result in greater PM, PM-10, and PM-2.5 emissions than the sawing of green lumber. No data specific to particleboard panel sanding are available. It is expected that water-based coatings are used to paint particleboard edges, and the resultant VOC emissions are relatively small. Emissions from adhesives used in the application of laminate surfaces or veneers are likely to include VOC's.

2.4 EMISSION CONTROL TECHNOLOGY[1-2,4-10]

In particleboard mills where particles are generated onsite, PM, PM-10, and PM-2.5 emissions from log debarking, sawing, and grinding operations can be controlled through capture in an exhaust system connected to a sized cyclone and/or fabric filter collection system. Emissions of PM, PM-10, and PM-2.5 from sanding and final trimming operations can be controlled using similar methods. These wood dust capture and collection systems are used not only to control atmospheric emissions, but also to collect the dust as a by-product fuel for a boiler or dryer.

Methods of controlling PM emissions from the particle dryer include multiclones, packed bed absorbers (PBA's), fabric filters, electrified filter beds (EFB's), wet electrostatic precipitators (WESP's), and incinerators. Emissions are generally controlled with multiclones, EFBs, or WESPs. The EFB uses electrostatic forces to attract pollutants to an electrically charged gravel bed. The WESP uses electrostatic forces to attract pollutants to either a charged metal plate or a charged metal tube. The collecting surfaces are continually rinsed with water to wash away the pollutants. Wet PM controls, such as PBA and WESP systems also may reduce VOC emissions from particle dryers, but to a lesser extent than PM emissions are reduced by such systems.

A VOC control technology gaining popularity in the wood products industry for controlling both dryer and press exhaust gases is regenerative thermal oxidation. Thermal oxidizers destroy VOCs, CO, and condensible organics by burning them at high temperatures. Regenerative thermal oxidizers (RTO's) are designed to preheat the inlet emission stream with heat recovered from the incineration exhaust gases. Up to 98 percent heat recovery is possible, although 95 percent is typically specified. Gases entering an RTO are heated by passing through pre-heated beds packed with a ceramic media. A gas burner brings the preheated emissions up to an incineration temperature between 788° and 871°C (1450° and 1600°F) in a combustion chamber with sufficient gas residence time to complete the combustion. Combustion gases then pass through a cooled ceramic bed where heat is extracted. By reversing the flow through the beds, the heat transferred from the combustion exhaust air preheats the gases to be treated, thereby reducing auxiliary fuel requirements.

Vendor literature indicates that an RTO can achieve a VOC destruction efficiency of 99 percent. The literature further indicates that with a particulate prefilter to remove inorganic PM, an RTO system can achieve a PM control efficiency of 95 percent. Industry experience has shown that RTO's typically achieve 95 percent reduction for VOC (except at inlet concentrations below 20 parts per million by volume as carbon [ppmvC]), and 70 to 80 percent reduction for CO. However, RTO's typically increase emissions of NO_x.

Biofiltration systems can be used effectively for control of a variety of pollutants including organic compounds (including formaldehyde and benzene), NO_x, CO, and PM from both dryer and press exhaust streams. Data from pilot plant studies in U.S. oriented strandboard mills indicate that biofilters can achieve VOC control efficiencies of 70 to 90 percent, formaldehyde control efficiencies of 85 to 98 percent, CO control efficiencies of 30 to 50 percent, NO_x control efficiencies of 80 to 95 percent, and resin/fatty acid control efficiencies of 83 to 99 percent.

Other potential control technologies for particleboard dryers and presses include exhaust gas recycle, regenerative catalytic oxidation (RCO), absorption systems (scrubbers), and adsorption systems.

Fugitive emissions from road dust and uncovered bark and dust storage piles may be controlled in a number of different ways. These methods include enclosure, wet suppression systems, and chemical stabilization. Control techniques for these sources are discussed more fully in AP-42 Chapter 13, Miscellaneous Sources.

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3. P. R. Hereso, ed., *1997 Directory of the Wood Products Industry*, San Francisco, Miller Freeman, Inc., November 1996.

4. *Emission Test Report: HAP Emission Testing on Selected Sources at a Wood Furniture Production Facility--Facility A*, prepared for U. S. Environmental Protection Agency, Research Triangle Park, NC, by Roy F. Weston, Inc., April 1993.

5. *Emission Test Report: HAP Emission Testing at Facility B*, EMB Report 92-PAR-02 prepared for U. S. Environmental Protection Agency, Research Triangle Park, NC, May 1993.

6. *Particleboard Production Facility Emission Test Report: Georgia-Pacific Corporation, Vienna, Georgia*, EMB Report 93-PAR-03 prepared for U. S. Environmental Protection Agency, Research Triangle Park, NC, April 1993.

7. *Particleboard and Medium Density Fiberboard Air Emission Databases, Technical Bulletin No. 693*, the National Council of the Paper Industry for Air and Stream Improvement, New York, New York, April 1995.

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9. Technical Memorandum, Minutes of the October 12-13, 1993 BACT Technologies Workshop, Raleigh, NC, sponsored by the American Forest and Paper Association, K. D. Bullock, Midwest Research Institute, Cary, NC, October 1993.

10. A. E. Cavadeas, *RTO Experience in the Wood Products Industry*, presented at Environmental Challenges: What's New in the Wood Products Industry?, workshop sponsored by the American Forest and Paper Association, Research Triangle Park, NC, February 4-5, 1997.

3. GENERAL DATA REVIEW AND ANALYSIS PROCEDURES

3.1 LITERATURE SEARCH AND SCREENING

Data for this investigation were obtained from a number of sources within the Office of Air Quality Planning and Standards (OAQPS) and from outside organizations. The Factor Information and Retrieval (FIRE), Crosswalk/Air Toxic Emission Factor Data Base Management System (XATEF), and VOC/PM Speciation Data Base Management System (SPECIATE) data bases were searched by SCC code for identification of the potential pollutants emitted and emission factors for those pollutants. A general search of the Air CHIEF CD-ROM also was conducted to supplement the information from these data bases.

Information on the industry, including number of plants, plant location, and annual production capacities, was obtained from the *Census of Manufactures* and other sources. A number of sources of information were investigated specifically for emission test reports and data. Searches of the Source Test Information Retrieval System (STIRS) and the Test Method Storage and Retrieval (TSAR) data bases were conducted to identify test reports for sources within the particleboard manufacturing industry. The EPA library was searched for additional test reports. Publications lists from the Office of Research and Development (ORD) and Control Technology Center (CTC) were also searched for reports on emissions from the particleboard manufacturing industry. In addition, the National Council of the Paper Industry for Air and Stream Improvement (NCASI), and representative trade associations, including the American Forest and Paper Association (AFPA), were contacted for assistance in obtaining information about the industry and emissions.

To screen out unusable test reports, documents, and information from which emission factors could not be developed, the following general criteria were used:

1. Emission data must be from a primary reference:

a. Source testing must be from a referenced study that does not reiterate information from previous studies.

b. The document must constitute the original source of test data. For example, a technical paper was not included if the original study was contained in the previous document. If the exact source of the data could not be determined, the document was eliminated.

2. The referenced study should contain test results based on more than one test run. If results from only one run are presented, the emission factors must be down rated.

3. The report must contain sufficient data to evaluate the testing procedures and source operating conditions (e.g., one-page reports were generally rejected).

A final set of reference materials was compiled after a thorough review of the pertinent reports, documents, and information according to these criteria.

3.2 DATA QUALITY RATING SYSTEM[1]

As part of the analysis of the emission data, the quantity and quality of the information contained in the final set of reference documents were evaluated. The following data were excluded from consideration:

1. Test series averages reported in units that cannot be converted to the selected reporting units;

2. Test series representing incompatible test methods (i.e., comparison of EPA Method 5 front half with EPA Method 5 front and back half);

3. Test series of controlled emissions for which the control device is not specified;

4. Test series in which the source process is not clearly identified and described; and

5. Test series in which it is not clear whether the emissions were measured before or after the control device.

Test data sets that were not excluded were assigned a quality rating. The rating system used was that specified by EFIG for preparing AP-42 sections. The data were rated as follows:

A—Multiple test runs that were performed using sound methodology and reported in enough detail for adequate validation. These tests do not necessarily conform to the methodology specified in EPA reference test methods, although these methods were used as a guide for the methodology actually used.

B—Tests that were performed by a generally sound methodology but lack enough detail for adequate validation.

C—Tests that were based on an unproven or new methodology or that lacked a significant amount of background information.

D—Tests that were based on a generally unacceptable method but may provide an order-of-magnitude value for the source.

The following criteria were used to evaluate source test reports for sound methodology and adequate detail:

1. Source operation. The manner in which the source was operated is well documented in the report. The source was operating within typical parameters during the test.

2. Sampling procedures. The sampling procedures conformed to a generally acceptable methodology. If actual procedures deviated from accepted methods, the deviations are well documented. When this occurred, an evaluation was made of the extent to which such alternative procedures could influence the test results.

3. Sampling and process data. Adequate sampling and process data are documented in the report, and any variations in the sampling and process operation are noted. If a large spread between test results cannot be explained by information contained in the test report, the data are suspect and are given a lower rating.

4. Analysis and calculations. The test reports contain original raw data sheets. The nomenclature and equations used were compared to those (if any) specified by EPA to establish equivalency. The depth of review of the calculations was dictated by the reviewer's confidence in the ability and conscientiousness of the tester, which in turn was based on factors such as consistency of results and completeness of other areas of the test report.

3.3 EMISSION FACTOR QUALITY RATING SYSTEM[1]

The quality of the emission factors developed from analysis of the test data was rated using the following general criteria:

A—Excellent: Developed from A- and B-rated source test data taken from many randomly chosen facilities in the industry population. The source category is specific enough so that variability within the source category population may be minimized.

B—Above average: Developed only from A- or B-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industries. The source category is specific enough so that variability within the source category population may be minimized.

C—Average: Developed only from A-, B-, and/or C-rated test data from a reasonable number of facilities. Although no specific bias is evident, it is not clear if the facilities tested represent a random sample of the industry. In addition, the source category is specific enough so that variability within the source category population may be minimized.

D—Below average: The emission factor was developed only from A-, B- and/or C-rated test data from a small number of facilities, and there is reason to suspect that these facilities do not represent a random sample of the industry. There also may be evidence of variability within the source category population. Limitations on the use of the emission factor are noted in the emission factor table.

E—Poor: The emission factor was developed from C- and D-rated test data, and there is reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population. Limitations on the use of these factors are footnoted.

The use of these criteria is somewhat subjective and depends to an extent upon the individual reviewer. Details of the rating of each candidate emission factor are provided in Section 4.

3.4 EMISSION TEST METHODS[2-4]

The primary air pollutants of concern from the manufacture of particleboard, plywood, and other reconstituted wood products are PM (or more specifically PM-10 and condensible PM) from drying operations, VOC from drying operations and hot presses, and formaldehyde from hot presses. Emission data for these pollutants have been obtained via a number of different methods, and these methods generate data that are not directly comparable. To facilitate interpretation of the data generated by different methods, the paragraphs below identify and briefly describe the procedures that have been used for measuring emissions of PM and related pollutants, VOCs, and formaldehyde from wood products industry dryers and presses.

Test methods for PM (both filterable and condensible) include the standard reference method (EPA Methods 1 through 5 with Method 5 being the primary PM procedure) and derivatives of Method 5. Other methods that have been used in the reconstituted wood products industry are EPA Method 17 for total PM, EPA Methods 201 and 201A for PM-10, EPA Method 202 for condensible PM, Oregon Department of Environmental Quality Method 8 (ODEQ-8) for filterable PM, and the Oregon Department of Environmental Quality Method 7 (ODEQ-7) for both filterable PM and condensible PM. The paragraphs below first describe the essential features of Method 5 and then describe how the other procedures differ from Method 5.

The primary components of the Method 5 train are the nozzle, the probe, a filter (which is maintained at 120 ± 14°C [250 ± 25°F] in a heated filter box), an impinger train that is kept in an ice bath to cool the gas stream to ambient temperature, a meter box, and a pump. The impinger train contains four impingers; the first two contain water, the third is dry, and the fourth contains silica gel to dry the gas stream before it enters the dry gas meter. The Method 5 train collects an integrated sample over one to several hours at sample points that span a cross-section of the exhaust duct or stack, typically on perpendicular traverses across the diameter of the stack. At each sampling point, a sample of the gas stream is collected isokinetically through the nozzle. The captured gas stream moves through the probe to the filter. Some particles are collected on the walls of the probe, and the remaining material that is in particle phase at 120°C (250°F) is collected on the filter. The gases that pass through the filter then go through the impinger train where any organic or inorganic materials that condense between 16° and 120°C (60° and 250°F) are collected. Typically, the material collected in the probe and filter (front half catch) is considered for regulatory purposes to be PM, and the material captured in the impingers (back half catch) is considered to be condensible PM. The procedures for Method 5 do not require the back half catch of the sampling train to be quantified. However, as explained below, the Method 5 train may be coupled with a Method 202 sampling train for measuring the condensible PM emission rate.

The other two methods that have been used to collect total PM emissions from wood products industry operations, EPA Method 17 and ODEQ-7, encompass the same principles as EPA Method 5 but have specific modifications. The primary difference between EPA Methods 5 and 17 is in the collection temperature for the front half catch. In order to maintain a collection temperature of 120°C (250°F), the Method 5 train employs a heated probe and filter. In contrast, the Method 17 train employs an in-stack filter, so the collection temperature is equal to the actual temperature of the stack gas. If the stack gas temperature is less than 120°C (250°F), then any material that condenses at temperatures between the stack gas temperature and 120°C (250°F) will be measured as filterable PM with Method 17. However, in a Method 5 train, this material would pass through the front half of the train to the impingers and would not be quantified as filterable PM. The measures are reversed if the stack gas temperature is greater than 120°C (250°F).

The ODEQ-7 method modifies EPA Method 5 by adding a filter between the third and fourth impingers to collect any condensed material that escapes the impingers. This filter is maintained at approximately ambient temperature, and the material collected in the first three impingers and on the second filter are added to the front-half catch to obtain total PM. This procedure is intended to measure those constituents in the emissions responsible for the formation of PM once the emissions have cooled to ambient temperature.

Oregon Department of Environmental Quality Method 8 is a high volume method of sampling filterable PM emissions, primarily designed for wood product handling cyclone and baghouse exhaust systems whose primary emissions are solid PM. The primary components of the ODEQ-8 train are the nozzle, the probe, a filter (unheated, outside stack), a meter box, and a pump. One primary difference between EPA Method 5 and ODEQ-8 is in the collection temperature for the filter catch. In order to maintain a collection temperature of 120°C (250°F), the Method 5 train employs a heated probe and filter. In contrast, the ODEQ-8 train uses an unheated probe, and an unheated, out-of-stack filter, so the collection temperature is near the actual temperature of the stack gas. If the stack gas temperature is less than 120°C (250°F), then any material that condenses at temperatures between the stack gas temperature and 120°C (250°F) will be measured as filterable PM with ODEQ-8. However, in a Method 5 train, this material would pass through the front half of the train to the impingers and would not be quantified as filterable PM. The other major difference between EPA Method 5 and ODEQ-8 is that the Oregon method does not include a series of impingers, or back half, and, therefore does not quantify condensible PM.

In 40 CFR Part 51, EPA has published two procedures for determining PM-10 emission rates (EPA Methods 201 and 201A) and a method for measuring condensible PM emission rates (EPA Method 202). Methods 201 and 201A are derivatives of Method 5 both of which include an in-stack cyclone to remove particles with an aerodynamic diameter greater than 10 micrometers (µm) from the gas stream followed by an in-stack filter to collect the remaining particles. The back half of the train is identical to the back half of the Method 5 train. Both methods require a traverse of the stack, but Method 201 uses isokinetic sampling with a recirculating system to maintain constant flow through the cyclone, while Method 201A uses a constant sampling rate. The PM-10 is determined gravimetrically from the material captured in the sample line between the cyclone and filter and on the filter. Neither of the two methods specify procedures for determining condensible PM, but both methods indicate that for applications such as inventories of sources contributing to ambient PM-10 levels, PM-10 should be the sum of condensible PM emissions and PM-10 emissions measured by the Method 201 or 201A procedures.

Condensible PM emissions can be determined by EPA Method 202. Method 202, which applies to determination of condensible PM from stationary sources, measures condensible PM as material that passes through the filter and is collected in the impingers of a PM train. The primary method specifies that condensible PM be based on the back-half catch of a Method 17 train (which uses an in-stack filter), but Method 5, 201, or 201A procedures are also acceptable. The method specifies that the impinger solution be extracted with methylene chloride, the inorganic and organic fractions be dried separately, the residues weighed, and the condensible PM be determined from the combination of both residues. Note that because the method allows the use of either a heated filter system or an in-stack filter system, some ambiguity in results can occur from test to test.

Total hydrocarbon or volatile organic compound emission estimates from wood products industry dryers and hot presses have been obtained primarily via one of two EPA methods--Method 25 and Method 25A--with Method 25A being the primary method used in particleboard manufacturing plants. Method 25 measures VOC emissions as total gaseous nonmethane organics (TGNMO), and emission levels are typically reported as carbon concentrations or mass rates. Because organic PM interferes with the organic analysis, the sample is drawn through a heated filter for PM removal. The method currently requires that the filter be maintained at 121° ± 3°C (250° ± 5°F), but these filter requirements have evolved. Initially, the filter was optional, and temperature requirements have changed over the years. The sample is drawn from the filter through a condensate trap into an evacuated sample tank. The material in the trap and sample tank are recovered and analyzed separately, and the results are combined to determine total VOC. The organic material in the condensate trap is oxidized to CO_2 and collected in an evacuated vessel; then a portion of the CO_2 is reduced to CH_4 and measured by flame ionization detector (FID). A portion of the gas collected in the sample tank is first passed through a gas chromatograph to separate CO, CO_2, and CH_4 from the remaining nonmethane organic material (NOM). The NOM is then oxidized to CO_2, reduced to CH_4, and measured by FID. This procedure essentially determines the number of carbon atoms present in the nonmethane volatile organic material and eliminates inconsistencies associated with the variable response of the FID to different organic compounds.

Method 25A is used to provide a continuous measure of the concentration of organic vapors consisting primarily of alkanes, alkenes, and aromatic hydrocarbons. The stack gas sample is collected through a heated sample line with either an in-stack or heated filter to remove PM. From the filter, the sample is directed to an FID, and the concentration of organic material in the gas stream is measured as calibration gas equivalents or as carbon equivalents. The results depend strongly on the particular constituents that make up the organic content of the gas stream because the FID has different response factors for different organic bond structures. In particular, the carbon/oxygen bond in formaldehyde provides a negative interference, so the response of the FID to formaldehyde is essentially zero, and responses for other aldehydes and ketones are diminished. Consequently, Method 25A does not include a measure of formaldehyde emissions and does not accurately quantify emissions of other aldehydes or ketones in the VOC estimate. Also, Method 25A measures methane, which is not regulated as a VOC. This may result in the overestimation of VOC emissions from gas-fired dryers which can have significant methane emissions.

Because the resins often used to bond wood products are formaldehyde-based, the exhaust gases from the presses and from drying operations are known to contain quantities of formaldehyde and may contain some amount of other aldehydes and ketones. The available data on aldehyde and ketone emissions from these operations have been obtained with EPA Method 0011. It is important to note that Method 0011 has not been validated for wood products industry emission sources. Method 0011 was developed specifically for formaldehyde emissions, but it has been applied to other aldehyde and ketone compounds. The procedure collects an integrated sample isokinetically at points along perpendicular traverses of the stack. The gaseous and particulate pollutants in the sample gas are collected in an impinger train that contains an aqueous acidic solution of dinitrophenyl-hydrazine. Formaldehyde reacts with the dinitrophenylhydrazine to form a formaldehyde dinitrophenylhydrazone derivative. This derivative is extracted, solvent exchanged, concentrated, and analyzed by high performance liquid chromatography.

3.5 EMISSION TESTING ISSUES

Many of the difficulties encountered in developing VOC and PM-10 emission factors for wood products industry dryers and hot presses arise because of the chemical composition of the organic materials found in the emission streams from these processes and the use of different test methods described above to collect and analyze these organic compounds for the historical data base. Also, the chemical and physical characteristics of these emission streams, particularly the moisture content and temperature variations, complicate sampling and analysis and data reduction. Particular issues of concern are complications associated with high moisture in exhaust streams, differing VOC and PM-10 results from different procedures and associated concerns with the condensible PM-10 as measured by Method 202, and the interrelationship between the estimates of VOC and PM-10 emissions. These issues are a general concern in the wood products industry and should be considered when interpreting test data and planning emission test programs for the industry. The paragraphs below first discuss the characteristics of the organic material in wood products exhaust streams and then address the general issues outlined above.

3.5.1 Organic Emissions from Dryers and Presses

As green wood is subjected to heat in wood products dryers, some of the organic material in the wood is volatilized and carried off with the exhaust stream. These organic materials that emanate from the wood are the primary VOCs and condensible organic PM in the dryer exhaust. Consequently, the organic compounds found in wood products dryer emissions typically include terpenes, terpene-like materials, resins, and fatty acids comparable to those found in wood. The boiling points of many of these materials are in the range of 155° to 370°C (310° to 700°F). These temperatures are greater than typical dryer temperatures, but the compounds exhibit significant vapor pressures at dryer temperatures. Consequently, some of these organic compounds are at saturation levels in the gas streams and will condense as the gas stream cools.

3.5.2 Moisture Content of Dryer Exhaust

The inherent moisture contents of exhaust streams from particleboard dryers complicate measurement of PM-10 emissions in these streams. This problem is most prevalent for facilities that have wet control devices such as wet ESP's. Because the exhaust from these systems is saturated, moisture condensation downstream from the control device is common. The PM-10 procedures described above prescribe an in-stack filter that operates at stack temperatures. If the gas stream contains water droplets, sample train filter blinding (blockage of gas flow through the filter) is likely to preclude PM-10 sampling. This problem has been encountered during EPA tests conducted on wet ESP-controlled dryers as a part of the program to develop emission factors for the wood products industry.

One solution to this problem is to use a heated filter rather than an in-stack filter in the Method 201 or 201A train. As a part of the testing, Method 202 could be used to determine condensible PM emissions from the back half of the Method 201 or 201A train. The total PM-10 emissions could be estimated as the sum of the PM-10 emissions obtained from Method 201 or 201A and the condensible PM emissions obtained from Method 202. This solution will eliminate the moisture problem, but it does have two drawbacks. First, since this procedure is different from the procedure used for dry control systems, the results will not be directly comparable. Second, this procedure exacerbates the problems related to the interrelationship of VOC and PM-10 emissions discussed below.

3.5.3 VOC and PM-10 Measurements

As suggested by the characteristics of the organic emissions from wood products dryers described above, the dryer exhaust gas contains a substantial amount of organic material that is condensible in the range of 50° to 120° C (120° to 250°F). Because all of the test methods described earlier contain a filter to collect PM, the amount of this material that remains on that filter and the amount that will be measured downstream from the filter depend on the operating temperature of the filter. Consequently, the material classified as PM-10, condensible PM, and VOC differs, depending on filter temperature. The situation related to VOC emissions is further complicated by the presence of aldehydes and ketones in the exhaust streams from dryers and presses. Because these compounds are treated differently by Methods 25 and 25A, results obtained by these two methods are not directly comparable. The paragraphs below first address the PM-10 issues and then the VOC issues.

The applicability sections for EPA Methods 201 and 201A indicate that if PM-10 results are to be used for purposes such as inventories, then the PM-10 results from those methods should be added to condensible PM results from Method 202 to obtain total PM-10 emissions. Because the primary purpose of AP-42 is to aid in preparing emission inventories, such a combination appears to be appropriate for developing AP-42 emission factors. However, condensible PM emissions can be determined via Method 202 in conjunction with a variety of trains. The available data base on condensible PM emissions from the wood products industry has been obtained using a Method 202 train following EPA Method 5 and Method 201A trains. Because these trains operate at different filter temperatures, they can generate different measures of condensible PM emissions for the same facility. Furthermore, because Method 201A operates with an in-stack filter, the distribution of filterable and condensible fractions will vary from site to site depending on stack gas temperatures. In addition, measurements of filterable PM by Method 5 and PM-10 by Methods 201 or 201A on the same stack gas can result in a PM-10 emission rate that is higher than the filterable PM emission rate because of the differences in sampling train filter temperatures. Such differences complicate averaging results across facilities to develop emission factors.

As noted in the discussion of Method 25 above, the protocol concerning the Method 25 particulate prefilter has changed over time. Data collected during the last several years are based on the organic material that passes through a 120°C (250°F) filter. However, some of the historical VOC data for the wood products industry were based on Method 25 trains with in-stack filters or with heated filters operating at 88°C (190°F). Because available data from NCASI testing indicate that substantial quantities of the organic material in wood products dryers may condense at temperatures between 77°C (170°F) and 120°C (250°F), the results from the historical tests with different filter temperatures cannot be combined consistently.

Development of VOC emission factors is further complicated by the differences between Method 25 and Method 25A results. First, Method 25A allows the use of an in-stack particulate filter in lieu of a heated filter, so the organic material that is subjected to analysis via the two methods is not equivalent. More importantly, the analytical methods are quite different. Method 25 collects an integrated sample over time and essentially counts the number of carbon atoms in the volatile fraction of the organic material collected. Consequently, irrespective of the structure of the organic compounds in the emission stream, the method measures the moles of carbon contained in those compounds. In contrast, Method 25A provides a continuous measure of the organic material present by measuring the response of an FID to that material relative to the response of the FID to a calibration gas. If the organic compounds in the exhaust gas are primarily aliphatic and aromatic hydrocarbons, the two methods provide reasonably comparable measures, but, if the exhaust contains substantial quantities of oxygenated compounds such as aldehydes and ketones, the results will differ substantially. This difference is a consequence of the diminished response of the FID to aldehydes and ketones. Because the hot press exhaust and some dryer exhaust streams are known to contain quantities of aldehydes and ketones, the two methods are not expected to produce comparable results for those operations.

3.5.4 Interrelationship of PM/PM-10 and VOC Emissions

Due to source characteristics there is an interrelationship between PM/PM-10 and VOC emissions. Because of this interrelationship, the differences in the test methods described above can result in measuring some fraction of the organic constituents in the exhaust stream as both PM-10 and VOC emissions.

Available test data for wood products dryer emissions indicate that irrespective of filter temperature, essentially all of the condensible PM that passes through the filter and is collected in the back half of a PM or PM-10 train is organic material. Also, any organic material that passes through an in-stack filter used with Method 25A or that passes through a heated filter at 120°C (250°F) as used with Method 25 will be measured as VOC. At the same time, organic material that condenses between the stack temperature and 120°C (250°F) will be measured as PM-10 by Methods 201 and 201A. Furthermore, material that condenses in the back half of an EPA Method 5 train will be classified as condensible PM by EPA Method 202.

An overlap in the measured PM-10 and VOC emissions in the historical data base may have resulted in two instances. First, if the recommendations of Methods 201 and 201A related to including condensible PM in estimating total PM-10 emissions are followed, condensible PM will be measured as both VOC and PM-10. Second, some fraction of the organic material retained on the Method 201 or 201A filter and measured as PM-10 may also be counted as VOC via Method 25 because the filter temperatures in the Method 25 train can be higher than that of the PM-10 train for these emission sources.

3.5.5 Summary

Several general conclusions can be made regarding the measurement of PM-10 and VOC emissions for these sources. First, the source characteristics result in an interrelationship between PM/PM-10 and VOC. The constituent organic pollutants emitted act as both PM and VOC. When an in-stack filter is used during sampling the measured filterable PM, condensible PM, and VOC will be affected by the stack gas temperature. Consequently, these measurements should be made under normal operating conditions; ideally simultaneous measurements should be taken.

Second, the PM-10 and VOC test methods should be conducted to minimize the amount of overlap in their measurement. Use of Methods 201/201A for filterable PM-10 in conjunction with Method 202 for condensible PM-10 will provide total PM-10 results on the same basis (distribution of emissions between the filterable and condensible fraction will be dependent upon stack gas temperature because the 201/201A train uses an in-stack filter). Use of Method 25A with an in-stack filter will provide VOC data on the same basis as the PM-10 measurements. In this case, the condensible organic PM-10 fraction measured using Method 202 will also be measured as VOC by Method 25A. However, the amount of measurement overlap can be estimated.

Finally, Method 25A has a very low response to formaldehyde, and a reduced response to other aldehydes and ketones; consequently, the VOC emissions measured by Method 25A will be biased low in cases where these compounds are present. A separate measurement method (e.g., Method 0011) should be used to quantify these compounds when they are expected to be present in the emissions; for example, in the exhaust gases from the presses and from drying operations.

REFERENCES FOR SECTION 3

1. *Procedures for Preparing Emission Factor Documents*, EPA-454/R-95-015, U. S. Environmental Protection Agency, Research Triangle Park, NC, May 1997.

2. Code of Federal Regulations, Title 40, Part 60, Appendix A-Reference Methods.

3. Code of Federal Regulations, Title 40, Part 51, Requirements for Preparation, Adoption, and Submittal of Implementation Plans.

4. *Source Sampling Manual Volume I*, State of Oregon, Department of Environmental Quality, Air Quality Division, January 1992.

4. REVIEW OF SPECIFIC DATA SETS

4.1 INTRODUCTION

This section describes how the AP-42 section was developed. First, descriptions of the data sets that were reviewed for this report are presented in Section 4.2. Section 4.3 explains how the candidate emission factors for particleboard manufacturing were developed. Finally, Section 4.4 discusses a partial statistical analysis of the data.

4.2 REVIEW OF SPECIFIC DATA SETS

A total of nine references were reviewed in the preparation of the AP-42 section on particleboard manufacturing. References 1 through 7, and 9 are emission test reports. Reference 8 is the National Council of the Paper Industry for Air and Stream Improvement (NCASI) Technical Bulletin No. 694 and the associated data base (hereafter referred to as the NCASI data base). The following sections, provide brief descriptions of these references.

4.2.1 Reference 1

This report documents measurements of emissions of several pollutants from a gas-fired particleboard core dryer, particleboard press, and veneer press. The test, which was conducted in 1992, was sponsored by EPA for the purposes of developing emission factors for emissions from particleboard manufacturing sources. The test quantified emissions of uncontrolled PM from the core dryer; multiclone-controlled PM, CO, NO_x, VOC, and selected speciated organic pollutants from the core dryer; and uncontrolled CO, VOC, and selected speciated organic pollutants from the particleboard and veneer presses. Process rates for the dryers and press were reported on the basis of production.

To manufacture particleboard, the plant typically uses furnish that consists of 6 parts hardwood material to 1 part of softwood material. During the test, the core dryer operated at an inlet temperature that ranged from 102° to 107°C (215° to 225°F) and an outlet temperature that ranged from 47.2° to 48.9°C (117° to 120°F). The average moisture content of the furnish entering the dryer ranged from 6.7 to 7.8 percent, and the average moisture content of material as it exited the dryer was 4.6 percent.

The facility was using a urea-formaldehyde resin to manufacture the particleboard and veneer panels during the test. The particleboard press platen temperature ranged from 174° to 177°C (345° to 351°F). The veneer press is used manufacture 3- and 5- ply furniture panels with veneer faces and particleboard cores. The veneer press platen temperature was maintained at 132°C (270°F).

Filterable PM and condensible PM were measured using Methods 5 and 202. Measurements of PM-10 were made with Method 201A with a cascade impactor to determine the PM-10 fraction. Volatile organic compound emissions were measured by Method 25A. Speciated VOC emissions were determined with Method 0030, and samples were analyzed for 45 compounds. Speciated semivolatile organic emissions were determined with Method 0010, and samples were analyzed for 54 compounds. Aldehyde/ketone emissions were measured with Method 0011, and samples were analyzed for 14 compounds. Carbon monoxide and NO_x emissions were measured with Methods 10 and 7E, respectively.

Emission factors were developed for controlled and uncontrolled filterable PM, filterable PM-10, and condensible PM from the core dryer. Using the particle size data, emission factors for controlled and uncontrolled PM-2.5 and PM-1.0 also were developed for the core dryer. In addition, emission factors were developed for CO, NO_x, VOC (as methane), four aldehydes, five semivolatile organic compounds, and five speciated VOC from the dryer. For the particleboard press, emission factors were developed for CO, VOC (as methane), and six aldehydes and ketones. Emission factors also were developed for emissions of five aldehydes and ketones, and 5 speciated VOC from the veneer press. Emission factors were not developed for those speciated organics for which the mass collected during at least two runs were below the detection limit.

With the exception of the dryer particle size data, all emission data for this test were rated A. Tests were performed by sound methodologies and are reported in enough detail for adequate validation. The particle size data for the dryer were rated C because the mass collected was well below the optimal mass recommended for gravimetric analysis. As discussed in Section 4.3 of this report, the factors developed for particleboard dryers from Reference 1 were inconsistent with many of the factors developed from other data and do not appear representative of the type of source and operating parameters that characterized the Reference 1 tests. In addition, the dryers were processing a mix of hardwood and softwood species. Therefore, the Reference 1 dryer data were not incorporated into the AP-42 section on particleboard.

4.2.2 Reference 2

The purpose of this test program was to assist EPA in developing emission factors for selected hazardous air pollutants emitted for several processes associated with the wood products industry. The sources tested included a particleboard core dryer, face dryer, and press. The test quantified emissions of uncontrolled filterable PM, condensible PM, and VOC from the core and face dryers; EFB-controlled filterable PM, filterable PM-10, condensible PM, CO, NO_x, VOC, and selected speciated organic pollutants from the core and face dryers; and uncontrolled filterable PM and PM-10, condensible PM, VOC, and selected speciated organic pollutants from the particleboard press. Process rates for the dryers and press were reported on the basis of production. The data from this test are included in the NCASI data base.

The facility manufactures a high grade, 5-layer particleboard, which is referred to as microboard and is used to manufacture furniture. The plant typically uses 100 percent pine furnish for the core, and a combination of 60 percent pine and 40 percent hardwood furnish for the face material. During the test, the core dryer operated at an inlet temperature that ranged from 523° to 539°C (973° to 1003°F) and an outlet temperature that ranged from 123° to 127°C (253° to 260°F). The average moisture content of the furnish entering the core dryer ranged from 47 to 53 percent, and the average moisture content of material as it exited the dryer ranged from 2.1 to 2.5 percent. The face dryer operated at an inlet temperature that ranged from 308° to 369°C (587° to 697°F) and an outlet temperature that ranged from 103° to 108°C (217° to 227°F). The average moisture content of the furnish entering the face dryer was 46 percent, and the average moisture content of material as it exited the dryer ranged from 6.1 to 6.9 percent.

The facility was using a urea-formaldehyde resin to manufacture the particleboard panels during the test. The particleboard press platen temperature ranged from 174° to 177°C (345° to 351°F). The press exhaust is emitted through eight identical roof vents; six vents are located directly above the press, and two vents are located above the cooling rack for the pressed panels. Testing was conducted on both cooling rack vents and on three of the six vents above the press.

Filterable PM and condensible PM were measured using Methods 5 and 202. Measurements of PM-10 were made with Method 201A. Volatile organic compound emissions were measured by

Method 25A. Speciated VOC emissions were determined with Method 0030, and samples were analyzed for 22 compounds. Speciated semivolatile organic emissions were determined with Method 0010, and samples were analyzed for 4 compounds. Aldehyde/ketone emissions were measured with Method 0011, and samples were analyzed for 15 compounds. Carbon monoxide and NO_x emissions were measured with Methods 10 and 7E, respectively. In addition, concentrations of carbon dioxide (CO_2) in the dryer exhaust streams were measured using Method 3A.

Emission factors were developed for uncontrolled and EFB-controlled filterable PM, filterable PM-10, condensible PM, CO, and VOC (as methane) from the core and face dryers. In addition, emission factors were developed for filterable PM-10, CO, NO_x, VOC (as methane), 15 aldehydes and ketones, 4 semivolatile organic compounds, and 7 speciated VOC from the core and face dryer EFB outlets. For the particleboard press, emission factors were developed for uncontrolled filterable PM, filterable PM-10, condensible PM, VOC (as methane), and 15 aldehydes and ketones. Emission factors were not developed for those speciated organics for which the mass collected during at least two runs was below the detection limit.

To account for total press emissions, the emission factors developed for the press were calculated using twice the sum of the emission rates for the three vents located above the press, plus the emission rates for the two vents above the cooling rack. In addition, only two runs were conducted for some of the sampling trains on the cooling rack vents. In such cases, the emission rate for the third run was taken as the average of the emission rates for the other two runs.

The quality ratings for these emission data are described in the discussion of Reference 8.

4.2.3 Reference 3

The purpose of this test program was to assist EPA in developing emission factors for selected hazardous air pollutants emitted for several processes associated with the wood products industry. The sources tested included a particleboard core dryer, face dryer, and press. The test quantified emissions of uncontrolled filterable PM and PM-10, condensible PM, CO, NO_x, VOC and selected speciated organic pollutants from the core and face dryers; and filterable PM and PM-10, condensible PM, VOC, and selected speciated organic pollutants from the particleboard press. Process rates for the dryers and press were reported on the basis of production. The data from this test are included in the NCASI data base.

The facility typically uses 100 percent pine furnish for the core and face material. During the test, the core dryer operated at an inlet temperature that ranged from 207° to 240°C (404° to 464°F) and an outlet temperature that ranged from 68.3° to 71.1°C (155° to 160°F). The average moisture content of the furnish entering the core dryer ranged from 15.9 to 19.1 percent, and the average moisture content of material as it exited the dryer ranged from 5.5 to 6.2 percent. The face dryer operated at an inlet temperature that ranged from 104° to 126°C (219° to 258°F) and an outlet temperature that ranged from 49.4° to 103°C (121° to 127°F). The average moisture content of the furnish entering the face dryer ranged from 15.7 to 19.3 percent, and the average moisture content of material as it exited the dryer ranged from 6.8 to 7.8 percent.

The facility was using a urea-formaldehyde resin to manufacture the particleboard panels during the test. Wax and formaldehyde scavenger also are blended in with the material prior to mat forming. The production line includes a prepress between the former and the press. The particleboard press platen generally is operated at a temperature of 154°C (310°F). The press exhaust is emitted through eight identical roof vents; six vents are located directly above the press, and two vents are located above the cooling rack for the pressed panels. Testing was conducted on both cooling rack vents and on three of the six vents above the press.

Filterable PM and condensible PM were measured using Methods 5 and 202. Measurements of PM-10 were made with Method 201A; the data also were used to estimate filterable PM emissions. Volatile organic compound emissions were measured by Method 25A. Speciated VOC emissions were determined with Method 0030, and samples were analyzed for 20 compounds. Speciated semivolatile organic emissions were determined with Method 0010, and samples were analyzed for 13 compounds. Aldehyde/ketone emissions were measured with Method 0011, and samples were analyzed for 12 compounds. Carbon monoxide and NO_x emissions were measured with Methods 10 and 7E, respectively. In addition, concentrations of carbon dioxide (CO_2) in the dryer exhaust streams were measured using Method 3A.

In order to provide suitable sampling locations, stack extensions were installed on all sources. Based on plant personnel, these extensions appeared to adversely affect the performance of the product recovery cyclones on the dryers, and it is suspected that the filterable PM and PM-10 results from the dryers are biased high as a result. In addition, for some of the speciated organics, the mass collected on one or more runs was beyond the calibration range of the instrument. In such cases, the emission rates for those compounds was estimated for those runs. No other problems were reported for the test.

Emission factors were developed for uncontrolled filterable PM, filterable PM-10, condensible PM, CO, NO_x, CO_2, VOC (as methane), 7 aldehydes and ketones, 4 semivolatile organic compounds, and 13 speciated VOC from the core and face dryers. For the particleboard press, emission factors were developed for uncontrolled filterable PM, filterable PM-10, condensible PM, VOC (as methane), and 11 aldehydes and ketones. Emission factors were not developed for those speciated organics for which the mass collected during at least two runs was below the detection limit.

The quality ratings for these emission data are described in the discussion of Reference 8.

4.2.4 Reference 4

This reference documents measurements of emissions of filterable and condensible PM, and formaldehyde from particleboard face and core dryers. The purpose of the test was to demonstrate compliance with state regulations; the test was conducted in 1989. Both uncontrolled and controlled emissions were measured. Process rates for the dryers were reported on the basis of production.

The facility manufactures a high grade, 5-layer particleboard, which is referred to as microboard and is used to manufacture furniture. The plant typically uses 100 percent pine furnish for the core, and a combination of 60 percent pine and 40 percent hardwood furnish for the face material. The core dryer typically is operated at inlet temperatures of 480° to 680°C (900° to 1250°F) and outlet temperatures of 130° to 140°C (260° to 280°F). The face dryer typically is operated at inlet temperatures of 320° to 480°C (600° to 900°F) and outlet temperatures of 91° to 96°C (195° to 205°F). The dryers are fired with sanderdust. Data on furnish inlet moisture contents for the dryers were not reported, but the report states that the dried furnish has a moisture of approximately 2 percent.

Emissions from each of the dryers are ducted to an EFB followed by a fabric filter. For the core dryer, emissions were sampled at the EFB inlet, at the stack with the EFB out of operation, and at the stack with the EFB in operation; emissions from the face dryer were tested at the stack with the EFB out of service and with the EFB in operation. Filterable PM was measured using Method 5. The back half of the sampling train also was analyzed for condensible PM. The organic fraction of the condensible material was quantified using a chloroform-ether extraction. Emissions of formaldehyde were quantified using National Institute for Occupational Safety and Health (NIOSH) Method 3500. In addition, concentrations of CO_2 in the gas streams was measured using Method 3A (Orsat). In each case, three test runs were conducted. Emission factors were developed for filterable PM, condensible inorganic PM, condensible organic PM, formaldehyde and CO_2.

With the exception of the formaldehyde, the emission data are assigned a rating of B. The test methods were sound and no problems were reported. However, the report does not include run-specific process rates. The formaldehyde data are rated D because the method used is subject to several interferences and does not provide reliable results.

4.2.5 Reference 5

This reference documents measurements of emissions from the face dryer that is the subject of Reference 4. Emissions of filterable and condensible PM were sampled to demonstrate compliance with state regulations; the test was conducted in 1988. Both uncontrolled and controlled emissions were measured. Process rates for the dryers were reported on the basis of production.

Data on dryer operating temperature, furnish species, and furnish moisture contents were not reported. Emissions were sampled at the EFB inlet, at the stack with the EFB out of operation, and at the stack with the EFB in operation. Filterable PM was measured using Method 5. The back half of the sampling train also was analyzed for condensible PM. The organic fraction of the condensible material was quantified using a chloroform-ether extraction. In addition, concentrations of CO_2 in the gas streams was measured using Method 3A (Orsat). In each case, three test runs were conducted. Emission factors were developed for filterable PM, condensible inorganic PM, condensible organic PM, and CO_2.

The emission data are assigned a rating of B. The test methods were sound and no problems were reported. However, the report does not include run-specific process rates.

4.2.6 Reference 6

This reference documents measurements of emissions from several sources associated with the manufacturing of door cores. Measured emissions included filterable PM, condensible PM, and NO_x from a particle dryer, and VOC from a board press and a board cooler. Emissions of filterable and condensible PM were sampled to demonstrate compliance with state regulations; the test was conducted in 1988. Only uncontrolled emissions were measured.

The process rate for the dryer was reported on the basis of feed. However, using data on the inlet and outlet moisture contents of the furnish reported in Reference 7, which documents a test on the same dryer, the dryer production rate was estimated from the feed rate. Data on dryer operating temperatures and furnish species also were not reported. However, Reference 7 includes the furnish moisture contents measured during a later test on the same dryer.

Filterable PM was measured using Method 5. The back half of the sampling train also was analyzed for condensible PM. The organic fraction of the condensible material was quantified using a methylene chloride extraction. In addition, concentrations of CO_2 in the gas streams was measured using Method 3A (Orsat). Emissions of NO_x were measured using Method 7. In each case, three test runs were conducted. Emission factors were developed for filterable PM, condensible inorganic PM, condensible organic PM, NO_x, and CO_2 from the dryer. Emission factors could not be developed for the other sources because process data were not reported.

The emission data are assigned a rating of B. The test methods were sound and no problems were reported. However, the report does not include run-specific process rates.

4.2.7 Reference 7

This reference documents measurements of EFB-controlled emissions from the door core dryer that is the subject of Reference 6. Measured emissions included filterable PM, condensible PM, and NO_x. The test was conducted in 1991 to demonstrate compliance with state regulations.

The process rate for the dryer was reported on the basis of feed. However, using the reported inlet and outlet moisture contents of the furnish, the production rate was estimated. The report also included data on dryer operating temperatures. However, the species of the wood furnish was not specified in the report.

Filterable PM was measured using Method 5. The back half of the sampling train also was analyzed for condensible PM. The organic fraction of the condensible material was quantified using a freon extraction. In addition, concentrations of CO_2 in the gas streams was measured using Method 3A (Orsat). Emissions of NO_x were measured using Method 7. In each case, three test runs were conducted. Emission factors were developed for filterable PM, condensible inorganic PM, condensible organic PM, NO_x, and CO_2 from the dryer.

The emission data are assigned a rating of B. The test methods were sound and no problems were reported. However, the report does not include run-specific process rates.

4.2.8 Reference 8

As indicated previously, this reference consists of a technical bulletin and the associated data base. The data base includes data on emission source design and operating parameters, emission test parameters, and emission measurements for a total of approximately 100 emission tests conducted at 11 particleboard manufacturing facilities. Because of the extent of the data presented in the data base, a narrative description of the emission tests addressed is not practical for this report. Instead, the data are summarized in a series of tables. Tables 4-1, -2, and -3 present data related to the sampling of criteria pollutants and related pollutants from particleboard dryers. Table 4-1 presents data on dryer design and operating parameters, including dryer type, type of firing, dryer capacity, emission control device, form of wood materials dried, and the hot air source. Table 4-2 summarizes the emission data for particleboard dryers. The table presents for each emission test, the test method, number of runs, volumetric flow rate, stack gas temperature and moisture, pollutant concentration, emission rate, process operating rate, and emission factor. Table 4-3 presents a summary of the other operating data that are likely to affect dryer emission levels. The table includes data on firing type, fuel type, wood species dried, inlet and outlet moisture contents of the wood furnish, dryer inlet and outlet temperatures, emission control device, number of test runs, emission factor, and data rating. The data in Tables 4-1 to 4-3 are ordered by pollutant and primary emission control device. The dryer test code and unit code for each test are provided in the first two columns of each of the tables. The dryer and parameter codes presented in these tables, as well as the other tables developed from the NCASI data base, are identical to the codes used in the NCASI data base. The footnotes at the end of each table define the relevant parameter codes that appear in the table.

Data on emissions of speciated organics from particleboard dryers are presented in Tables 4-4 and 4-5. The data in these tables correspond to the data presented in Tables 4-2 and 4-3 on emission test parameters and other operating parameters that are likely to affect emissions. Table 4-6 defines the pollutant codes used in Tables 4-4 and 4-5. These pollutant codes match those used in the NCASI data base and throughout this section.

Tables 4-7 and 4-8 present a summary of the data on particleboard presses. Table 4-7 includes press design and operating data and emission test parameters including press size, number of vents, test method, number of runs, stack parameters, pollutant concentration, emission rate, process rate, and emission factor. Table 4-8 presents other data that are likely to have a significant effect on emissions, including press temperature, cycle time, board thickness and density, moisture content, wood species, type of resin, resin application rate, the use of catalysts or scavengers, wax application rate, pollutant, and emission factor.

Table 4-9 presents the data on particleboard press board coolers, and Table 4-10 summarizes the emission data for miscellaneous particleboard equipment. The emission factors that appear in Table 4-10 are based on tests performed on product recovery cyclones and fabric filters that serve milling, sanding, trimming, storage, and other operations. Some of the factors are presented in units of pounds of PM emitted from a specific control device per ton of material collected by that control device. However, because there are no data on the processing rates of the operations that these control devices serve, the reported emission rates cannot be related to the amount of particleboard processed during the emission tests. The remaining factors are based on processing rates of the operations that these control devices serve, however, the source operations or configurations are not clearly documented, therefore any generic emission factors based on these data would be highly suspect. For this reason, the data presented in Table 4-10 were not incorporated into the AP-42 section and are not discussed further in this report.

The quality ratings for the emission data presented in Tables 4-1 to 4-5 and Tables 4-7 to 4-10 take into account the number of test runs, test method, and any other indication that the test results may be suspect. Generally, data based on 3 or more test runs were assigned a rating of A, 2-run data were assigned a rating of B, and single-run data were assigned a rating of D. If there were indications of other reasons for questioning the data, the rating was further lowered. For example, for tests in which only half of the press vents were sampled, the data rating was lowered one rating. Also, data based on National Institute for Occupational Safety and Health (NIOSH) Method 3500 for sampling formaldehyde were rated no higher than D due to the error associated with that method, and were not used to develop emission factors. For measurements of speciated organics, the rating was reduced if the response to a compound was beyond the calibration range of the analytical instrument or if the result was reported as semiquantitive due to the lack of acceptance criteria.

For some of the test results included in the NCASI data base, it was reported that the dryer was drying partially dried material during the emission test. The codes for these tests are 043-042192A, 043-042192B, 166-100692A, and 166-100692A. The results of these tests were not incorporated in the emission factors developed for the AP-42 section because they are not considered representative of normal drying operations.

4.2.9 Reference 9

This report presents the results of air emissions tests performed on May 9-12, 1994, at the Louisiana-Pacific particleboard plant located in Missoula, Montana. The emission streams were sampled for filterable and condensible PM, VOC, formaldehyde, NO_x, and CO.

The Missoula plant includes a predryer system, six rotary dryers, two press lines, and two rotary board coolers. The pre-dry system consists of two 12 foot diameter by 40 foot long triple pass rotary drum dryers manufactured by Guarantee Performance. Emissions are vented to the atmosphere via two 40 inch diameter, 90 foot tall stacks. Heat for the predryers is supplied by a 35 mmBTU/hr Coen sanderdust burner. Emissions from the predryer are controlled by Polutrol multicyclones.

The two dryers which supply Line 2, the surface dryer (C) and core dryer (D), are triple pass rotary dryers manufactured by Heil. Dryer C is 9 feet in diameter and 32 feet long, dryer D is 8 feet in diameter and 28 feet long. Emissions from the dryers are controlled by Polutrol multicyclones and emitted to the atmosphere via two 36 inch diameter, 40 foot tall ducts. Heat for all six dryers is supplied via a ROEMMC tube by a 50 mmBTU/hr ROEMMC sanderdust burner and a 55 mmBTU/hr Babcock-Wilcox boiler.

The Line 2 continuous particleboard press is ventilated by four roof-mounted axial fans. The board cooler is vented by two four foot square ducts. The plant processed 100 percent softwoods during the test period. Urea formaldehyde resin was used in both the face and core layers throughout the test period.

Particulate matter and condensible PM emissions were tested in accordance with Methods 5 and 202, respectively. Method 5 and 202 results are reported as front half and back half organic and inorganic fractions. Volatile organic compounds were tested in accordance with Method 25A, and results are reported as carbon. Formaldehyde emissions were tested in accordance with Method 0011. Nitrogen oxides emissions were measured in accordance with Method 7. Carbon monoxide emissions were tested in accordance with Method 10.

The dryer and pre-dryer emissions were excluded from this report because the source configuration is unique and would not yield emission factors of value to any other facility.

A rating of A was assigned to the hot press and board cooler data with the exception of all VOC data and the board cooler formaldehyde data. The VOC data were rated B because the Method 25A calibration requirements were not met. The board cooler formaldehyde data were downrated to C due to super-isokinetic sampling (129-130 percent) for all three runs.

4.3 DEVELOPMENT OF CANDIDATE EMISSION FACTORS

As explained previously, Tables 4-1 to 4-10 summarize the data taken from the NCASI data base on emissions from particleboard manufacturing. Table 4-11 summarizes the particleboard dryer data from the other emission test reports (References 1 to 7) that also were reviewed in the preparation of this report. It should be noted that the data from References 2 and 3 are included in the NCASI data base and are presented in Tables 4-1 to 4-5 rather than in Table 4-11. In addition, the dryers for which data are presented in References 4 to 7 match dryers included in the NCASI data base for tests conducted on other dates. In such cases, the NCASI unit codes are used in Table 4-11 to identify those dryers. Table 4-12 presents a summary of particleboard press and board cooler emission data from References 1 and 9, which were the only references that contained press and board cooler emission data that were not included in the NCASI data base.

The candidate emission factors for criteria pollutant emissions from particleboard manufacturing dryers are presented in Table 4-13. Table 4-14 includes the candidate emission factors for speciated organic pollutant emissions from particleboard dryers. Table 4-15 presents the candidate emission factors for particleboard presses and coolers. Tables 4-13 to 4-15 include the number of tests on which the factors are based, the range of the factors (minimum and maximum values), and the emission factor ratings. For those emission factors based on five or more emission tests, the factor standard deviations also are presented. Appendix A presents a series of tables that show which data sets were used to develop each of the factors presented in Tables 4-13 to 4-15. The following paragraphs describe the general approach used to develop the emission factors presented in those tables. After the discussion of the general approach, the factors for individual sources and pollutants are described.

4.3.1 General Approach to Developing Emission Factors

The emission factors were developed by grouping the data by pollutant, control device, and other parameters that could significantly impact emissions. In this study, the parameters for which separate emission factors were developed for particleboard dryers are dryer type, fuel type, emission control device, and wood species. Although data were available for other parameters, emission factors are not presented separately for these other parameters because either only a single category was reported or the categories were not exclusive of one another. For particleboard presses, emission factor were differentiated only by press type. All press emission data are for uncontrolled presses using UF resins.

Emission data for mixed wood species were discarded. Emission factors for specific mixes of wood species may be calculated by combining emission factors for individual wood species as emission data for those species become available.

For criteria pollutants (i.e., PM, VOC, NO_x, SO_2, CO, and CO_2), the data were grouped by specific parameters as the data allowed. However, for speciated organic pollutants (as presented in Tables 4-4 and 4-5), the data for a specific pollutant generally were grouped by wood species; the type of control device and the values of the other parameters were not considered. The reason for taking this approach is that the data are so few, and show such a wide variability, it is unlikely that the data would demonstrate the effects of specific parameters on emission levels.

The NCASI data base included the results of several measurements of combined emissions of filterable PM and condensible PM and combined filterable PM-10 and condensible PM. These data were not used to develop separate factors for these combined emissions. However, the separate factors for filterable PM and condensible PM from the AP-42 section may be summed as appropriate to determine a factor for total PM. In addition, factors for VOC emissions are presented in the NCASI data base and in Tables 4-2, 4-3, 4-7, 4-8, 4-9, and 4-10 on a carbon basis. However, for the purposes of AP-42, the VOC factors were converted to a propane basis.

The ratings assigned to the candidate emission factors generally are largely a function of the data ratings and the number of data sets upon which the specific factors are based. Generally, D-rated data were discarded and were not used in the determination of candidate emission factors. However, in cases where only D-rated data (or only C- and D-rated data) were available, the data were used and the candidate emission factor was assigned a rating of E. In addition, factors based a single data set also were rated E. For factors based on multiple data sets, the ratings were based primarily on the number of data sets. In general, the candidate emission factors for criteria pollutants were rated D, if based on less than 10 data sets, factors based on 10 to 19 data sets were rated C, and factors based on 20 or more data sets were rated B. Factors speciated organics were assigned lower ratings due to the inconsistency and sparsity of the data.

4.3.2 Particleboard Dryers

The candidate emission factors for particleboard dryers are presented in Tables 4-13 and 4-14. Generally, dryer emission data were available for the criteria pollutants and several speciated organic pollutants. The control devices for which data were available included multiclones, fabric filters, EFB's, incineration, packed bed absorbers, and WESP's. Data were also available for uncontrolled emissions (emissions from the primary product recovery cyclone). Dryer emissions data were available for few wood species, including Southern yellow pine, oak, Douglas fir, and aspen. However, for much of the data the wood species is reported as unspecified pines, unspecified, softwoods, unspecified hardwoods, or no specification is reported. Most of the dryer data pertains to direct-fired dryers that use wood materials for fuel; some data also are provided on natural gas-fired dryers.

4.3.2.1 Particulate Matter. For emissions of PM, the data from dryers were grouped first by emission control device, then by wood species, by type of firing (i.e., direct, indirect, or a combination of both), and by fuel type. Generally, fuel type was classified either as natural gas or wood (i.e., sanderdust, wood residue, and other wood forms). Emission factors were developed for emissions of filterable PM, filterable PM-10, and condensible PM. Although the organic and inorganic fractions of condensible PM were reported in some of the references, most of the condensible PM data are for total condensibles. Therefore, where applicable, the organic and inorganic fractions for individual data sets were combined and only the total condensible PM factors are presented. However, the data on the condensible PM fractions was used to estimate the percentages of the organic and inorganic fractions of the condensible PM (as measured using Method 202). These percentages are presented at the end of Appendix A, Table A-3 and are included in the footnotes to the emission factor table in AP-42.

Data were available for one test of PM emissions from a natural gas-fired dryer drying oak furnish (Reference 1), and the emission factor developed from the data for filterable PM and filterable PM-10 were 10 lb/ODT and 6.4 lb/ODT, respectively. Because the dryer was gas-fired, it would be expected to have lower PM emissions than from a comparable wood-fired dryer. However, as shown in Tables A-1 and A-3, the factors developed from the Reference 1 data are 2 to 4 times higher than any of the other factors. Therefore, it was concluded that the Reference 1 data were not representative of gas-fired dryers drying oak furnish, and separate PM emission factors for that combination of wood species and fuel type are not reported in the AP-42 section.

Four of the dryers for which emission data are presented in the NCASI data base are identified as predryers (1D039, 3D166, 4D166, and 1D182), and three of the dryers are identified as final dryers (5D039, XD039, and YD039). The results of tests on these dryers are reported separately.

Appendix A, Table A-1 presents the emission factor calculations for cyclone-controlled filterable PM emissions from particleboard dryers. Table A-2 shows the calculations for filterable PM emissions controlled with devices other than cyclones. The emission factor calculations for dryer PM-10 and condensible PM emissions are presented in Table A-3.

4.3.2.2 Volatile Organic Compounds. The data on emissions of VOC are all based on Method 25A results, with the exception of one data set, which is based on Method 25 results. In some cases of the emission tests reported in the NCASI data base, a modified Method 25A sampling train was used. Details are not provided on the type of modifications or the effect the modifications were likely to have on emissions. Those data sets were assigned a quality rating of C and were not used to develop candidate emission factors.

In general, the VOC emission data were grouped by wood species, fuel type, and firing type, where possible. The candidate emission factors developed from the data are presented in Table 4-13. These factors are presented on a propane basis. The factors for specific organic compounds that are not classified as VOC, including methane, methylene chloride, and acetone were subtracted from the factors for VOC. In addition, because aldehydes and other oxygenated compounds respond poorly to the FID used in Method 25A sampling trains, the emission factors for formaldehyde were added to the corresponding VOC emission factors; the VOC factors in Table 4-13 are actually the sum of the Method 25A results and the corresponding factor for formaldehyde emissions. However, the formaldehyde factor was not added to the factor developed from the one Method 25 emission test. The emission factor calculations for dryer VOC emissions are summarized in Appendix A, Table A-4.

4.3.2.3 Other Criteria Pollutants. The data on emissions of CO, CO_2, and NO_x were grouped only by dryer type and fuel type; emission control device and wood species were not considered to have a significant effect on emissions of these compounds. For CO emissions, three data sets were based on measurements using Method 3A (Orsat). The factors developed from the Method 3A data sets, which were rated C, were much higher than the factors developed from all but one other data set. For these reasons, the Method 3A data sets were discarded. For emissions of SO_2, only 5 data sets were available, and four of those were rated D. The D-rated sets were discarded, and the remaining A-rated data set was used to develop the candidate emission factor. The emission factor calculations for dryer CO and CO_2 emissions are summarized in Appendix A, Table A-5. Table A-6 summarizes the calculations for dryer NO_x and SO_2 emissions.

4.3.2.4 Speciated Organic Compounds. The candidate emission factors for speciated organic compound emissions from particleboard dryers are presented in Table 4-14. The table includes factors for 51 different compounds. The general approach taken in developing these factors was to group the data by wood species. The majority of the data were derived from tests on wood-fired dryers drying unspecified pines. However, data were available for formaldehyde emissions from the drying of Southern yellow pine. These candidate emission factors were assigned a rating of E due to the scarcity and variability of the data. Table A-7 of Appendix A summarizes the emission factor calculations for dryer emissions of speciated organics.

4.3.3 Particleboard Presses and Coolers

Table 4-15 summarizes the candidate emission factors for particleboard presses and coolers. For presses, emission factors were developed for emissions of filterable PM, filterable PM-10, condensible PM, VOC, CO, and 16 speciated organic compounds. The emission factors are presented in units of pounds per thousand square feet of 3/4-inch thick board (lb/MSF 3/4). The available data included the results of measurements of speciated organic compound emissions from a veneer press. Because the factors developed from these data were generally much smaller in magnitude (as much as two orders of magnitude lower), the factors developed from the veneer press data are presented separately in Table 4-15.

For condensible PM emissions from presses, the only available data were for measurements of combined filterable PM plus condensible PM or measurements of combined filterable PM-10 plus condensible PM. To develop a factor for condensible PM, the filterable PM-10 factor was subtracted from the factor for combined filterable PM-10 plus condensible PM. The other factors for particleboard presses were developed using the same general methodology as was described in Section 4.3.2 for particleboard dryers. The emission factor calculations for particleboard presses are summarized in Table A-8 of Appendix A.

For particleboard coolers, emission factors were developed for filterable PM, filterable PM-10, condensible PM, VOC, and 11 speciated organic compounds. The condensible PM factor was determined using the same approach as described in the previous paragraph for presses. The other factors for particleboard coolers were developed using the same general methodology as was described in Section 4.3.2 for particleboard dryers. Table A-9 of Appendix A summarizes the emission factor calculations for particleboard coolers.

4.4 STATISTICAL ANALYSIS OF PARTICLEBOARD DATA

To determine the effects of various parameters on emission levels, some exploratory statistical analyses were performed on the data for dryer emissions of filterable PM. This group of data was selected because it was one of the largest in terms of number of emission tests for a specific source and pollutant combination.

Using analysis of variance and regression techniques, the effects and interactions of several parameters were considered. The discrete variables considered included type of control device, type of firing (direct, indirect), dryer design (rotary triple pass, rotary single pass, unspecified rotary, and tube), type of fuel (wood, gas), type of material (core, surface), and wood species. The continuous variables considered included dryer inlet and outlet temperatures and material moisture contents. A more detailed discussion of the analysis and the log sheet showing the results of each step are included as Appendix B to this report.

Although a relatively large number of data points were considered in the analysis, the number of observations were not well distributed among the various values of the parameters considered. For example, for rotary single pass dryers, the only data available were for EFB-controlled emissions; no data were available for filterable PM emissions from uncontrolled, multiclone-controlled, or WESP-controlled rotary single pass dryers. Furthermore, the data for specific combinations of parameter values showed a high degree of variability. As a result, the analysis showed that the data were too few and the variability of the data was too large to demonstrate statistical significance in the effects of these parameters on emissions, other than the effect of control device. Further analysis of the data for emissions of other pollutants may show the effects of these parameters on emissions to a statistically significant level, but such analyses are beyond the scope of this report.

TABLE 4-1. SUMMARY OF PARTICLEBOARD DRYER DESIGN DATA FROM NCASI DATA BASE[a]

Test code	Unit code	Dryer type[b]	Firing type[c]	Dryer capacity	Emission control device[d]			Core/ surface/ both[e]	Wood material form[f]		Hot air source[g]			
											Primary		Secondary	
					Initial	Interm.	Final		Primary	Second.	Source	%	Source	%
FILTERABLE PM														
167-102288A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
167-102288B	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
022-102689B	1D022	NS	DFIRE	NS	NS	NS	CYC	C	NS	NS	DFIRE	NS	NS	
022-102689C	2D022	NS	DFIRE	NS	NS	NS	CYC	S	NS	NS	DFIRE	NS	NS	
030-011993C	1D030	RTP	DFIRE	NS	NS	NS	CYC	S	SHAV	NS	SUSP BU	NS	NS	
030-012093C	2D030	RTP	DFIRE	NS	NS	NS	CYC	C	SHAV	NS	SUSP BU	NS	NS	
043-042192A	1D043	RTP	DFIRE	22,000 lb/hr (wet)	NS	NS	CYC	S	NS	NS	SUSP BU	100	NA	
043-042192B	2D043	RTP	DFIRE	22,000 lb/hr (wet)	NS	NS	CYC	C	NS	NS	SUSP BU	100	NA	
045-041593A	1D045	RTP	DFIRE	12.5 T/hr	NS	NS	CYC	S	SF	NS	SUSP BU	100	NA	
045-041593B	2D045	RTP	DFIRE	12.5 T/Hr	NS	NS	CYC	S	SF	NS	SUSP BU	100	NA	
166-100192A	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100192B	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100292A	5D166	NS	DFIRE	NS	CYC	NS	CYC	B	NS	NS	DFIRE	100	NA	
166-100692A	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100692B	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
167-062288B	2D167	RU	DFIRE	20,000 lb/hr	NS	NS	CYC	NS	SHAV	NS	SUSP BU	100	NA	
167-082589A	2D167	RU	DFIRE	20,000 lb/hr	NS	NS	CYC	NS	SKERF	CHP	SUSP BU	100	NA	
202-071393A	1D202	RTP	BOTH	14 ODTH	NS	NS	CYC	S	SHAV	NS	IHEAT	75	GAS B	25
202-071393B	2D202	RTP	BOTH	12 ODTH	NS	NS	CYC	C	SHAV	NS	IHEAT	75	GAS B	25
166-092892A	3D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
166-092992A	4D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
167-091890A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-091990A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-100490A	5D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	

TABLE 4-1. (continued)

Test code	Unit code	Dryer type[b]	Firing type[c]	Dryer capacity	Emission control device[d]			Core/ surface/ both[e]	Wood material form[f]		Hot air source[g]			
											Primary		Secondary	
					Initial	Interm.	Final		Primary	Second.	Source	%	Source	%
167-102090A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	
167-102090B	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	
167-102390A	5D167	RTP	DFIRE	30000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
202-081788A	XD202	RTP	BOTH	19 ODTH	CYC	NS	EFB	B	SHAV	NS	BOTH	NS	NS	
228-091692D	1D228	RSP	DFIRE	21,500 lb/hr	NS	MCLO	EFB	S	SF	SAWD	SUSP BU	75	Flue gas	25
228-091692F	3D228	RSP	DFIRE	25,500 OD lb/hr	MCLO	NS	EFB	C	SF	SAWD	SUSP BU	75	Flue gas	25
182-090889A	2D182	TUBE	DFIRE	48,000 lb/hr @27% MC	CYC	NS	INC	NS	SHAV	SAWD	SUSP BU	100	NA	
167-061988A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
167-061988B	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
167-082189A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	B	SKERF	CHP	SUSP BU	100	NA	
167-100588A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
167-102588A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
228-091592A	3D228	RSP	DFIRE	25,500 OD lb/hr	MCLO		EFB	C	SF	SAWD	SUSP BU	75	Flue gas	25
228-091692A	1D228	RSP	DFIRE	21,500 lb/hr	NS	MCLO	EFB	S	SF	SAWD	SUSP BU	75	Flue gas	25
182-090689B	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
182-090689C	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
182-100589B	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
167-062288A	1D167	RTP	DFIRE	30000 lb/hr	CYC	VSC	PBA	NS	SKERF	CHP	SUSP BU	100	NA	
167-082389A	1D167	RTP	DFIRE	30000 lb/hr	CYC	VSC	PBA	NS	CHP	NS	SUSP BU	100	NA	
182-090689A	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
182-100589A	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	

TABLE 4-1. (continued)

Test code	Unit code	Dryer type[b]	Firing type[c]	Dryer capacity	Emission control device[d]			Core/ surface/ both[e]	Wood material form[f]		Hot air source[g]			
											Primary		Secondary	
					Initial	Interm.	Final		Primary	Second.	Source	%	Source	%
FILTERABLE PM-10														
030-011993D	1D030	RTP	DFIRE	NS	NS	NS	CYC	S	SHAV	NS	SUSP BU	NS	NS	
030-012093D	2D030	RTP	DFIRE	NS	NS	NS	CYC	C	SHAV	NS	SUSP BU	NS	NS	
045-041593A	1D045	RTP	DFIRE	12.5 T/hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
045-041593B	2D045	RTP	DFIRE	12.5 T/Hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
039-082791A	1D039	RSP	DFIRE	Predryer Use	CYC	NS	EFB	NS	CHP	NS	Flue gas	100	NA	
228-091692D	1D228	RSP	DFIRE	21,500 lb/hr	NS	MCLO	EFB	S	SF	SAWD	SUSP BU	75	Flue gas	25
228-091692F	3D228	RSP	DFIRE	25,500 OD lb/hr	MCLO	NS	EFB	C	SF	SAWD	SUSP BU	75	Flue gas	25
CONDENSIBLE PM														
228-091592A	3D228	RSP	DFIRE	25,500 OD lb/hr	MCLO	NS	EFB	C	SF	SAWD	SUSP BU	75	Flue gas	25
228-091692A	1D228	RSP	DFIRE	21,500 lb/hr	NS	MCLO	EFB	S	SF	SAWD	SUSP BU	75	Flue gas	25
182-090689B	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
182-090689C	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
182-100589B	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
030-011993C	1D030	RTP	DFIRE	NS	NS	NS	CYC	S	SHAV	NS	SUSP BU	NS	NS	
030-012093C	2D030	RTP	DFIRE	N	NS	NS	CYC	C	SHAV	NS	SUSP BU	NS	NS	
045-041593A	1D045	RTP	DFIRE	12.5 T/hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
045-041593B	2D045	RTP	DFIRE	12.5 T/Hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
166-100192A	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100192B	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100292A	5D166	NS	DFIRE	NS	CYC	NS	CYC	B	NS	NS	DFIRE	100	NA	
166-100692A	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100692B	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
167-062288B	2D167	RU	DFIRE	20,000 lb/hr	NS	NS	CYC	NS	SHAV	NS	SUSP BU	100	NA	
167-082589A	2D167	RU	DFIRE	20,000 lb/hr	NS	NS	CYC	NS	SKERF	CHP	SUSP BU	100	NA	

TABLE 4-1. (continued)

Test code	Unit code	Dryer type[b]	Firing type[c]	Dryer capacity	Emission control device[d]			Core/ surface/ both[e]	Wood material form[f]		Hot air source[g]			
											Primary		Secondary	
					Initial	Interm.	Final		Primary	Second.	Source	%	Source	%
166-092892A	3D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
166-092992A	4D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
167-091890A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-091990A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-100490A	5D167	RTP	DFIRE	30000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-102090A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	
167-102090B	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	
167-102390A	5D167	RTP	DFIRE	30000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
202-081788A	XD202	RTP	BOTH	19 ODTH	CYC	NS	EFB	B	SHAV	NS	BOTH	NS	NS	
182-090889A	2D182	TUBE	DFIRE	48,000 lb/hr @27% MC	CYC	NS	INC	NS	SHAV	SAWD	SUSP BU	100	NA	
167-061988A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
167-061988B	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
167-082189A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	B	SKERF	CHP	SUSP BU	100	NA	
167-100588A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
167-102588A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
167-062288A	1D167	RTP	DFIRE	30000 lb/hr	CYC	VSC	PBA	NS	SKERF	CHP	SUSP BU	100	NA	
167-082389A	1D167	RTP	DFIRE	30000 lb/hr	CYC	VSC	PBA	NS	CHP	NS	SUSP BU	100	NA	
182-090689A	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
182-100589A	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
TOTAL PM (FILTERABLE + CONDENSIBLE PM)														
228-091592A	3D228	RSP	DFIRE	25, 500 OD lb/hr	MCLO	NS	EFB	C	SF	SAWD	SUSP BU	75	Flue gas	25
228-091692A	1D228	RSP	DFIRE	21,500 lb/hr	NS	MCLO	EFB	S	SF	SAWD	SUSP BU	75	Flue gas	25
182-090689B	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
182-090689C	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
182-100589B	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	

TABLE 4-1. (continued)

Test code	Unit code	Dryer type[b]	Firing type[c]	Dryer capacity	Emission control device[d]			Core/ surface/ both[e]	Wood material form[f]		Hot air source[g]			
											Primary		Secondary	
					Initial	Interm.	Final		Primary	Second.	Source	%	Source	%
030-011993C	1D030	RTP	DFIRE	NS	NS	NS	CYC	S	SHAV	NS	SUSP BU	NS	NS	
030-012093C	2D030	RTP	DFIRE	NS	NS	NS	CYC	C	SHAV	NS	SUSP BU	NS	NS	
045-041593A	1D045	RTP	DFIRE	12.5 T/hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
045-041593B	2D045	RTP	DFIRE	12.5 T/Hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
166-100192A	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100192B	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100292A	5D166	NS	DFIRE	NS	CYC	NS	CYC	B	NS	NS	DFIRE	100	NA	
166-100692A	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100692B	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
167-062288B	2D167	RU	DFIRE	20,000 lb/hr	NS	NS	CYC	NS	SHAV	NS	SUSP BU	100	NA	
167-082589A	2D167	RU	DFIRE	20,000 lb/hr	NS	NS	CYC	NS	SKERF	CHP	SUSP BU	100	NA	
166-092892A	3D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
166-092992A	4D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
167-091890A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-091990A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-100490A	5D167	RTP	DFIRE	30000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-102090A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	
167-102090B	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	
167-102390A	5D167	RTP	DFIRE	30000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
202-081788A	XD202	RTP	BOTH	19 ODTH	CYC	NS	EFB	B	SHAV	NS	BOTH	NS	NS	
182-090889A	2D182	TUBE	DFIRE	48,000 lb/hr @27% MC	CYC	NS	INC	NS	SHAV	SAWD	SUSP BU	100	NA	
167-061988A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
167-061988B	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
167-082189A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	B	SKERF	CHP	SUSP BU	100	NA	
167-100588A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	

TABLE 4-1. (continued)

Test code	Unit code	Dryer type[b]	Firing type[c]	Dryer capacity	Emission control device[d]			Core/ surface/ both[e]	Wood material form[f]		Hot air source[g]			
											Primary		Secondary	
					Initial	Interm.	Final		Primary	Second.	Source	%	Source	%
167-102588A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
167-062288A	1D167	RTP	DFIRE	30,000 lb/hr	CYC	VSC	PBA	NS	SKERF	CHP	SUSP BU	100	NA	
167-082389A	1D167	RTP	DFIRE	30,000 lb/hr	CYC	VSC	PBA	NS	CHP	NS	SUSP BU	100	NA	
156-022087A	XD156	RSP	DFIRE	NS	SCRB	NS	SF	B	SAWD	NS	SUSP BU	100	NA	
156-032191A	XD156	RSP	DFIRE	NS	SCRB	NS	SF	B	SAWD	NS	SUSP BU	100	NA	
156-051090A	XD156	RSP	DFIRE	NS	SCRB	NS	SF	B	SAWD	NS	SUSP BU	100	NA	
156-061688A	XD156	RSP	DFIRE	NS	SCRB	NS	SF	B	SAWD	NS	SUSP BU	100	NA	
156-062592A	XD156	RSP	DFIRE	NS	SCRB	NS	SF	B	SAWD	NS	SUSP BU	100	NA	
156-090789A	XD156	RSP	DFIRE	NS	SCRB	NS	SF	B	SAWD	NS	SUSP BU	100	NA	
182-090689A	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
182-100589A	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
TOTAL PM-10 (FILTERABLE PM-10 + CONDENSIBLE PM)														
045-041593A	1D045	RTP	DFIRE	12.5 T/hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
045-041593B	2D045	RTP	DFIRE	12.5 T/Hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
228-091692D	1D228	RSP	DFIRE	21,500 lb/hr	NS	MCLO	EFB	S	SF	SAWD	SUSP BU	75	Flue gas	25
228-091692F	3D228	RSP	DFIRE	25,500 OD lb/hr	MCLO	NS	EFB	C	SF	SAWD	SUSP BU	75	Flue gas	25
CARBON MONOXIDE														
182-090689B	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
182-090689C	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	
030-011993B	1D030	RTP	DFIRE	NS	NS	NS	CYC	S	SHAV	NS	SUSP BU	NS	NS	
030-012093B	2D030	RTP	DFIRE	NS	NS	NS	CYC	C	SHAV	NS	SUSP BU	NS	NS	
045-041593A	1D045	RTP	DFIRE	12.5 T/hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
045-041593B	2D045	RTP	DFIRE	12.5 T/Hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
166-100192A	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100192B	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	

TABLE 4-1. (continued)

Test code	Unit code	Dryer type[b]	Firing type[c]	Dryer capacity	Emission control device[d]			Core/ surface/ both[e]	Wood material form[f]		Hot air source[g]			
											Primary		Secondary	
					Initial	Interm.	Final		Primary	Second.	Source	%	Source	%
166-100292A	5D166	NS	DFIRE	NS	CYC	NS	CYC	B	NS	NS	DFIRE	100	NA	
166-100692A	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100692B	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
202-071393A	1D202	RTP	BOTH	14 ODTH	NS	NS	CYC	S	SHAV	NS	IHEAT	75	GAS B	25
202-071393B	2D202	RTP	BOTH	12 ODTH	NS	NS	CYC	C	SHAV	NS	IHEAT	75	GAS B	25
039-102692A	1D039	RSP	DFIRE	Predryer Use	CYC	NS	EFB	NS	CHP	NS	Flue gas	100	NA	
166-092892A	3D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
166-092992A	4D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
167-091890A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-091990A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-100490A	5D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-102090A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	
167-102090B	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	
167-102390A	5D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
202-071592C	XD202	RTP	BOTH	19 ODTH	CYC	NS	EFB	B	SHAV	NS	BOTH	NS	NS	
228-091592B	3D228	RSP	DFIRE	25,500 OD lb/hr	MCLO	NS	EFB	C	SF	NS	SUSP BU	75	Flue gas	25
228-091692C	1D228	RSP	DFIRE	21,500 lb/hr	NS	MCLO	EFB	S	SF	SAWD	SUSP BU	75	Flue gas	25
039-102692B	XD039	RSP	DFIRE	NS	CYC	NS	MCLO	NS	CHP	NS	Flue gas	100	NA	
039-102692C	YD039	RSP	DFIRE	NS	CYC	NS	MCLO	NS	CHP	NS	Flue gas	100	NA	
039-102692D	5D039	RSP	DFIRE	36,400 lb/hr	CYC	NS	MCLO	NS	CHP	NS	Flue gas	100	NA	
167-102588A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	
156-032191A	XD156	RSP	DFIRE	NS	SCRB	NS	SF	B	SAWD	NS	SUSP BU	100	NA	
156-062592A	XD156	RSP	DFIRE	NS	SCRB	NS	SF	B	SAWD	NS	SUSP BU	100	NA	
182-090689A	1D182	RTP	DFIRE	48,000 lb/hr @27% MC	CYC	MCLO	WESP	NS	SHAV	SAWD	SUSP BU	100	NA	

TABLE 4-1. (continued)

Test code	Unit code	Dryer type[b]	Firing type[c]	Dryer capacity	Emission control device[d]			Core/ surface/ both[e]	Wood material form[f]		Hot air source[g]			
											Primary		Secondary	
					Initial	Interm.	Final		Primary	Second.	Source	%	Source	%
NITROGEN OXIDES														
030-011993B	1D030	RTP	DFIRE	NS	NS	NS	CYC	S	SHAV	NS	SUSP BU	NS	NS	
030-012093B	2D030	RTP	DFIRE	NS	NS	NS	CYC	C	SHAV	NS	SUSP BU	NS	NS	
045-041593A	1D045	RTP	DFIRE	12.5 T/hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
045-041593B	2D045	RTP	DFIRE	12.5 T/Hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
166-100192A	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100192B	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100292A	5D166	NS	DFIRE	NS	CYC	NS	CYC	B	NS	NS	DFIRE	100	NA	
166-100692A	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100692B	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
202-071393A	1D202	RTP	BOTH	14 ODTH	NS	NS	CYC	S	SHAV	NS	IHEAT	75	GAS B	25
202-071393B	2D202	RTP	BOTH	12 ODTH	NS	NS	CYC	C	SHAV	NS	IHEAT	75	GAS B	25
166-092892A	3D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
166-092992A	4D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
167-091890A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-091990A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-100490A	5D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-102090A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	
167-102090B	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	
167-102390A	5D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
202-071592C	XD202	RTP	BOTH	19 ODTH	CYC	NS	EFB	B	SHAV	NS	BOTH	NS	NS	
228-091492B	3D228	RSP	DFIRE	25,500 OD lb/hr	MCLO	NS	EFB	C	SF	SAWD	SUSP BU	75	Flue gas	25
228-091692C	1D228	RSP	DFIRE	21,500 lb/hr	NS	MCLO	EFB	S	SF	SAWD	SUSP BU	75	Flue gas	25
167-082189A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	B	SKERF	CHP	SUSP BU	100	NA	
167-102588A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	NS	SKERF	CHP	SUSP BU	100	NA	

TABLE 4-1. (continued)

Test code	Unit code	Dryer type[b]	Firing type[c]	Dryer capacity	Emission control device[d]			Core/ surface/ both[e]	Wood material form[f]		Hot air source[g]			
											Primary		Secondary	
					Initial	Interm.	Final		Primary	Second.	Source	%	Source	%
156-032191A	XD156	RSP	DFIRE	NS	SCRB	NS	SF	B	SAWD	NS	SUSP BU	100	NA	
156-062592A	XD156	RSP	DFIRE	NS	SCRB	NS	SF	B	SAWD	NS	SUSP BU	100	NA	
VOLATILE ORGANIC COMPOUNDS														
228-091492A	3D228	RSP	DFIRE	25,500 OD lb/hr	MCLO	NS	EFB	C	SF	SAWD	SUSP BU	75	Flue gas	25
228-091692B	1D228	RSP	DFIRE	21,500 lb/hr	NS	MCLO	EFB	S	SF	SAWD	SUSP BU	75	Flue gas	25
030-011993B	1D030	RTP	DFIRE	NS	NS	NS	CYC	S	SHAV	NS	SUSP BU	NS	NS	
030-012093B	2D030	RTP	DFIRE	NS	NS	NS	CYC	C	SHAV	NS	SUSP BU	NS	NS	
045-041593A	1D045	RTP	DFIRE	12.5 T/hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
045-041593B	2D045	RTP	DFIRE	12.5 T/Hr	NS	NS	CYC	NS	SF	NS	SUSP BU	100	NA	
166-100192A	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100192A	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100192B	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100192B	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100292A	5D166	NS	DFIRE	NS	CYC	NS	CYC	B	NS	NS	DFIRE	100	NA	
166-100692A	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100692B	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
202-071592D	1D202	RTP	BOTH	14 ODTH	NS	NS	CYC	S	SHAV	NS	IHEAT	75	GAS B	25
202-071592E	2D202	RTP	BOTH	12 ODTH	NS	NS	CYC	C	SHAV	NS	IHEAT	75	GAS B	25
039-102692A	1D039	RSP	DFIRE	Predryer use	CYC	NS	EFB	NS	CHP	NS	Flue gas	100	NA	
166-092892A	3D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
166-092992A	4D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
167-091890A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-091990A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-100490A	5D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	B	SF	SKERF	SUSP BU	100	NA	
167-102090A	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	

TABLE 4-1. (continued)

Test code	Unit code	Dryer type[b]	Firing type[c]	Dryer capacity	Emission control device[d]			Core/ surface/ both[e]	Wood material form[f]		Hot air source[g]			
											Primary		Secondary	
					Initial	Interm.	Final		Primary	Second.	Source	%	Source	%
167-102090B	4D167	RTP	DFIRE	30,000 lb/hr	CYC	CYC	EFB	NS	SKERF	CHP	SUSP BU	100	NA	
202-071592C	XD202	RTP	BOTH	19 ODTH	CYC	NS	EFB	B	SHAV	NS	BOTH	NS	NS	
228-091492B	3D228	RSP	DFIRE	25,500 OD lb/hr	MCLO	NS	EFB	C	SF	SAWD	SUSP BU	75	Flue gas	25
228-091692C	1D228	RSP	DFIRE	21,500 lb/hr	NS	MCLO	EFB	S	SF	SAWD	SUSP BU	75	Flue gas	25
039-102692B	XD039	RSP	DFIRE	NS	CYC	NS	MCLO	NS	CHP	NS	Flue gas	100	NA	
039-102692C	YD039	RSP	DFIRE	NS	CYC	NS	MCLO	NS	CHP	NS	Flue gas	100	NA	
039-102692D	5D039	RSP	DFIRE	36,400 lb/hr	CYC	NS	MCLO	NS	CHP	NS	Flue gas	100	NA	
167-082189A	3D167	RTP	DFIRE	29,000 lb/hr	CYC	NS	MCLO	B	SKERF	CHP	SUSP BU	100	NA	
SULFUR DIOXIDE														
166-100192A	1D166	RTP	DFIRE	NS	NS	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-100292A	5D166	NS	DFIRE	NS	CYC	NS	CYC	B	NS	NS	DFIRE	100	NA	
166-100692A	2D166	RTP	DFIRE	NS	CYC	NS	CYC	B	NS	NS	SUSP BU	100	NA	
166-092892A	3D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	
166-092992A	4D166	RSP	DFIRE	NS	CYC	CYC	EFB	B	SKERF	NS	DFIRE	100	NA	

[a]Reference 8. NS = not specified. NA = not applicable. ODTH = oven-dried tons per hour.
[b]Dryer types: RSP= rotary single pass; RTP = rotary triple pass; RU = unspecified rotary dryer; TUBE = tube dryer.
[c]Firing types: DFIRE = direct firing; BOTH = combination of direct and indirect firing .
[d]Emission control devices: CYC = cyclone; MCLO = multiclone; EFB = electrified filter bed; WESP = wet electrostatic precipitator; PBA = packed bed absorber; SF = sand filter; INC = incinerator.
[e]Core/surface/both: C = core material dryer; S = surface material dryer; B = combination of core and surface material dryer.
[f]Wood material forms: SF = strands or flakes; SAWD = sawdust; CHP = chips; SKERF = saw kerf; SHAV = shavings.
[g]Hot air sources: SUSP BU = suspension burner; FLUE GAS = combustion unit gases directly contact wood furnish; DFIRE = unspecified type of direct firing; IHEAT = unspecified type of indirect heat; GAS B = gas burner; BOTH = unspecified combination of direct and indirect heat.

TABLE 4-2. SUMMARY OF EMISSION DATA FOR PARTICLEBOARD DRYERS FROM NCASI DATA BASE[a]

Test code	Unit code	No. of runs	Test method[b]	Stack gas parameters			Pollutant concentration,		Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
				Flow, dscfm	Temp., °F	Moisture, %	ppm	gr/dscf			
FILTERABLE PM											
167-102288A	3D167	2	M5	34,600	192	NS		0.085	24.5	10.74	2.29
167-102288B	3D167	1	M5	33,900	191	NS		0.187	54.3	10.50	5.17
022-102689B	1D022	2	M5	28,958	142	3.8		0.0365	9.2	NS	
022-102689C	2D022	2	M5	25,381	133	2.1		0.144	33.2	NS	
030-011993C	1D030	3	M5	31,933	115	3.4		0.0701	20.0	16.40	1.18
030-012093C	2D030	3	M5	33,672	159	6.9		0.109	31.5	9.49	3.69
043-042192A	1D043	3	M5	23,388	130	4.2		0.0493	11.2	10.37	1.07
043-042192B	2D043	3	M5	27,533	149	6.1		0.0640	14.7	17.82	0.82
045-041593A	1D045	2	M5	35,288	NS	NS		0.250	75.8	16.15	4.81
045-041593B	2D045	2	M5	30,445	NS	NS		0.919	259.1	23.17	11.11
166-100192A	1D166	3	M5	35,500	NS	NS		0.123	39.0	14.60	2.70
166-100192B	1D166	3	M5	38,929	NS	NS		0.0790	25.8	9.67	2.67
166-100292A	5D166	3	M5	15,801	NS	NS		0.0980	13.6	9.63	1.48
166-100692A	2D166	2	M5	15,092	NS	NS		0.428	56.5	8.70	6.50
166-100692B	2D166	2	M5	15,142	NS	NS		0.268	34.1	9.75	3.52
167-062288B	2D167	3	M5	25,000	115	2.3		0.0343	7.4	9.36	0.79
167-082589A	2D167	2	M5	24,000	183	12.7		0.0850	17.4	6.38	2.72
202-071393A	1D202	2	OD8	30,000	157	3		0.040	11.0	12.10	0.91
202-071393B	2D202	2	OD8	28,000	151	3		0.070	17.2	10.20	1.69
166-092892A	3D166	3	M5	33,673	NS	NS		0.0277	8.0	6.00	1.18

TABLE 4-2. (continued)

Test code	Unit code	No. of runs	Test method[b]	Stack gas parameters: Flow, dscfm	Stack gas parameters: Temp., °F	Stack gas parameters: Moisture, %	Pollutant concentration, ppm	Pollutant concentration, gr/dscf	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
166-092992A	4D166	3	M5	30,406	NS	NS		0.0297	7.9	10.33	0.74
167-091890A	4D167	4	M5	33,900	167	13.2		0.00825	2.4	11.28	0.21
167-091990A	4D167	2	M5	35,300	169	11.4		0.0040	1.3	9.20	0.16
167-100490A	5D167	4	M5	29,800	183	18.2		0.0235	5.6	13.90	0.40
167-102090A	4D167	3	M5	31,900	177	15.4		0.0080	2.3	11.86	0.19
167-102090B	4D167	3	M5	33,200	157	14.6		0.00767	2.3	11.05	0.21
167-102390A	5D167	3	M5	31,200	205	14.4		0.00833	2.3	11.32	0.20
202-081788A	XD202	3	OD7	45,869	154	2.62			3.1	22.67	0.14
228-091692D	1D228	2	M5	47,683	219	13.8			2.4	9.17	0.27
228-091692F	3D228	2	M5	38,063	251	24.2			18.8	12.49	1.51
182-090889A	2D182	3	OD7	3,294	165	52.23		0.154	4.3	19.50	0.22
167-061988A	3D167	1	M5	35,300	203	NS		0.0760	22.9	10.17	2.26
167-061988B	3D167	1	M5	35,000	210	NS		0.0340	10.1	10.14	0.99
167-082189A	3D167	3	M5	31,300	194	12.1		0.0470	13.0	9.07	1.44
167-100588A	3D167	3	M5	29,300	187	NS		0.107	28.0	9.75	2.86
167-102588A	3D167	2	M5	33,000	173	14.3		0.141	39.5	10.32	3.83
228-091592A	3D228	3	M5	32,142	261	24.4		0.115	31.3	12.49	2.53
228-091692A	1D228	3	M5	47,717	224	14.5		0.046	18.7	9.33	2.01
182-090689B	1D182	3	OD7	26,919	568.7	10.18		0.0887	19.8	19.50	1.02
182-090689C	1D182	3	OD7	21,176	135	16.64		0.0533	9.8	19.50	0.50
182-100589B	1D182	3	OD7	21,341	155.8	18.1		0.0723	13.3	19.50	0.68

TABLE 4-2. (continued)

				Stack gas parameters			Pollutant concentration,				
Test code	Unit code	No. of runs	Test method[b]	Flow, dscfm	Temp., °F	Moisture, %	ppm	gr/dscf	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
167-062288A	1D167	3	M5	26,300	137	14.3		0.0277	6.4	10.67	0.60
167-082389A	1D167	3	M5	26,600	132	16.5		0.0500	11.2	8.90	1.26
182-090689A	1D182	3	OD7	27,223	131.4	15.65		0.0147	3.2	19.50	0.16
182-100589A	1D182	3	OD7	26,258	134.5	16.78		0.00533	1.2	19.50	0.06
FILTERABLE PM-10											
030-011993D	1D030	3	M201A	33,062	128	5.9		0.0104	2.940	16.03	0.184
030-012093D	2D030	3	M201A	30,153	156	20.3		0.0283	7.613	9.58	0.801
045-041593A	1D045	2	M201A/202	35,288	NS	NS	0.0344		10.395	16.15	0.654
045-041593B	2D045	2	M201A/202	30,445	NS	NS	0.09625		27.010	23.17	1.140
039-082791A	1D039	3	M201A	37,226	176	24.6		0.0072	2.283	45.47	0.050
228-091692D	1D228	3	M201A	47,683	219	13.8		0.0036	1.503	9.17	0.163
228-091692F	3D228	3	M201A	38,063	251	24.2		0.0216	7.980	12.49	0.641
CONDENSIBLE PM											
228-091592A	3D228	3	M202	32,142	261	24.4			22.053	12.49	1.763
228-091692A	1D228	3	M202	47,717	224	14.5			6.063	9.33	0.661
182-090689B	1D182	3	OD7	26,919	568.7	10.18		0.017	3.800	19.50	0.195
182-090689C	1D182	3	OD7	21,176	135	16.64		0.041	7.580	19.50	0.389
182-100589B	1D182	3	OD7	21,341	155.8	18.1		0.0080	1.470	19.50	0.075
030-011993C	1D030	3	M202	31,933	115	3.4			0.313	16.40	0.019
030-012093C	2D030	3	M202	33,672	159	6.9			0.773	9.49	0.089
045-041593A	1D045	2	M202	35,288	NS	NS		0.0263	8.000	16.15	0.508

TABLE 4-2. (continued)

Test code	Unit code	No. of runs	Test method[b]	Stack gas parameters: Flow, dscfm	Stack gas parameters: Temp., °F	Stack gas parameters: Moisture, %	Pollutant concentration, ppm	Pollutant concentration, gr/dscf	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
045-041593B	2D045	2	M202	30,445	NS	NS		0.0280	7.875	23.17	0.344
166-100192A	1D166	3	M5	35,500	NS	NS		0.0163	5.613	14.60	0.386
166-100192B	1D166	3	M5	38,929	NS	NS		0.0153	5.027	9.67	0.524
166-100292A	5D166	3	M5	15,801	NS	NS		0.00867	1.217	9.63	0.131
166-100692A	2D166	2	M5	15,092	NS	NS		0.0050	0.655	8.70	0.076
166-100692B	2D166	2	M5	15,142	NS	NS		0.0075	0.990	9.75	0.106
167-062288B	2D167	3	M5	25,000	115	2.3		0.0010	0.197	9.36	0.021
167-082589A	2D167	2	M5	24,000	183	12.7		0.0040	0.830	6.38	0.130
166-092892A	3D166	3	M5	33,673	NS	NS		0.0093	2.687	6.00	0.456
166-092992A	4D166	3	M5	30,406	NS	NS		0.0090	2.403	10.33	0.235
167-091890A	4D167	4	M5	33,900	167	13.2		0.0050	1.520	11.28	0.135
167-091990A	4D167	2	M5	35,300	169	11.4		0.0015	0.425	9.20	0.046
167-100490A	5D167	4	M5	29,800	183	18.2		0.0155	3.745	13.90	0.265
167-102090A	4D167	3	M5	31,900	177	15.4		0.0040	1.120	11.86	0.095
167-102090B	4D167	3	M5	33,200	157	14.6		0.0027	0.800	11.05	0.072
167-102390A	5D167	3	M5	31,200	205	14.4		0.0077	2.083	11.32	0.184
202-081788A	XD202	3	OD7	45,869	154	2.62			1.460	22.67	0.064
182-090889A	2D182	3	OD7	3,294	165	52.23		0.0107	0.300	19.50	0.015
167-061988A	3D167	1	M5	35,300	203	NS		0.0090	1.240	10.17	0.122
167-061988B	3D167	1	M5	35,000	210	NS		0.0050	1.610	10.14	0.159
167-082189A	3D167	3	M5	31,300	194	12.1		0.0013	0.433	9.07	0.048

TABLE 4-2. (continued)

Test code	Unit code	No. of runs	Test method[b]	Stack gas parameters: Flow, dscfm	Stack gas parameters: Temp., °F	Stack gas parameters: Moisture, %	Pollutant concentration, ppm	Pollutant concentration, gr/dscf	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
167-100588A	3D167	3	M5	29,300	187	NS		0.0080	2.053	9.75	0.207
167-102588A	3D167	2	M5	33,000	173	14.3		0.0155	4.350	10.32	0.424
167-062288A	1D167	3	M5	26,300	137	14.3		0.0013	0.267	10.67	0.025
167-082389A	1D167	3	M5	26,600	132	16.5		0.0010	0.200	8.90	0.023
182-090689A	1D182	3	OD7	27,223	131.4	15.65		0.0043	0.943	19.50	0.048
182-100589A	1D182	3	OD7	26,258	134.5	16.78		0.0033	0.763	19.50	0.039
TOTAL PM (FILTERABLE + CONDENSIBLE PM)											
228-091592A	3D228	3	M5/202	32,142	261	24.4		0.196	53.367	12.49	4.293
228-091692A	1D228	3	M5/202	47,717	224	14.5		0.062	24.767	9.33	2.670
182-090689B	1D182	3	OD7	26,919	568.7	10.18		0.105	23.633	19.50	1.213
182-090689C	1D182	3	OD7	21,176	135	16.64		0.094	17.333	19.50	0.891
182-100589B	1D182	3	OD7	21,341	155.8	18.1		0.080	14.733	19.50	0.756
030-011993C	1D030	3	M5/202	31,933	115	3.4		0.071	20.350	16.40	1.205
030-012093C	2D030	3	M5/202	33,672	159	6.9		0.111	32.300	9.49	3.783
045-041593A	1D045	2	M5	35,288	NS	NS		0.276	83.870	16.15	5.315
045-041593B	2D045	2	M5	30,445	NS	NS		0.948	266.900	23.17	11.445
166-100192A	1D166	3	M5	35,500	NS	NS		0.140	44.600	14.60	3.083
166-100192B	1D166	3	M5	38,929	NS	NS		0.094	30.867	9.67	3.190
166-100292A	5D166	3	M5	15,801	NS	NS		0.107	14.833	9.63	1.613
166-100692A	2D166	2	M5	15,092	NS	NS		0.433	57.200	8.70	6.580
166-100692B	2D166	2	M5	15,142	NS	NS		0.275	35.100	9.75	3.620

TABLE 4-2. (continued)

Test code	Unit code	No. of runs	Test method[b]	Stack gas parameters: Flow, dscfm	Stack gas parameters: Temp., °F	Stack gas parameters: Moisture, %	Pollutant concentration, ppm	Pollutant concentration, gr/dscf	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
167-062288B	2D167	3	M5	25,000	115	2.3		0.0353	7.553	9.36	0.807
167-082589A	2D167	2	M5	24,000	183	12.7		0.0890	18.195	6.38	2.855
166-092892A	3D166	3	M5	33,673	NS	NS		0.0370	10.700	6.00	1.630
166-092992A	4D166	3	M5	30,406	NS	NS		0.0387	10.267	10.33	0.983
167-091890A	4D167	4	M5	33,900	167	13.2		0.0133	3.885	11.28	0.344
167-091990A	4D167	2	M5	35,300	169	11.4		0.0055	1.710	9.20	0.197
167-100490A	5D167	4	M5	29,800	183	18.2		0.0390	9.350	13.90	0.664
167-102090A	4D167	3	M5	31,900	177	15.4		0.0117	3.387	11.86	0.287
167-102090B	4D167	3	M5	33,200	157	14.6		0.0110	3.460	11.05	0.317
167-102390A	5D167	3	M5	31,200	205	14.4		0.0160	4.377	11.32	0.387
202-081788A	XD202	3	OD7	45,869	154	2.62		0.0117	4.600	22.67	0.203
182-090889A	2D182	3	OD7	3,294	165	52.23		0.164	4.617	19.50	0.237
167-061988A	3D167	1	M5	35,300	203	NS		0.085	24.180	10.17	2.380
167-061988B	3D167	1	M5	35,000	210	NS		0.039	11.590	10.14	1.140
167-082189A	3D167	3	M5	31,300	194	12.1		0.049	13.433	9.07	1.480
167-100588A	3D167	3	M5	29,300	187	NS		0.115	30.080	9.75	3.067
167-102588A	3D167	2	M5	33,000	173	14.3		0.156	43.850	10.32	4.255
167-062288A	1D167	3	M5	26,300	137	14.3		0.029	6.653	10.67	0.623
167-082389A	1D167	3	M5	26,600	132	16.5		0.051	11.393	8.90	1.290
156-022087A	XD156	2	OD7	11,191	159.3	29.96		0.065	6.040	23.60	0.256
156-032191A	XD156	3	OD7	8,951	149	30		0.161	4.600	28.37	0.162

TABLE 4-2. (continued)

Test code	Unit code	No. of runs	Test method[b]	Stack gas parameters: Flow, dscfm	Stack gas parameters: Temp., °F	Stack gas parameters: Moisture, %	Pollutant concentration, ppm	Pollutant concentration, gr/dscf	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
156-051090A	XD156	3	OD7	11,539	144	21.1		0.053	4.800	29.77	0.161
156-061688A	XD156	3	OD7	9,172	179.3	43.21		0.089	7.607	25.20	0.302
156-062592A	XD156	3	OD7	13,252	146	31		0.049	5.090	33.60	0.152
156-090789A	XD156	2	OD7	12,877	159.3	30.8		0.064	6.920	29.80	0.232
182-090689A	1D182	3	OD7	27,223	131.4	15.65		0.019	4.170	19.50	0.214
182-100589A	1D182	3	OD7	26,258	134.5	16.78		0.0087	1.980	19.50	0.102
TOTAL PM-10 (FILTERABLE PM-10 + CONDENSIBLE PM)											
045-041593A	1D045	2	M201A/202	35,288	NS	NS		0.061	18.390	16.15	1.162
045-041593B	2D045	2	M201A/202	30,445	NS	NS		0.124	34.885	23.17	1.481
228-091692D	1D228	2	M201A/202	47,683	219	13.8		0.011	4.595	9.17	0.505
228-091692F	3D228	2	M201A/202	38,063	251	24.2		0.077	25.800	12.49	2.015
CARBON MONOXIDE											
182-090689B	1D182	3	M3	26,919	568.7	10.18	943		107.467	19.50	5.510
182-090689C	1D182	3	M3	21,176	135	16.64	736		69.200	19.50	3.547
030-011993B	1D030	3	M10	31,896	NS	NS	7.5		1.068	15.23	0.071
030-012093B	2D030	3	M10	31,660	NS	NS	19		2.737	7.51	0.366
045-041593A	1D045	2	M10	35,288	NS	NS	250		37.550	16.15	2.450
045-041593B	2D045	2	M10	30,445	NS	NS	84		10.825	23.17	0.480
166-100192A	1D166	3	M10	35,500	NS	NS	113		18.480	14.60	1.297
166-100192B	1D166	3	M10	38,929	NS	NS	81		13.460	9.67	1.403
166-100292A	5D166	3	M10	15,801	NS	NS	49		3.480	9.63	0.367

TABLE 4-2. (continued)

Test code	Unit code	No. of runs	Test method[b]	Stack gas parameters			Pollutant concentration,		Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
				Flow, dscfm	Temp., °F	Moisture, %	ppm	gr/dscf			
166-100692A	2D166	2	M10	15,092	NS	NS	50		3.335	8.70	0.380
166-100692B	2D166	2	M10	15,142	NS	NS	56		3.640	9.75	0.380
202-071393A	1D202	2	M10	30,000	157	3	2.5		0.350	12.10	0.030
202-071393B	2D202	2	M10	28,000	151	3			0.000	10.20	0.000
039-102692A	1D039	3	M10	42,800	NS	NS			0.960	49.86	0.019
166-092892A	3D166	3	M10	33,673	NS	NS	73		10.760	6.00	1.750
166-092992A	4D166	3	M10	30,406	NS	NS	79		10.607	10.33	1.040
167-091890A	4D167	4	M10	33,900	167	13.2	62		9.250	11.28	0.823
167-091990A	4D167	2	M10	35,300	169	11.4	42		6.650	9.20	0.735
167-100490A	5D167	4	M10	29,800	183	18.2	76		9.350	13.90	0.670
167-102090A	4D167	3	M10	31,900	177	15.4	96		14.033	11.86	1.187
167-102090B	4D167	3	M10	33,200	157	14.6	68		9.830	11.05	0.874
167-102390A	5D167	3	M10	31,200	205	14.4	42		5.700	11.32	0.503
202-071592C	XD202	3	M10	41,100	150	4	22		4.033	19.11	0.200
228-091592B	3D228	3	M10	39,000	NS	NS	214		36.400	12.31	2.823
228-091692C	1D228	3	M10	49,858	226	13.1	104		22.223	9.33	2.340
039-102692B	XD039	3	M10	28,900	NS	NS			12.900	20.49	0.629
039-102692C	YD039	3	M10	28,900	NS	NS			17.067	19.27	0.886
039-102692D	5D039	3	M10	18,700	NS	NS			7.540	10.34	0.729
167-102588A	3D167	2	M10	33,000	173	14.3	756		107.850	10.32	10.470
156-032191A	XD156	3	M10	8,951	149	30	204		6.927	28.37	0.244

TABLE 4-2. (continued)

Test code	Unit code	No. of runs	Test method[b]	Stack gas parameters			Pollutant concentration,		Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
				Flow, dscfm	Temp., °F	Moisture, %	ppm	gr/dscf			
156-062592A	XD156	3	M10	13,252	146	31	131		6.957	33.60	0.207
182-090689A	1D182	3	M3	27,223	131.4	15.65	583		62.100	19.50	3.187
NITROGEN OXIDES											
030-011993B	1D030	3	M7	31,896	NS	NS	4.9		1.123	15.23	0.074
030-012093B	2D030	3	M7	31,660	NS	NS	28		6.420	7.51	0.854
045-041593A	1D045	2	M7E	35,288	NS	NS	41		9.960	16.15	0.627
045-041593B	2D045	2	M7E	30,445	NS	NS	24		5.000	23.17	0.222
166-100192A	1D166	3	M7C	35,500	NS	NS	68		18.000	14.60	1.236
166-100192B	1D166	3	M7C	38,929	NS	NS	67		18.270	9.67	1.908
166-100292A	5D166	3	M7C	15,801	NS	NS	6.3		0.740	9.63	0.077
166-100692A	2D166	2	M7C	15,092	NS	NS	19		2.035	8.70	0.236
166-100692B	2D166	2	M7C	15,142	NS	NS	17		1.760	9.75	0.183
202-071393A	1D202	2	M7E	30,000	157	3	0.50		0.100	12.10	0.010
202-071393B	2D202	2	M7E	28,000	151	3	0.50		0.200	10.20	0.020
166-092892A	3D166	3	M7C	33,673	NS	NS	68		16.383	6.00	2.627
166-092992A	4D166	3	M7C	30,406	NS	NS	69		15.290	10.33	1.488
167-091890A	4D167	4	M7C	33,900	167	13.2	79		19.450	11.28	1.725
167-091990A	4D167	2	M7C	35,300	169	11.4	3.4		0.900	9.20	0.099
167-100490A	5D167	4	M7C	29,800	183	18.2	86		17.700	13.90	1.287
167-102090A	4D167	3	M7C	31,900	177	15.4	69		16.137	11.86	1.361
167-102090B	4D167	3	M7C	33,200	157	14.6	6		1.433	11.05	0.129

TABLE 4-2. (continued)

Test code	Unit code	No. of runs	Test method[b]	Stack gas parameters: Flow, dscfm	Stack gas parameters: Temp., °F	Stack gas parameters: Moisture, %	Pollutant concentration, ppm	Pollutant concentration, gr/dscf	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
167-102390A	5D167	3	M7C	31,200	205	14.4	85		19.133	11.32	1.691
202-071592C	XD202	3	M7E	41,100	150	4	58		17.267	19.11	0.903
228-091492B	3D228	3	M7E	37,400	NS	NS	56		15.567	12.90	1.207
228-091692C	1D228	3	M7E	49,858	226	13.1	37		12.900	9.33	1.383
167-082189A	3D167	3	M7C	31,300	194	12.1	4.0		0.933	9.07	0.103
167-102588A	3D167	2	M7C	33,000	173	14.3	85		19.800	10.32	1.919
156-032191A	XD156	3	M7E	8,951	149	30	310		17.267	28.37	0.608
156-062592A	XD156	3	M7E	13,252	146	31	345		30.633	33.60	0.912
VOLATILE ORGANIC COMPOUNDS[c]											
228-091492A	3D228	3	M25A	33,200	NS	NS	1,471		88.233	12.31	7.173
228-091692B	1D228	3	M25A	41,000	NS	NS	138		11.620	9.33	1.232
030-011993B	1D030	3	M25A	31,896	NS	NS	8.4		0.513	15.23	0.034
030-012093B	2D030	3	M25A	31,660	NS	NS	76		4.577	7.51	0.581
045-041593A	1D045	2	M25A	35,288	NS	NS	193		14.235	16.15	0.891
045-041593B	2D045	2	M25A	30,445	NS	NS	284		19.160	23.17	0.839
166-100192A	1D166	3	M25A	35,500	NS	NS	93		6.457	14.60	0.443
166-100192A	1D166	3	M25M	35,500	NS	NS	50		3.470	14.60	0.240
166-100192B	1D166	3	M25A	38,929	NS	NS	80		5.727	9.67	0.605
166-100192B	1D166	3	M25M	38,929	NS	NS	30		2.157	9.67	0.220
166-100292A	5D166	3	M25M	15,801	NS	NS	98		3.000	9.63	0.313
166-100692A	2D166	2	M25M	15,092	NS	NS	20		0.560	8.70	0.065

TABLE 4-2. (continued)

Test code	Unit code	No. of runs	Test method[b]	Stack gas parameters: Flow, dscfm	Stack gas parameters: Temp., °F	Stack gas parameters: Moisture, %	Pollutant concentration, ppm	Pollutant concentration, gr/dscf	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
166-100692B	2D166	2	M25M	15,142	NS	NS	15		0.400	9.75	0.038
202-071592D	1D202	3	M25A	27,500	167	3	66		3.500	12.81	0.273
202-071592E	2D202	3	M25A	28,900	181	3.4	214		11.593	11.38	1.020
039-102692A	1D039	3	M25A	42,800	NS	NS			35.317	49.86	0.708
166-092892A	3D166	3	M25M	33,673	NS	NS	36		2.277	6.00	0.315
166-092992A	4D166	3	M25M	30,406	NS	NS	41		2.360	10.33	0.230
167-091890A	4D167	4	M25A	33,900	167	13.2	30		1.950	11.28	0.175
167-091990A	4D167	2	M25A	35,300	169	11.4	9.0		0.600	9.20	0.065
167-100490A	5D167	4	M25A	29,800	183	18.2	12		0.650	13.90	0.048
167-102090A	4D167	3	M25A	31,900	177	15.4	110		6.977	11.86	0.590
167-102090B	4D167	3	M25A	33,200	157	14.6	100		6.247	11.05	0.569
202-071592C	XD202	3	M25A	41,100	150	4	353		27.467	19.11	1.440
228-091492B	3D228	3	M25A	37,400	NS	NS	1,057		76.433	12.90	6.190
228-091692C	1D228	3	M25A	49,858	226	13.1	105		9.760	9.33	1.011
039-102692B	XD039	3	M25A	28,900	NS	NS			26.073	20.49	1.275
039-102692C	YD039	3	M25A	28,900	NS	NS			20.153	19.27	1.046
039-102692D	5D039	3	M25A	18,700	NS	NS			12.817	10.34	1.239
167-082189A	3D167	3	M25A	31,300	194	12.1	7.5		0.467	9.07	0.050

TABLE 4-2. (continued)

Test code	Unit code	No. of runs	Test method[b]	Stack gas parameters: Flow, dscfm	Stack gas parameters: Temp., °F	Stack gas parameters: Moisture, %	Pollutant concentration, ppm	Pollutant concentration, gr/dscf	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
SULFUR DIOXIDE											
166-100192A	1D166	3	M6	35,500	NS	NS	0.070		0.025	14.60	0.0020
166-100292A	5D166	1	M6	15,801	NS	NS	0.050		0.010	9.63	0.0010
166-100692A	2D166	1	M6	15,092	NS	NS	0.060		0.030	8.70	0.0020
166-092892A	3D166	1	M6	33,673	NS	NS	0.050		0.020	6.00	0.0030
166-092992A	4D166	1	M6	30,406	NS	NS	0.050		0.010	10.33	0.0010

[a]Reference 8. NS = not specified. ODTH = oven-dried tons per hour. Lb/ODT = pounds of pollutant per oven-dried ton of wood material out of dryer.

[b]Test methods: M5 = EPA Method 5; OD7 = Oregon Department of Environmental Quality (ODEQ) Method 7; OD8 = ODEQ Method 8; M201A = EPA Method 201A; M202 = EPA Method 202; M3 = EPA Method 3; M10 = EPA Method 10; M7 = EPA Method 7; M7C = EPA Method 7C; M7E = EPA Method 7E; M25A = EPA Method 25A; M25AM = Modified EPA Method 25A; M6 = EPA Method 6.

[c]Factors for VOC on a carbon basis.

TABLE 4-3. SUMMARY OF EMISSION FACTORS FOR PARTICLEBOARD DRYERS FROM NCASI DATA BASE[a]

Test code	Unit code	Firing type[b]	Fuel type[c]	Wood species[d]				Moisture content, %		Temp., °F		Emission control device[e]	No. of runs	Emission factor, lb/ODT	Data rating
				Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
FILTERABLE PM															
167-102288A	3D167	DFIRE	SDUST	HWOOD	100	NA		37.0	2.5	777	219	CYC	2	2.29	B
167-102288B	3D167	DFIRE	SDUST	HWOOD	100	NA		40.0	2.4	750	218	CYC	1	5.17	D
022-102689B	1D022	DFIRE	NS	PINE SP	95	HWOOD	5	NS	NS	NS	NS	CYC	2	NS	
022-102689C	2D022	DFIRE	NS	PINE SP	95	HWOOD	5	NS	NS	NS	NS	CYC	2	NS	
030-011993C	1D030	DFIRE	WREF	PINE SP	95	HWOOD	5	20.3	7.9	219	121	CYC	3	1.18	A
030-012093C	2D030	DFIRE	WREF	PINE SP	95	HWOOD	5	21.2	5.7	404	160	CYC	3	3.69	A
043-042192A	1D043	DFIRE	WREF	SY PINE	100	NA		18.0	6.0	NS	NS	CYC	3	1.07	A
043-042192B	2D043	DFIRE	WREF	SY PINE	100	NA		18.0	5.1	NS	NS	CYC	3	0.82	A
045-041593A	1D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.8	6.6	220	116	CYC	2	4.81	B
045-041593B	2D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.0	4.7	490	140	CYC	2	11.11	B
166-100192A	1D166	DFIRE	SDUST	NS		NS		21.9	3.6	521	183	CYC	3	2.70	A
166-100192B	1D166	DFIRE	SDUST	NS		NS		31.8	2.2	502	187	CYC	3	2.67	A
166-100292A	5D166	DFIRE	NGAS	NS		NS		11.5	4.3	296	202	CYC	3	1.48	A
166-100692A	2D166	DFIRE	SDUST	NS		NS		21.5	6.0	299	141	CYC	2	6.50	B
166-100692B	2D166	DFIRE	SDUST	NS		NS		17.3	6.1	249	133	CYC	2	3.52	B
167-062288B	2D167	DFIRE	SDUST	PINE SP	75	HWOOD	25	6.8	5.4	115	100	CYC	3	0.79	A
167-082589A	2D167	DFIRE	SDUST	HWOOD	100	NA		40.6	4.3	666	202	CYC	2	2.72	B
202-071393A	1D202	BOTH	NGAS	PINE SP	75	DFIR	10	8.0	3.2	NS	NS	CYC	2	0.91	B
202-071393B	2D202	BOTH	NGAS	PINE SP	75	DFIR	10	8.0	3.1	NS	NS	CYC	2	1.69	B
166-092892A	3D166	DFIRE	NS	NS		NS		105.0	22.5	871	193	EFB	3	1.18	A
166-092992A	4D166	DFIRE	NS	NS		NS		126.0	24.7	854	175	EFB	3	0.74	A
167-091890A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.0	870	204	EFB	4	0.21	A
167-091990A	4D167	DFIRE	SDUST	HWOOD	100	NA		35.0	2.9	722	NS	EFB	2	0.16	B
167-100490A	5D167	DFIRE	SDUST	HWOOD	65	PINE SP	35	31.5	4.2	978	228	EFB	4	0.40	A
167-102090A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.3	921	201	EFB	3	0.19	A

TABLE 4-3. (continued)

Test code	Unit code	Firing type[b]	Fuel type[c]	Wood species[d] Primary	%	Secon.	%	Moisture content, % Inlet	Outlet	Temp., °F Inlet	Outlet	Emission control device[e]	No. of runs	Emission factor, lb/ODT	Data rating
167-102090B	4D167	DFIRE	SDUST	HWOOD	100	NA		40.3	3.2	888	203	EFB	3	0.21	A
167-102390A	5D167	DFIRE	SDUST	HWOOD	65	PINE SP	35	34.0	4.7	822	229	EFB	3	0.20	A
202-081788A	XD202	BOTH	NGAS	PINE SP	75	DFIR	10	NS	NS	NS	NS	EFB	3	0.14	A
228-091692D	1D228	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	2	0.27	B
228-091692F	3D228	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	2	1.51	B
182-090889A	2D182	DFIRE	SDUST	DFIR	90	UWOOD	10	13.0	2.9	498	290	INC	3	0.22	A
167-061988A	3D167	DFIRE	SDUST	HWOOD	100	NA		45.0	3.0	810	NS	MCLO	1	2.26	D
167-061988B	3D167	DFIRE	SDUST	HWOOD	100	NA		45.0	3.0	800	NS	MCLO	1	0.99	D
167-082189A	3D167	DFIRE	SDUST	HWOOD	100	NA		38.0	2.3	710	212	MCLO	3	1.44	A
167-100588A	3D167	DFIRE	SDUST	HWOOD	100	NA		37.0	2.3	730	215	MCLO	3	2.86	A
167-102588A	3D167	DFIRE	SDUST	HWOOD	100	NA		42.5	2.5	862	223	MCLO	2	3.83	B
228-091592A	3D228	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	MCLO	3	2.53	A
228-091692A	1D228	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	MCLO	3	2.01	A
182-090689B	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	MCLO	3	1.02	A
182-090689C	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	MCLO	3	0.50	A
182-100589B	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	NS	NS	NS	NS	MCLO	3	0.68	A
167-062288A	1D167	DFIRE	SDUST	ASPEN	NS	HWOOD	NS	31.2	3.7	593	216	PBA	3	0.60	A
167-082389A	1D167	DFIRE	SDUST	ASPEN	100	NS		40.4	3.7	698	232	PBA	3	1.26	A
182-090689A	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	WESP	3	0.16	A
182-100589A	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	NS	NS	NS	NS	WESP	3	0.063	A
FILTERABLE PM-10															
030-011993D	1D030	DFIRE	WREF	PINE SP	95	HWOOD	5	19.2	7.7	240	125	CYC	3	0.184	A
030-012093D	2D030	DFIRE	WREF	PINE SP	95	HWOOD	5	21.6	6.5	421	160	CYC	3	0.801	A
045-041593A	1D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.8	6.6	220	116	CYC	2	0.654	B
045-041593B	2D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.0	4.7	490	140	CYC	2	1.140	B

TABLE 4-3. (continued)

Test code	Unit code	Firing type[b]	Fuel type[c]	Wood species[d] Primary	%	Secon.	%	Moisture content, % Inlet	Outlet	Temp., °F Inlet	Outlet	Emission control device[e]	No. of runs	Emission factor, lb/ODT	Data rating
039-082791A	1D039	DFIRE	WREF	HWOOD	55	SWOOD	45	95.0	65.0	691	180	EFB	3	0.050	A
228-091692D	1D228	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.163	A
228-091692F	3D228	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	3	0.641	A
CONDENSIBLE PM															
228-091592A	3D228	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	3	1.763	A
228-091692A	1D228	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.661	A
182-090689B	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	WESP	3	0.195	A
182-090689C	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	WESP	3	0.389	A
182-100589B	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	NS	NS	NS	NS	WESP	3	0.075	A
030-011993C	1D030	DFIRE	WREF	PINE SP	95	HWOOD	5	20.3	7.9	219	121	CYC	3	0.019	A
030-012093C	2D030	DFIRE	WREF	PINE SP	95	HWOOD	5	21.2	5.7	404	160	CYC	3	0.089	A
045-041593A	1D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.8	6.6	220	116	CYC	2	0.508	B
045-041593B	2D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.0	4.7	490	140	CYC	2	0.344	B
166-100192A	1D166	DFIRE	SDUST	NS		NS		21.9	3.6	521	183	CYC	3	0.386	A
166-100192B	1D166	DFIRE	SDUST	NS		NS		31.8	2.2	502	187	CYC	3	0.524	A
166-100292A	5D166	DFIRE	NGAS	NS		NS		11.5	4.3	296	202	CYC	3	0.131	A
166-100692A	2D166	DFIRE	SDUST	NS		NS		21.5	6.0	299	141	CYC	2	0.076	B
166-100692B	2D166	DFIRE	SDUST	NS		NS		17.3	6.1	249	133	CYC	2	0.106	B
167-062288B	2D167	DFIRE	SDUST	PINE SP	75	HWOOD	25	6.8	5.4	115	100	CYC	3	0.021	A
167-082589A	2D167	DFIRE	SDUST	HWOOD	100	NA		40.6	4.3	666	202	CYC	2	0.130	B
166-092892A	3D166	DFIRE	NS	NS		NS		105.0	22.5	871	193	EFB	3	0.456	A
166-092992A	4D166	DFIRE	NS	NS		NS		126.0	24.7	854	175	EFB	3	0.235	A
167-091890A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.0	870	204	EFB	4	0.135	A
167-091990A	4D167	DFIRE	SDUST	HWOOD	100	NA		35.0	2.9	722	NS	EFB	2	0.046	B
167-100490A	5D167	DFIRE	SDUST	HWOOD	65	PINE SP	35	31.5	4.2	978	228	EFB	4	0.265	A

TABLE 4-3. (continued)

Test code	Unit code	Firing type[b]	Fuel type[c]	Wood species[d]				Moisture content, %		Temp., °F		Emission control device[e]	No. of runs	Emission factor, lb/ODT	Data rating
				Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
167-102090A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.3	921	201	EFB	3	0.095	A
167-102090B	4D167	DFIRE	SDUST	HWOOD	100	NA		40.3	3.2	888	203	EFB	3	0.072	A
167-102390A	5D167	DFIRE	SDUST	HWOOD	65	PINE SP	35	34.0	4.7	822	229	EFB	3	0.184	A
202-081788A	XD202	BOTH	NGAS	PINE SP	75	DFIR	10	NS	NS	NS	NS	EFB	3	0.064	A
182-090889A	2D182	DFIRE	SDUST	DFIR	90	UWOOD	10	13.0	2.9	498	290	INC	3	0.015	A
167-061988A	3D167	DFIRE	SDUST	HWOOD	100	NA		45.0	3.0	810	NS	MCLO	1	0.122	D
167-061988B	3D167	DFIRE	SDUST	HWOOD	100	NA		45.0	3.0	800	NS	MCLO	1	0.159	D
167-082189A	3D167	DFIRE	SDUST	HWOOD	100	NA		38.0	2.3	710	212	MCLO	3	0.048	A
167-100588A	3D167	DFIRE	SDUST	HWOOD	100	NA		37.0	2.3	730	215	MCLO	3	0.207	A
167-102588A	3D167	DFIRE	SDUST	HWOOD	100	NA		42.5	2.5	862	223	MCLO	2	0.424	B
167-062288A	1D167	DFIRE	SDUST	ASPEN	NS	HWOOD	NS	31.2	3.7	593	216	PBA	3	0.025	A
167-082389A	1D167	DFIRE	SDUST	ASPEN	100	NA		40.4	3.7	698	232	PBA	3	0.023	A
182-090689A	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	WESP	3	0.048	A
182-100589A	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	NS	NS	NS	NS	WESP	3	0.039	A
TOTAL PM (FILTERABLE PM + CONDENSIBLE PM)															
228-091592A	3D228	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	3	4.293	A
228-091692A	1D228	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	2.670	A
182-090689B	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	WESP	3	1.213	A
182-090689C	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	WESP	3	0.891	A
182-100589B	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	NS	NS	NS	NS	WESP	3	0.756	A
030-011993C	1D030	DFIRE	WREF	PINE SP	95	HWOOD	5	20.3	7.9	219	121	CYC	3	1.205	A
030-012093C	2D030	DFIRE	WREF	PINE SP	95	HWOOD	5	21.2	5.7	404	160	CYC	3	3.783	A
045-041593A	1D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.8	6.6	220	116	CYC	2	5.315	B
045-041593B	2D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.0	4.7	490	140	CYC	2	11.445	B
166-100192A	1D166	DFIRE	SDUST	NS		NS		21.9	3.6	521	183	CYC	3	3.083	A

TABLE 4-3. (continued)

Test code	Unit code	Firing type[b]	Fuel type[c]	Wood species[d] Primary	%	Secon.	%	Moisture content, % Inlet	Outlet	Temp., °F Inlet	Outlet	Emission control device[e]	No. of runs	Emission factor, lb/ODT	Data rating
166-100192B	1D166	DFIRE	SDUST	NS		NS		31.8	2.2	502	187	CYC	3	3.190	A
166-100292A	5D166	DFIRE	NGAS	NS		NS		11.5	4.3	296	202	CYC	3	1.613	A
166-100692A	2D166	DFIRE	SDUST	NS		NS		21.5	6.0	299	141	CYC	2	6.580	B
166-100692B	2D166	DFIRE	SDUST	NS		NS		17.3	6.1	249	133	CYC	2	3.620	B
167-062288B	2D167	DFIRE	SDUST	PINE SP	75	HWOOD	25	6.8	5.4	115	100	CYC	3	0.807	A
167-082589A	2D167	DFIRE	SDUST	HWOOD	100	NA		40.6	4.3	666	202	CYC	2	2.855	B
166-092892A	3D166	DFIRE	NS	NS				105.0	22.5	871	193	EFB	3	1.630	A
166-092992A	4D166	DFIRE	NS	NS				126.0	24.7	854	175	EFB	3	0.983	A
167-091890A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.0	870	204	EFB	4	0.344	A
167-091990A	4D167	DFIRE	SDUST	HWOOD	100	NA		35.0	2.9	722	NS	EFB	2	0.197	B
167-100490A	5D167	DFIRE	SDUST	HWOOD	65	PINE SP	35	31.5	4.2	978	228	EFB	4	0.664	A
167-102090A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.3	921	201	EFB	3	0.287	A
167-102090B	4D167	DFIRE	SDUST	HWOOD	100	NA		40.3	3.2	888	203	EFB	3	0.317	A
167-102390A	5D167	DFIRE	SDUST	HWOOD	65	PINE SP	35	34.0	4.7	822	229	EFB	3	0.387	A
202-081788A	XD202	BOTH	NGAS	PINE SP	75	DFIR	10	NS	NS	NS	NS	EFB	3	0.203	A
182-090889A	2D182	DFIRE	SDUST	DFIR	90	UWOOD	10	13.0	2.9	498	290	INC	3	0.237	A
167-061988A	3D167	DFIRE	SDUST	HWOOD	100	NA		45.0	3.0	810	NS	MCLO	1	2.380	D
167-061988B	3D167	DFIRE	SDUST	HWOOD	100	NA		45.0	3.0	800	NS	MCLO	1	1.140	D
167-082189A	3D167	DFIRE	SDUST	HWOOD	100	NA		38.0	2.3	710	212	MCLO	3	1.480	A
167-100588A	3D167	DFIRE	SDUST	HWOOD	100	NA		37.0	2.3	730	215	MCLO	3	3.067	A
167-102588A	3D167	DFIRE	SDUST	HWOOD	100	NA		42.5	2.5	862	223	MCLO	2	4.255	B
167-062288A	1D167	DFIRE	SDUST	ASPEN	NS	HWOOD	NS	31.2	3.7	593	216	PBA	3	0.623	A
167-082389A	1D167	DFIRE	SDUST	ASPEN	100	NS		40.4	3.7	698	232	PBA	3	1.290	A
156-022087A	XD156	DFIRE	SDUST	PINE SP	15	UFIR	85	NS	NS	NS	NS	SF	2	0.256	B
156-032191A	XD156	DFIRE	SDUST	PINE SP	15	UFIR	85	NS	NS	NS	NS	SF	3	0.162	A

TABLE 4-3. (continued)

Test code	Unit code	Firing type[b]	Fuel type[c]	Wood species[d] Primary	%	Secon.	%	Moisture content, % Inlet	Outlet	Temp., °F Inlet	Outlet	Emission control device[e]	No. of runs	Emission factor, lb/ODT	Data rating
156-051090A	XD156	DFIRE	SDUST	PINE SP	15	UFIR	85	NS	NS	NS	NS	SF	3	0.161	A
156-061688A	XD156	DFIRE	SDUST	PINE SP	15	UFIR	85	NS	NS	NS	NS	SF	3	0.302	A
156-062592A	XD156	DFIRE	SDUST	PINE SP	15	UFIR	85	NS	NS	576	216	SF	3	0.152	A
156-090789A	XD156	DFIRE	SDUST	PINE SP	15	UFIR	85	SN	NS	NS	NS	SF	2	0.232	B
182-090689A	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	WESP	3	0.214	A
182-100589A	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	NS	NS	NS	NS	WESP	3	0.102	A
TOTAL PM-10 (FILTERABLE PM-10 AND CONDENSIBLE PM)															
045-041593A	1D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.8	6.6	220	116	CYC	2	1.162	B
045-041593B	2D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.0	4.7	490	140	CYC	2	1.481	B
228-091692D	1D228	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	2	0.505	B
228-091692F	3D228	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	2	2.015	B
CARBON MONOXIDE															
182-090689B	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	WESP	3	5.510	C
182-090689C	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	WESP	3	3.547	C
030-011993B	1D030	DFIRE	WREF	PINE SP	95	HWOOD	5	24.7	8.0	223	128	CYC	3	0.071	A
030-012093B	2D030	DFIRE	WREF	PINE SP	95	HWOOD	5	18.1	6.4	426	158	CYC	3	0.366	A
045-041593A	1D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.8	6.6	220	116	CYC	2	2.450	B
045-041593B	2D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.0	4.7	490	140	CYC	2	0.480	B
166-100192A	1D166	DFIRE	SDUST	NS		NS		21.9	3.6	521	183	CYC	3	1.297	A
166-100192B	1D166	DFIRE	SDUST	NS		NS		31.8	2.2	502	187	CYC	3	1.403	A
166-100292A	5D166	DFIRE	NGAS	NS		NS		11.5	4.3	296	202	CYC	3	0.367	B
166-100692A	2D166	DFIRE	SDUST	NS		NS		21.5	6.0	299	141	CYC	2	0.380	B
166-100692B	2D166	DFIRE	SDUST	NS		NS		17.3	6.1	249	133	CYC	2	0.380	B
202-071393A	1D202	BOTH	NGAS	PINE SP	75	DFIR	10	8.0	3.2	NS	NS	CYC	2	0.030	B
202-071393B	2D202	BOTH	NGAS	PINE SP	75	DFIR	10	8.0	3.1	NS	NS	CYC	2	0.000	B

TABLE 4-3. (continued)

Test code	Unit code	Firing type[b]	Fuel type[c]	Wood species[d]				Moisture content, %		Temp., °F		Emission control device[e]	No. of runs	Emission factor, lb/ODT	Data rating
				Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
039-102692A	1D039	DFIRE	WREF	HWOOD	55	SWOOD	45	95.0	65.0	650	165	EFB	3	0.019	A
166-092892A	3D166	DFIRE	NS	NS		NS		105.0	22.5	871	193	EFB	3	1.750	A
166-092992A	4D166	DFIRE	NS	NS		NS		126.0	24.7	854	175	EFB	3	1.040	A
167-091890A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.0	870	204	EFB	4	0.823	A
167-091990A	4D167	DFIRE	SDUST	HWOOD	100	NA		35.0	2.9	722	NS	EFB	2	0.735	B
167-100490A	5D167	DFIRE	SDUST	HWOOD	65	PINE SP	35	31.5	4.2	978	228	EFB	4	0.670	A
167-102090A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.3	921	201	EFB	3	1.187	A
167-102090B	4D167	DFIRE	SDUST	HWOOD	100	NA		40.3	3.2	888	203	EFB	3	0.874	A
167-102390A	5D167	DFIRE	SDUST	HWOOD	65	PINE SP	35	34.0	4.7	822	229	EFB	3	0.503	A
202-071592C	XD202	BOTH	NGAS	PINE SP	75	DFIR	10	13.5	2.0	NS	NS	EFB	3	0.200	A
228-091592B	3D228	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	3	2.823	A
228-091692C	1D228	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	2.340	A
039-102692B	XD039	DFIRE	WREF	HWOOD	55	SWOOD	45	65.0	5.0	592	286	MCLO	3	0.629	A
039-102692C	YD039	DFIRE	WREF	HWOOD	55	SWOOD	45	65.0	5.0	571	267	MCLO	3	0.886	A
039-102692D	5D039	DFIRE	SDUST	HWOOD	55	SWOOD	45	65.0	5.0	603	253	MCLO	3	0.729	A
167-102588A	3D167	DFIRE	SDUST	HWOOD	100	NA		42.5	2.5	862	223	MCLO	2	10.470	B
156-032191A	XD156	DFIRE	SDUST	PINE SP	15	UFIR	85	NS	NS	NS	NS	SF	3	0.244	A
156-062592A	XD156	DFIRE	SDUST	PINE SP	15	UFIR	85	NS	NS	576	216	SF	3	0.207	A
182-090689A	1D182	DFIRE	SDUST	DFIR	90	UWOOD	10	51.3	13.0	540	138	WESP	3	3.187	C
NITROGEN OXIDES															
030-011993B	1D030	DFIRE	WREF	PINE SP	95	HWOOD	5	24.7	8.0	223	128	CYC	3	0.074	A
030-012093B	2D030	DFIRE	WREF	PINE SP	95	HWOOD	5	18.1	6.4	426	158	CYC	3	0.854	A
045-041593A	1D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.8	6.6	220	116	CYC	2	0.627	B
045-041593B	2D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.0	4.7	490	140	CYC	2	0.222	B
166-100192A	1D166	DFIRE	SDUST	NS		NS		21.9	3.6	521	183	CYC	3	1.236	A

TABLE 4-3. (continued)

Test code	Unit code	Firing type[b]	Fuel type[c]	Wood species[d]				Moisture content, %		Temp., °F		Emission control device[e]	No. of runs	Emission factor, lb/ODT	Data rating
				Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
166-100192B	1D166	DFIRE	SDUST	NS		NS		31.8	2.2	502	187	CYC	3	1.908	A
166-100292A	5D166	DFIRE	NGAS	NS		NS		11.5	4.3	296	202	CYC	3	0.077	B
166-100692A	2D166	DFIRE	SDUST	NS		NS		21.5	6.0	299	141	CYC	2	0.236	B
166-100692B	2D166	DFIRE	SDUST	NS		NS		17.3	6.1	249	133	CYC	2	0.183	B
202-071393A	1D202	BOTH	NGAS	PINE SP	75	DFIR	10	8.0	3.2	NS	NS	CYC	2	0.010	B
202-071393B	2D202	BOTH	NGAS	PINE SP	75	DFIR	10	8.0	3.1	NS	NS	CYC	2	0.020	B
166-092892A	3D166	DFIRE	NS	NS		NS		105.0	22.5	871	193	EFB	3	2.627	A
166-092992A	4D166	DFIRE	NS	NS		NS		126.0	24.7	854	175	EFB	3	1.488	A
167-091890A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.0	870	204	EFB	4	1.725	A
167-091990A	4D167	DFIRE	SDUST	HWOOD	100	NA		35.0	2.9	722	NS	EFB	2	0.099	B
167-100490A	5D167	DFIRE	SDUST	HWOOD	65	PINE SP	35	31.5	4.2	978	228	EFB	4	1.287	A
167-102090A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.3	921	201	EFB	3	1.361	A
167-102090B	4D167	DFIRE	SDUST	HWOOD	100	NA		40.3	3.2	888	203	EFB	3	0.129	A
167-102390A	5D167	DFIRE	SDUST	HWOOD	65	PINE SP	35	34.0	4.7	822	229	EFB	3	1.691	A
202-071592C	XD202	BOTH	NGAS	PINE SP	75	DFIR	10	13.5	2.0	NS	NS	EFB	3	0.903	A
228-091492B	3D228	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	1.207	A
228-091692C	1D228	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	1.383	A
167-082189A	3D167	DFIRE	SDUST	HWOOD	100	NA		38.0	2.3	710	212	MCLO	3	0.103	A
167-102588A	3D167	DFIRE	SDUST	HWOOD	100	NA		42.5	2.5	862	223	MCLO	2	1.919	B
156-032191A	XD156	DFIRE	SDUST	PINE SP	15	UFIR	85	NS	NS	NS	NS	SF	3	0.608	A
156-062592A	XD156	DFIRE	SDUST	PINE SP	15	UFIR	85	NS	NS	576	216	SF	3	0.912	A
VOLATILE ORGANIC COMPOUNDS[f]															
228-091492A	3D228	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	7.173	A
228-091692B	1D228	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	1.232	A
030-011993B	1D030	DFIRE	WREF	PINE SP	95	HWOOD	5	24.7	8.0	223	128	CYC	3	0.034	A

TABLE 4-3. (continued)

Test code	Unit code	Firing type[b]	Fuel type[c]	Wood species[d]				Moisture content, %		Temp., °F		Emission control device[e]	No. of runs	Emission factor, lb/ODT	Data rating
				Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
030-012093B	2D030	DFIRE	WREF	PINE SP	95	HWOOD	5	18.1	6.4	426	158	CYC	3	0.581	A
045-041593A	1D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.8	6.6	220	116	CYC	2	0.891	B
045-041593B	2D045	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.0	4.7	490	140	CYC	2	0.839	B
166-100192A	1D166	DFIRE	SDUST	NS		NS		21.9	3.6	521	183	CYC	3	0.443	A
166-100192A	1D166	DFIRE	SDUST	NS		NS		21.9	3.6	521	183	CYC	3	0.240	A
166-100192B	1D166	DFIRE	SDUST	NS		NS		31.8	2.2	502	187	CYC	3	0.605	A
166-100192B	1D166	DFIRE	SDUST	NS		NS		31.8	2.2	502	187	CYC	3	0.220	A
166-100292A	5D166	DFIRE	NGAS	NS		NS		11.5	4.3	296	202	CYC	3	0.313	A
166-100692A	2D166	DFIRE	SDUST	NS		NS		21.5	6.0	299	141	CYC	2	0.065	C
166-100692B	2D166	DFIRE	SDUST	NS		NS		17.3	6.1	249	133	CYC	2	0.038	C
202-071592D	1D202	BOTH	NGAS	PINE SP	75	DFIR	10	13.5	2.0	NS	NS	CYC	3	0.273	A
202-071592E	2D202	BOTH	NGAS	PINE SP	75	DFIR	10	13.5	2.0	NS	NS	CYC	3	1.020	A
039-102692A	1D039	DFIRE	WREF	HWOOD	55	SWOOD	45	95.0	65.0	650	165	EFB	3	0.708	A
166-092892A	3D166	DFIRE	NS	NS		NS		105.0	22.5	871	193	EFB	2	0.315	D
166-092992A	4D166	DFIRE	NS	NS		NS		126.0	24.7	854	175	EFB	3	0.230	A
167-091890A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.0	870	204	EFB	4	0.175	A
167-091990A	4D167	DFIRE	SDUST	HWOOD	100	NA		35.0	2.9	722	NS	EFB	2	0.065	B
167-100490A	5D167	DFIRE	SDUST	HWOOD	65	PINE SP	35	31.5	4.2	978	228	EFB	4	0.048	A
167-102090A	4D167	DFIRE	SDUST	HWOOD	100	NA		36.3	3.3	921	201	EFB	3	0.590	A
167-102090B	4D167	DFIRE	SDUST	HWOOD	100	NA		40.3	3.2	888	203	EFB	3	0.569	A
202-071592C	XD202	BOTH	NGAS	PINE SP	75	DFIR	10	13.5	2.0	NS	NS	EFB	3	1.440	A
228-091492B	3D228	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	6.190	A
228-091692C	1D228	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	1.011	A
039-102692B	XD039	DFIRE	WREF	HWOOD	55	SWOOD	45	65.0	5.0	592	286	MCLO	3	1.275	A
039-102692C	YD039	DFIRE	WREF	HWOOD	55	SWOOD	45	65.0	5.0	571	267	MCLO	3	1.046	A

TABLE 4-3. (continued)

Test code	Unit code	Firing type[b]	Fuel type[c]	Wood species[d] Primary	%	Secon.	%	Moisture content, % Inlet	Outlet	Temp., °F Inlet	Outlet	Emission control device[e]	No. of runs	Emission factor, lb/ODT	Data rating
039-102692D	5D039	DFIRE	SDUST	HWOOD	55	SWOOD	45	65.0	5.0	603	253	MCLO	3	1.239	A
167-082189A	3D167	DFIRE	SDUST	HWOOD	100	NA		38.0	2.3	710	212	MCLO	3	0.050	A
SULFUR DIOXIDE															
166-100192A	1D166	DFIRE	SDUST	NS		NS		21.9	3.6	521	183	CYC	3	0.002	A
166-100292A	5D166	DFIRE	NGAS	NS		NS		11.5	4.3	296	202	CYC	1	0.001	D
166-100692A	2D166	DFIRE	SDUST	NS		NS		21.5	6.0	299	141	CYC	1	0.002	D
166-092892A	3D166	DFIRE	NS	NS		NS		105.0	22.5	871	193	EFB	1	0.003	D
166-092992A	4D166	DFIRE	NS	NS		NS		126.0	24.7	854	175	EFB	1	0.001	D

[a]Reference 8. NS = not specified; NA = not applicable. Lb/ODT = pounds of pollutant per oven-dried ton of wood material out of dryer.
[b]Firing types: DFIRE = direct firing; BOTH = combination of direct and indirect firing.
[c]Fuel types: SDUST = sanderdust; WREF = wood residue; NGAS = natural gas.
[d]Wood species: SY PINE = Southern Yellow Pine; PINE SP = unknown pine species; DFIR = Douglas Fir; UFIR = unspecified fir; SWOOD = unspecified softwood; ASPEN = Aspen; HWOOD = unspecified hardwood; UWOOD = unspecified wood from urban recycling.
[e]Emission control devices: CYC = cyclone; MCLO = multiclone; EFB = electrified filter bed; WESP = wet electrostatic precipitator; PBA = packed bed absorber; SF = sand filter; INC = incinerator.
[f]Factors for VOC on a carbon basis.

TABLE 4-4. SUMMARY OF EMISSION DATA FOR PARTICLEBOARD DRYERS FROM NCASI DATA BASE--SPECIATED ORGANICS[a]

Test code	Unit code	Pollutant[b]	No. of runs	Test method[c]	Stack gas parameters: Flow, dscfm	Temp., °F	Moisture, %	Pollutant concentration, ppm	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
030-011993F	1D030	111-T-CH-E	3	M0030	31,870	132	5.8	0.00019	0.00012	15.67	7.5E-06
030-012093F	2D030	111-T-CH-E	3	M0030	30,948	152	7.3	0.00022	0.00014	8.96	1.6E-05
030-011993E	1D030	124TMBENZ	3	M0010	31,870	132	5.8	0.00148	0.00083	13.62	6.4E-05
030-012093E	2D030	124TMBENZ	3	M0010	30,948	152	7.3	0.00173	0.00101	8.59	0.00011
030-011993A	1D030	2-5-DMBENZ	3	M0011	34,132	127	5.2	0.00063	0.00045	13.57	3.3E-05
228-091692C	1D228	2-5-DMBENZ	3	M0011	49,858	226	13.1	0.0134	0.0138	9.33	0.0015
228-091692E	3D228	2-5-DMBENZ	3	M0011	37,421	248	21.4	0.0783	0.0640	11.88	0.0053
030-011993F	1D030	4-M-2-PENT	3	M0030	31,870	132	5.8	0.00110	0.00052	15.67	3.3E-05
030-012093F	2D030	4-M-2-PENT	3	M0030	30,948	152	7.3	0.00238	0.00115	8.96	0.00013
030-012093E	2D030	44METDIAN	1	M0010	30,948	152	7.3	0.00342	0.00033	8.59	3.3E-05
030-011993E	1D030	A-PINENE	3	M0010	31,870	132	5.8	0.340	0.219	13.62	0.017
030-011993F	1D030	A-PINENE	3	M0030	31,870	132	5.8	2.04	1.31	15.67	0.084
030-012093E	2D030	A-PINENE	3	M0010	30,948	152	7.3	0.980	0.647	8.59	0.076
030-012093F	2D030	A-PINENE	3	M0030	30,948	152	7.3	22	14.4	8.96	1.671
228-091792A	1D228	A-PINENE	3	M0010	48,273	219	14.9	3.11	3.37	9.31	0.36
228-091792A	1D228	A-PINENE	3	M0030	48,273	219	14.9	4.87	5.29	9.31	0.57
228-091792B	3D228	A-PINENE	3	M0010	38,306	254	23.3	34.57	28.25	12.31	2.3
228-091792B	3D228	A-PINENE	3	M0030	38,306	254	23.3	17.51	19.35	12.31	1.6
030-011993E	1D030	A-TERPINE	3	M0010	31,870	132	5.8	0.563	0.410	13.62	0.032
030-012093E	2D030	A-TERPINE	3	M0010	30,948	152	7.3	1.13	0.842	8.59	0.10
228-091792A	1D228	A-TERPINE	3	M0010	48,273	219	14.9	0.387	0.477	9.31	0.053
228-091792B	3D228	A-TERPINE	3	M0010	38,306	254	23.3	2.23	2.05	12.31	0.17
030-011993A	1D030	ACETALD	1	M0011	34,132	127	5.2	0.144	0.0337	13.57	0.0025
030-012093A	2D030	ACETALD	3	M0011	30,870	155	8	0.168	0.0371	6.28	0.0096
228-091592A	3D228	ACETALD	3	M0011	32,142	261	24.4	3.30	0.872	12.49	0.070
228-091692C	1D228	ACETALD	3	M0011	49,858	226	13.1	0.145	0.0487	9.33	0.0052

TABLE 4-4. (continued)

Test code	Unit code	Pollutant[b]	No. of runs	Test method[c]	Stack gas parameters: Flow, dscfm	Stack gas parameters: Temp., °F	Stack gas parameters: Moisture, %	Pollutant concentration, ppm	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
228-091692E	3D228	ACETALD	3	M0011	37,421	248	21.4	3.31	0.872	11.88	0.074
030-011993A	1D030	ACETONE	3	M0011	34,132	127	5.2	0.482	0.144	13.57	0.010
030-011993F	1D030	ACETONE	3	M0030	31,870	132	5.8	0.126	0.0287	15.67	0.0018
030-012093A	2D030	ACETONE	1	M0011	30,870	155	8	1.02	0.278	6.28	0.034
030-012093F	2D030	ACETONE	3	M0030	30,948	152	7.3	0.419	0.101	8.96	0.011
228-091592A	3D228	ACETONE	3	M0011	32,142	261	24.4	3.27	1.14	12.49	0.092
228-091692C	1D228	ACETONE	3	M0011	49,858	226	13.1	0.275	0.122	9.33	0.013
228-091692E	3D228	ACETONE	3	M0011	37,421	248	21.4	3.27	1.14	11.88	0.096
228-091792A	1D228	ACETONE	3	M0030	48,273	219	14.9	0.646	0.297	9.31	0.032
228-091792B	3D228	ACETONE	3	M0030	38,306	254	23.3	7.47	3.54	12.31	0.287
030-011993E	1D030	ACETPH	3	M0010	31,870	132	5.8	0.000681	0.00039	13.62	3.1E-05
030-012093E	2D030	ACETPH	2	M0010	30,948	152	7.3	0.00137	0.00080	8.59	9.8E-05
030-011993A	1D030	ACROLEIN	3	M0011	34,132	127	5.2	0.0201	0.00572	13.57	0.00041
030-011993F	1D030	ACROLEIN	3	M0030	31,870	132	5.8	0.106	0.0270	15.67	0.0017
030-012093A	2D030	ACROLEIN	3	M0011	30,870	155	8	0.0427	0.0119	6.28	0.0027
030-012093F	2D030	ACROLEIN	3	M0030	30,948	152	7.3	0.290	0.0796	8.96	0.0083
228-091592A	3D228	ACROLEIN	3	M0011	32,142	261	24.4	0.839	0.280	12.49	0.022
228-091692C	1D228	ACROLEIN	3	M0011	49,858	226	13.1	0.0180	0.00773	9.33	0.00081
228-091692E	3D228	ACROLEIN	3	M0011	37,421	248	21.4	0.839	0.280	11.88	0.024
030-011993F	1D030	ACRYLNIT	3	M0030	31,870	132	5.8	0.00278	0.00068	15.67	4.3E-05
030-012093F	2D030	ACRYLNIT	3	M0030	30,948	152	7.3	0.00461	0.00118	8.96	0.00013
030-011993E	1D030	B-PINENE	3	M0010	31,870	132	5.8	0.205	0.132	13.62	0.010
030-011993F	1D030	B-PINENE	3	M0030	31,870	132	5.8	0.496	0.371	15.67	0.020
030-012093E	2D030	B-PINENE	3	M0010	30,948	152	7.3	0.554	0.366	8.59	0.043
030-012093F	2D030	B-PINENE	3	M0030	30,948	152	7.3	7.78	5.13	8.96	0.59
228-091792A	1D228	B-PINENE	3	M0010	48,273	219	14.9	1.03	1.11	9.31	0.12

TABLE 4-4. (continued)

Test code	Unit code	Pollutant[b]	No. of runs	Test method[c]	Stack gas parameters			Pollutant concentration, ppm	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
					Flow, dscfm	Temp., °F	Moisture, %				
228-091792A	1D228	B-PINENE	3	M0030	48,273	219	14.9	1.82	1.97	9.31	0.21
228-091792B	3D228	B-PINENE	3	M0010	38,306	254	23.3	12.00	9.75	12.31	0.79
228-091792B	3D228	B-PINENE	3	M0030	38,306	254	23.3	9.41	10.41	12.31	0.85
030-011993A	1D030	BENZALD	3	M0011	34,132	127	5.2	0.0219	0.0119	13.57	0.00088
030-012093A	2D030	BENZALD	3	M0011	30,870	155	8	0.0481	0.0248	6.28	0.0044
228-091692C	1D228	BENZALD	3	M0011	49,858	226	13.1	0.0958	0.0774	9.33	0.0082
228-091692E	3D228	BENZALD	3	M0011	37,421	248	21.4	2.22	1.41	11.88	0.12
030-011993F	1D030	BENZENE	3	M0030	31,870	132	5.8	0.00485	0.00177	15.67	0.00011
030-012093F	2D030	BENZENE	3	M0030	30,948	152	7.3	0.0080	0.00303	8.96	0.00033
228-091792B	3D228	BENZENE	1	M0030	38,306	254	23.3	0.0967	0.0572	12.31	0.0047
030-011993E	1D030	BIPHENYL	3	M0010	31,870	132	5.8	0.000269	0.00020	13.62	1.6E-05
030-012093E	2D030	BIPHENYL	3	M0010	30,948	152	7.3	0.000719	0.00054	8.59	6.1E-05
030-011993E	1D030	BIS-2EH-PH	3	M0010	31,870	132	5.8	0.000469	0.00086	13.62	6.4E-05
030-012093E	2D030	BIS-2EH-PH	3	M0010	30,948	152	7.3	0.00277	0.00523	8.59	0.00058
030-011993F	1D030	BROMOMET	3	M0030	31,870	132	5.8	0.000341	0.00015	15.67	9.4E-06
030-012093F	2D030	BROMOMET	3	M0030	30,948	152	7.3	0.000895	0.00041	8.96	4.6E-05
030-011993E	1D030	BUTBENPHTH	2	M0010	31,870	132	5.8	0.000432	0.00015	13.62	1.4E-05
030-011993A	1D030	BUTYLALDEH	3	M0011	34,132	127	5.2	0.0248	0.00907	13.57	0.00067
030-012093A	2D030	BUTYLALDEH	3	M0011	30,870	155	8	0.0763	0.0270	6.28	0.0054
228-091592A	3D228	BUTYLALDEH	3	M0011	32,142	261	24.4	0.816	0.356	12.49	0.029
228-091692C	1D228	BUTYLALDEH	3	M0011	49,858	226	13.1	0.0323	0.0178	9.33	0.0019
030-011993F	1D030	CARBDIS	3	M0030	31,870	132	5.8	0.000485	0.00018	15.67	1.2E-05
030-012093F	2D030	CARBDIS	2	M0030	30,948	152	7.3	0.000607	0.00023	8.96	2.4E-05
030-011993F	1D030	CARBTETCHL	3	M0030	31,870	132	5.8	0.000171	0.00012	15.67	7.8E-06
030-012093F	2D030	CARBTETCHL	3	M0030	30,948	152	7.3	0.000198	0.00015	8.96	1.6E-05
228-091792B	3D228	CHLOROFORM	2	M0030	38,306	254	23.3	0.00136	0.00128	12.31	0.00010

TABLE 4-4. (continued)

Test code	Unit code	Pollutant[b]	No. of runs	Test method[c]	Stack gas parameters			Pollutant concentration, ppm	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
					Flow, dscfm	Temp., °F	Moisture, %				
030-011993F	1D030	CHLOROMET	3	M0030	31,870	132	5.8	0.00293	0.00070	15.67	4.5E-05
030-012093F	2D030	CHLOROMET	3	M0030	30,948	152	7.3	0.00676	0.00165	8.96	0.00018
228-091592A	3D228	CROTONALDE	3	M0011	32,142	261	24.4	0.289	0.123	12.49	0.010
228-091692C	1D228	CROTONALDE	3	M0011	49,858	226	13.1	0.0145	0.00773	9.33	0.00082
228-091692E	3D228	CROTONALDE	3	M0011	37,421	248	21.4	0.289	0.123	11.88	0.010
030-011993E	1D030	CUMENE	3	M0010	31,870	132	5.8	0.000860	0.00049	13.62	3.7E-05
030-012093E	2D030	CUMENE	3	M0010	30,948	152	7.3	0.00152	0.00063	8.59	0.00010
228-091792B	3D228	CUMENE	3	M0030	38,306	254	23.3	0.0260	0.0252	12.31	0.0020
030-011993E	1D030	D-N-BUT-PH	3	M0010	31,870	132	5.8	0.000137	0.00018	13.62	1.4E-05
030-012093E	2D030	D-N-BUT-PH	3	M0010	30,948	152	7.3	0.000216	0.00029	8.59	3.3E-05
030-012093F	2D030	DMS	3	M0030	30,948	152	7.3	0.000219	0.00013	8.96	1.4E-05
030-011993F	1D030	ETYLBENZ	2	M0030	31,870	132	5.8	0.000112	5.80E-05	15.67	3.8E-06
030-011993A	1D030	FOR	3	M0011	34,132	127	5.2	1.36	0.209	13.57	0.015
030-012093A	2D030	FOR	3	M0011	30,870	155	8	2.11	0.312	6.28	0.064
039-102692A	1D039	FOR	3	TO-5	42,800	NS	NS	NS	0.00967	49.86	0.00017
039-102692B	XD039	FOR	3	TO-5	28,900	NS	NS	NS	0.0247	20.49	0.0012
039-102692C	YD039	FOR	3	TO-5	28,900	NS	NS	NS	0.0170	19.27	0.00087
039-102692D	5D039	FOR	3	TO-5	18,700	NS	NS	NS	0.0117	10.34	0.0012
045-041593A	1D045	FOR	2	TO-5	35,288	NS	NS	2.45	0.386	16.15	0.025
045-041593B	2D045	FOR	2	TO-5	30,445	NS	NS	2.45	0.347	23.17	0.017
166-092892A	3D166	FOR	3	N3500	33,673	NS	NS	3.58	0.563	6.00	0.088
166-092992A	4D166	FOR	3	N3500	30,406	NS	NS	2.81	0.403	10.33	0.039
167-021892A	4D167	FOR	8	N3500	30,038	184	19.5	2.97	0.421	8.65	0.049
167-082189A	3D167	FOR	3	N3500	31,300	194	12.1	1.47	0.233	9.07	0.026
167-102090A	4D167	FOR	3	N3500	31,900	177	15.4	2.53	0.387	11.86	0.033
167-102090B	4D167	FOR	3	N3500	33,200	157	14.6	5.43	0.850	11.05	0.076

TABLE 4-4. (continued)

Test code	Unit code	Pollutant[b]	No. of runs	Test method[c]	Stack gas parameters: Flow, dscfm	Stack gas parameters: Temp., °F	Stack gas parameters: Moisture, %	Pollutant concentration, ppm	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
167-102390A	5D167	FOR	3	N3500	31,200	205	14.4	8.17	1.200	11.32	0.11
228-091692C	1D228	FOR	3	M0011	49,858	226	13.1	0.775	0.177	9.33	0.019
228-091692E	3D228	FOR	3	M0011	37,421	248	21.4	11.1	2.00	11.88	0.17
030-011993A	1D030	HEXALD	1	M0011	34,132	127	5.2	0.0289	0.0154	13.57	0.0011
030-012093A	2D030	HEXALD	3	M0011	30,870	155	8	0.131	0.0652	6.28	0.016
228-091692C	1D228	HEXALD	3	M0011	49,858	226	13.1	0.0754	0.0578	9.33	0.0062
228-091692E	3D228	HEXALD	3	M0011	37,421	248	21.4	0.442	0.282	11.88	0.022
030-011993E	1D030	HYDROQUIN	2	M0010	31,870	132	5.8	0.00134	0.00069	13.62	6.0E-05
030-011993A	1D030	ISOVALALD	3	M0011	34,132	127	5.2	0.00727	0.00326	13.57	0.00024
030-012093A	2D030	ISOVALALD	3	M0011	30,870	155	8	0.0115	0.00480	6.28	0.00080
228-091692C	1D228	ISOVALALD	3	M0011	49,858	226	13.1	0.0156	0.0102	9.33	0.0011
228-091692E	3D228	ISOVALALD	3	M0011	37,421	248	21.4	0.418	0.215	11.88	0.0181
030-011993F	1D030	M-P-XYLENE	3	M0030	31,870	132	5.8	0.00255	0.00125	15.67	7.9E-05
030-012093F	2D030	M-P-XYLENE	3	M0030	30,948	152	7.3	0.00263	0.00136	8.96	0.00015
228-091792B	3D228	M-P-XYLENE	3	M0030	38,306	254	23.3	0.109	0.0931	12.31	0.0076
030-011993A	1D030	M-TOLALD	1	M0011	34,132	127	5.2	0.00541	0.00346	13.57	0.00025
030-012093A	2D030	M-TOLALD	2	M0011	30,870	155	8	0.00432	0.00254	6.28	0.00045
030-011993A	1D030	MEK	3	M0011	34,132	127	5.2	0.0235	0.00862	13.57	0.00063
030-011993F	1D030	MEK	3	M0030	31,870	132	5.8	0.00856	0.00275	15.67	0.00017
030-012093F	2D030	MEK	3	M0030	30,948	152	7.3	0.0744	0.0256	8.96	0.0031
228-091692C	1D228	MEK	2	M0011	49,858	226	13.1	0.00777	0.00424	9.33	0.00046
228-091692E	3D228	MEK	3	M0011	37,421	248	21.4	0.254	0.110	11.88	0.0092
202-071592C	XD202	METH	3	M18	41,100	150	4	34.3	3.57	19.11	0.19
202-071592D	1D202	METH	3	M18	27,500	167	3	1.33	0.0667	12.81	0.0052
202-071592E	2D202	METH	3	M18	28,900	181	3.4	54.0	3.93	11.38	0.35
030-011993F	1D030	METHENECHL	3	M0030	31,870	132	5.8	0.0269	0.0108	15.67	0.00071

TABLE 4-4. (continued)

Test code	Unit code	Pollutant[b]	No. of runs	Test method[c]	Stack gas parameters			Pollutant concentration, ppm	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
					Flow, dscfm	Temp., °F	Moisture, %				
030-012093F	2D030	METHENECHL	3	M0030	30,948	152	7.3	0.0126	0.00513	8.96	0.00060
228-091792A	1D228	METHENECHL	3	M0030	48,273	219	14.9	0.0433	0.0297	9.31	0.0032
228-091792B	3D228	METHENECHL	3	M0030	38,306	254	23.3	0.0387	0.0268	12.31	0.0022
228-091692E	3D228	N-BUTYRALD	3	M0011	37,421	248	21.4	0.816	0.356	11.88	0.030
030-012093F	2D030	N-HEXANE	3	M0030	30,948	152	7.3	0.000483	0.00024	8.96	2.6E-05
030-011993E	1D030	NITROBENZ	1	M0010	31,870	132	5.8	0.000284	0.00017	13.62	1.7E-05
228-091692C	1D228	O-TOLALD	3	M0011	49,858	226	13.1	0.00677	0.00614	9.33	0.00066
228-091692E	3D228	O-TOLALD	3	M0011	37,421	248	21.4	0.174	0.126	11.88	0.011
030-011993F	1D030	O-XYLENE	3	M0030	31,870	132	5.8	0.000187	9.27E-05	15.67	5.9E-06
030-012093F	2D030	O-XYLENE	3	M0030	30,948	152	7.3	0.000394	0.00020	8.96	2.3E-05
228-091792B	3D228	O-XYLENE	2	M0030	38,306	254	23.3	0.00656	0.00555	12.31	0.00045
030-011993E	1D030	P-CYMEME	3	M0010	31,870	132	5.8	0.0220	0.0139	13.62	0.0011
030-011993F	1D030	P-CYMEME	3	M0030	31,870	132	5.8	0.0484	0.0304	15.67	0.0019
030-012093E	2D030	P-CYMEME	3	M0010	30,948	152	7.3	0.114	0.0741	8.59	0.0086
030-012093F	2D030	P-CYMEME	3	M0030	30,948	152	7.3	0.177	0.115	8.96	0.013
228-091792A	1D228	P-CYMEME	3	M0010	48,273	219	14.9	0.00850	0.00908	9.31	0.00098
228-091792A	1D228	P-CYMEME	3	M0030	48,273	219	14.9	0.0186	0.0200	9.31	0.0022
228-091792B	3D228	P-CYMEME	2	M0010	38,306	254	23.3	0.104	0.0813	12.31	0.0066
228-091792B	3D228	P-CYMEME	3	M0030	38,306	254	23.3	0.169	0.183	12.31	0.015
228-091692C	1D228	P-TOLALD	3	M0011	49,858	226	13.1	0.0472	0.0434	9.33	0.0046
228-091692E	3D228	P-TOLALD	3	M0011	37,421	248	21.4	0.435	0.310	11.88	0.026
228-091592A	3D228	PROPIONALD	3	M0011	32,142	261	24.4	0.365	0.128	12.49	0.010
228-091692C	1D228	PROPIONALD	3	M0011	49,858	226	13.1	0.00829	0.00368	9.33	0.00039
228-091692E	3D228	PROPIONALD	3	M0011	37,421	248	21.4	0.365	0.128	11.88	0.011
030-012093F	2D030	STYRENE	3	M0030	30,948	152	7.3	0.00205	0.00103	8.96	0.00012
228-091792B	3D228	STYRENE	2	M0030	38,306	254	23.3	0.00529	0.00441	12.31	0.00036

TABLE 4-4. (continued)

Test code	Unit code	Pollutant[b]	No. of runs	Test method[c]	Stack gas parameters			Pollutant concentration, ppm	Emission rate, lb/hr	Process rate, ODTH	Emission factor, lb/ODT
					Flow, dscfm	Temp., °F	Moisture, %				
030-012093F	2D030	T1-4-DCBUT	1	M0030	30,948	152	7.3	0.000346	0.00021	8.96	2.4E-05
030-011993F	1D030	TOLUENE	3	M0030	31,870	132	5.8	0.0110	0.00479	15.67	0.00031
030-012093F	2D030	TOLUENE	3	M0030	30,948	152	7.3	0.0611	0.0272	8.96	0.0031
228-091792A	1D228	TOLUENE	3	M0030	48,273	219	14.9	0.0164	0.0118	9.31	0.0012
228-091792B	3D228	TOLUENE	3	M0030	38,306	254	23.3	0.351	0.261	12.31	0.021
030-011993A	1D030	VALALD	3	M0011	34,132	127	5.2	0.0404	0.0210	13.57	0.0016
030-012093A	2D030	VALALD	3	M0011	30,870	155	8	0.0778	0.0332	6.28	0.0074
228-091692C	1D228	VALALD	3	M0011	49,858	226	13.1	0.0566	0.0373	9.33	0.0040
228-091692E	3D228	VALALD	3	M0011	37,421	248	21.4	0.324	0.168	11.88	0.014
030-012093F	2D030	VINYLACET	1	M0030	30,948	152	7.3	0.000691	0.00029	8.96	2.9E-05

[a]Reference 8. NS = not specified. ODTH = oven-dried tons per hour. Lb/ODT = pounds of pollutant per oven-dried ton of wood material out of dryer.
[b]Pollutant codes are identified in Table 4-6.
[c]Test methods: M18 = EPA Method 18; M0010 = SW-846 Method 0010 (semi-VOST); M0011 = BIF Method 0011 (aldehydes and ketones); M0030 = SW-846 Method 0030 (VOST); T0-5 = TO-5 (from Compendiuim of Methods for the Determination of Toxic Organic Compounds in Ambient Air); N3500 = NIOSH Method 3500.

TABLE 4-5. SUMMARY OF EMISSION FACTORS FOR PARTICLEBOARD DRYERS FROM NCASI DATA BASE--SPECIATED ORGANICS[a]

Test code	Unit code	Pollutant[b]	Firing type[c]	Fuel type[d]	Wood species[e]				Moisture content, %		Temp., °F		Emission control device[f]	No. of runs	Emission factor, lb/ODT	Data rating
					Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
030-011993F	1D030	111-T-CH-E	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	7.5E-06	A
030-012093F	2D030	111-T-CH-E	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	1.6E-05	A
030-011993E	1D030	124TMBENZ	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	3	6.4E-05	A
030-012093E	2D030	124TMBENZ	DFIRE	WREF	PINE SP	95	HWOOD	5	19.9	6.1	464	158	CYC	3	0.00011	A
030-011993A	1D030	2-5-DMBENZ	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	3	3.3E-05	A
228-091692C	1D228	2-5-DMBENZ	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.0015	B
228-091692E	3D228	2-5-DMBENZ	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.0053	A
030-011993F	1D030	4-M-2-PENT	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	3.3E-05	A
030-012093F	2D030	4-M-2-PENT	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.00013	A
030-012093E	2D030	44METDIAN	DFIRE	WREF	PINE SP	95	HWOOD	5	19.9	6.1	464	158	CYC	1	3.3E-05	D
030-011993E	1D030	A-PINENE	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	3	0.017	C
030-011993F	1D030	A-PINENE	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	0.084	C
030-012093E	2D030	A-PINENE	DFIRE	WREF	PINE SP	95	HWOOD	5	19.9	6.1	464	158	CYC	3	0.076	C
030-012093F	2D030	A-PINENE	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	1.671	C
228-091792A	1D228	A-PINENE	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	8.0	630	220	EFB	3	0.36	A
228-091792A	1D228	A-PINENE	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	8.0	630	220	EFB	3	0.57	A
228-091792B	3D228	A-PINENE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	3	2.3	A
228-091792B	3D228	A-PINENE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	3	1.6	A
030-011993E	1D030	A-TERPINE	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	3	0.032	C
030-012093E	2D030	A-TERPINE	DFIRE	WREF	PINE SP	95	HWOOD	5	19.9	6.1	464	158	CYC	3	0.10	C
228-091792A	1D228	A-TERPINE	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	8.0	630	220	EFB	3	0.053	A
228-091792B	3D228	A-TERPINE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	3	0.17	A
030-011993A	1D030	ACETALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	1	0.0025	D
030-012093A	2D030	ACETALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.2	6.6	418	159	CYC	3	0.0096	C

TABLE 4-5. (continued)

Test code	Unit code	Pollutant[b]	Firing type[c]	Fuel type[d]	Wood species[e]				Moisture content, %		Temp., °F		Emission control device[f]	No. of runs	Emission factor, lb/ODT	Data rating
					Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
228-091592A	3D228	ACETALD	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	3	0.070	A
228-091692C	1D228	ACETALD	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.0052	A
228-091692E	3D228	ACETALD	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.074	A
030-011993A	1D030	ACETONE	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	3	0.010	A
030-011993F	1D030	ACETONE	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	0.0018	C
030-012093A	2D030	ACETONE	DFIRE	WREF	PINE SP	95	HWOOD	5	22.2	6.6	418	159	CYC	1	0.034	D
030-012093F	2D030	ACETONE	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.011	A
228-091592A	3D228	ACETONE	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	3	0.092	A
228-091692C	1D228	ACETONE	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.013	A
228-091692E	3D228	ACETONE	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.096	A
228-091792A	1D228	ACETONE	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	8.0	630	220	EFB	3	0.032	A
228-091792B	3D228	ACETONE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	3	0.287	A
030-011993E	1D030	ACETPH	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	3	3.1E-05	A
030-012093E	2D030	ACETPH	DFIRE	WREF	PINE SP	95	HWOOD	5	19.9	6.1	464	158	CYC	2	9.8E-05	B
030-011993A	1D030	ACROLEIN	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	3	0.00041	A
030-011993F	1D030	ACROLEIN	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	0.0017	C
030-012093A	2D030	ACROLEIN	DFIRE	WREF	PINE SP	95	HWOOD	5	22.2	6.6	418	159	CYC	3	0.0027	A
030-012093F	2D030	ACROLEIN	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.0083	C
228-091592A	3D228	ACROLEIN	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	3	0.022	A
228-091692C	1D228	ACROLEIN	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.00081	A
228-091692E	3D228	ACROLEIN	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.024	A
030-011993F	1D030	ACRYLNIT	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	4.3E-05	C
030-012093F	2D030	ACRYLNIT	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.00013	C
030-011993E	1D030	B-PINENE	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	3	0.010	C

TABLE 4-5. (continued)

Test code	Unit code	Pollutant[b]	Firing type[c]	Fuel type[d]	Wood species[e] Primary	%	Secon.	%	Moisture content, % Inlet	Outlet	Temp., °F Inlet	Outlet	Emission control device[f]	No. of runs	Emission factor, lb/ODT	Data rating
030-011993F	1D030	B-PINENE	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	0.020	C
030-012093E	2D030	B-PINENE	DFIRE	WREF	PINE SP	95	HWOOD	5	19.9	6.1	464	158	CYC	3	0.043	C
030-012093F	2D030	B-PINENE	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.59	C
228-091792A	1D228	B-PINENE	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	8.0	630	220	EFB	3	0.12	A
228-091792A	1D228	B-PINENE	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	8.0	630	220	EFB	3	0.21	A
228-091792B	3D228	B-PINENE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	3	0.79	A
228-091792B	3D228	B-PINENE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	3	0.85	A
030-011993A	1D030	BENZALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	3	0.00088	A
030-012093A	2D030	BENZALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.2	6.6	418	159	CYC	3	0.0044	A
228-091692C	1D228	BENZALD	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.0082	A
228-091692E	3D228	BENZALD	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.12	A
030-011993F	1D030	BENZENE	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	0.00011	A
030-012093F	2D030	BENZENE	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.00033	A
228-091792B	3D228	BENZENE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	1	0.0047	D
030-011993E	1D030	BIPHENYL	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	3	1.6E-05	A
030-012093E	2D030	BIPHENYL	DFIRE	WREF	PINE SP	95	HWOOD	5	19.9	6.1	464	158	CYC	3	6.1E-05	A
030-011993E	1D030	BIS-2EH-PH	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	3	6.4E-05	A
030-012093E	2D030	BIS-2EH-PH	DFIRE	WREF	PINE SP	95	HWOOD	5	19.9	6.1	464	158	CYC	3	0.00058	A
030-011993F	1D030	BROMOMET	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	9.4E-06	A
030-012093F	2D030	BROMOMET	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	4.6E-05	A
030-011993E	1D030	BUTBENPHTH	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	2	1.4E-05	B
030-011993A	1D030	BUTYLALDEH	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	3	0.00067	A
030-012093A	2D030	BUTYLALDEH	DFIRE	WREF	PINE SP	95	HWOOD	5	22.2	6.6	418	159	CYC	3	0.0054	A
228-091592A	3D228	BUTYLALDEH	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	3	0.029	A

TABLE 4-5. (continued)

Test code	Unit code	Pollutant[b]	Firing type[c]	Fuel type[d]	Wood species[e]				Moisture content, %		Temp., °F		Emission control device[f]	No. of runs	Emission factor, lb/ODT	Data rating
					Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
228-091692C	1D228	BUTYLALDEH	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.0019	A
030-011993F	1D030	CARBDIS	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	1.2E-05	A
030-012093F	2D030	CARBDIS	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	2	2.4E-05	B
030-011993F	1D030	CARBTETCHL	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	7.8E-06	A
030-012093F	2D030	CARBTETCHL	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	1.6E-05	A
228-091792B	3D228	CHLOROFORM	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	2	0.00010	B
030-011993F	1D030	CHLOROMET	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	4.5E-05	A
030-012093F	2D030	CHLOROMET	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.00018	A
228-091592A	3D228	CROTONALDE	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	3	0.010	A
228-091692C	1D228	CROTONALDE	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.00082	A
228-091692E	3D228	CROTONALDE	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.010	A
030-011993E	1D030	CUMENE	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	3	3.7E-05	A
030-012093E	2D030	CUMENE	DFIRE	WREF	PINE SP	95	HWOOD	5	19.9	6.1	464	158	CYC	3	0.00010	A
228-091792B	3D228	CUMENE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	3	0.0020	A
030-011993E	1D030	D-N-BUT-PH	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	3	1.4E-05	A
030-012093E	2D030	D-N-BUT-PH	DFIRE	WREF	PINE SP	95	HWOOD	5	19.9	6.1	464	158	CYC	3	3.3E-05	A
030-012093F	2D030	DMS	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	1.4E-05	A
030-011993F	1D030	ETYLBENZ	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	2	3.8E-06	B
030-011993A	1D030	FOR	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	3	0.015	A
030-012093A	2D030	FOR	DFIRE	WREF	PINE SP	95	HWOOD	5	22.2	6.6	418	159	CYC	3	0.064	A
039-102692A	1D039	FOR	DFIRE	WREF	HWOOD	55	SWOOD	45	95.0	65.0	650	165	EFB	3	0.00017	A
039-102692B	XD039	FOR	DFIRE	WREF	HWOOD	55	SWOOD	45	65.0	5.0	592	286	MCLO	3	0.0012	A
039-102692C	YD039	FOR	DFIRE	WREF	HWOOD	55	SWOOD	45	65.0	5.0	571	267	MCLO	3	0.00087	A
039-102692D	5D039	FOR	DFIRE	SDUST	HWOOD	55	SWOOD	45	65.0	5.0	603	253	MCLO	3	0.0012	A

TABLE 4-5. (continued)

Test code	Unit code	Pollutant[b]	Firing type[c]	Fuel type[d]	Wood species[e] Primary	%	Secon.	%	Moisture content, % Inlet	Outlet	Temp., °F Inlet	Outlet	Emission control device[f]	No. of runs	Emission factor, lb/ODT	Data rating
045-041593A	1D045	FOR	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.8	6.6	220	116	CYC	2	0.025	B
045-041593B	2D045	FOR	DFIRE	SDUST	SY PINE	98	HWOOD	2	12.0	4.7	490	140	CYC	2	0.017	B
166-092892A	3D166	FOR	DFIRE	NS	NS		NS		105.0	22.5	871	193	EFB	3	0.088	D
166-092992A	4D166	FOR	DFIRE	NS	NS		NS		126.0	24.7	854	175	EFB	3	0.039	D
167-021892A	4D167	FOR	DFIRE	SDUST	HWOOD	100	NA		86.7	2.8	887	210	EFB	8	0.049	D
167-082189A	3D167	FOR	DFIRE	SDUST	HWOOD	100	NA		38.0	2.3	710	212	MCLO	3	0.026	D
167-102090A	4D167	FOR	DFIRE	SDUST	HWOOD	100	NA		36.3	3.3	921	201	EFB	3	0.033	D
167-102090B	4D167	FOR	DFIRE	SDUST	HWOOD	100	NA		40.3	3.2	888	203	EFB	3	0.076	D
167-102390A	5D167	FOR	DFIRE	SDUST	HWOOD	65	PINE SP	35	34.0	4.7	822	229	EFB	3	0.11	D
228-091692C	1D228	FOR	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.019	A
228-091692E	3D228	FOR	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.17	A
030-011993A	1D030	HEXALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	1	0.0011	D
030-012093A	2D030	HEXALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.2	6.6	418	159	CYC	3	0.016	A
228-091692C	1D228	HEXALD	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.0062	A
228-091692E	3D228	HEXALD	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.022	A
030-011993E	1D030	HYDROQUIN	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	2	6.0E-05	B
030-011993A	1D030	ISOVALALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	3	0.00024	A
030-012093A	2D030	ISOVALALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.2	6.6	418	159	CYC	3	0.00080	A
228-091692C	1D228	ISOVALALD	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.0011	A
228-091692E	3D228	ISOVALALD	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.0181	A
030-011993F	1D030	M-P-XYLENE	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	7.9E-05	A
030-012093F	2D030	M-P-XYLENE	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.00015	A
228-091792B	3D228	M-P-XYLENE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	3	0.0076	A
030-011993A	1D030	M-TOLALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	1	0.00025	D

TABLE 4-5. (continued)

Test code	Unit code	Pollutant[b]	Firing type[c]	Fuel type[d]	Wood species[e]				Moisture content, %		Temp., °F		Emission control device[f]	No. of runs	Emission factor, lb/ODT	Data rating
					Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
030-012093A	2D030	M-TOLALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.2	6.6	418	159	CYC	2	0.00045	B
030-011993A	1D030	MEK	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	3	0.00063	A
030-011993F	1D030	MEK	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	0.00017	A
030-012093F	2D030	MEK	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.0031	A
228-091692C	1D228	MEK	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	2	0.00046	B
228-091692E	3D228	MEK	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.0092	A
202-071592C	XD202	METH	BOTH	NGAS	PINE SP	75	DFIR	10	13.5	2.0	NS	NS	EFB	3	0.19	A
202-071592D	1D202	METH	BOTH	NGAS	PINE SP	75	DFIR	10	13.5	2.0	NS	NS	CYC	3	NS	NR
202-071592E	2D202	METH	BOTH	NGAS	PINE SP	75	DFIR	10	13.5	2.0	NS	NS	CYC	3	0.35	A
030-011993F	1D030	METHENECHL	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	0.00071	A
030-012093F	2D030	METHENECHL	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.00060	A
228-091792A	1D228	METHENECHL	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	8.0	630	220	EFB	3	0.0032	A
228-091792B	3D228	METHENECHL	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	3	0.0022	A
228-091692E	3D228	N-BUTYRALD	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.030	A
030-012093F	2D030	N-HEXANE	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	2.6E-05	A
030-011993E	1D030	NITROBENZ	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	1	1.7E-05	D
228-091692C	1D228	O-TOLALD	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.00066	A
228-091692E	3D228	O-TOLALD	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.011	A
030-011993F	1D030	O-XYLENE	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	5.9E-06	A
030-012093F	2D030	O-XYLENE	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	2.3E-05	A
228-091792B	3D228	O-XYLENE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	2	0.00045	B
030-011993E	1D030	P-CYMEME	DFIRE	WREF	PINE SP	95	HWOOD	5	19.7	7.7	248	125	CYC	3	0.0011	C
030-011993F	1D030	P-CYMEME	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	0.0019	C
030-012093E	2D030	P-CYMEME	DFIRE	WREF	PINE SP	95	HWOOD	5	19.9	6.1	464	158	CYC	3	0.0086	C

TABLE 4-5. (continued)

Test code	Unit code	Pollutant[b]	Firing type[c]	Fuel type[d]	Wood species[e]				Moisture content, %		Temp., °F		Emission control device[f]	No. of runs	Emission factor, lb/ODT	Data rating
					Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
030-012093F	2D030	P-CYMEME	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.013	C
228-091792A	1D228	P-CYMEME	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	8.0	630	220	EFB	3	0.00098	A
228-091792A	1D228	P-CYMEME	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	8.0	630	220	EFB	3	0.0022	A
228-091792B	3D228	P-CYMEME	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	2	0.0066	B
228-091792B	3D228	P-CYMEME	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	3	0.015	A
228-091692C	1D228	P-TOLALD	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.0046	A
228-091692E	3D228	P-TOLALD	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.026	A
228-091592A	3D228	PROPIONALD	DFIRE	SDUST	PINE SP	100	NA		108.0	2.2	990	260	EFB	3	0.010	A
228-091692C	1D228	PROPIONALD	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.00039	A
228-091692E	3D228	PROPIONALD	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.011	A
030-012093F	2D030	STYRENE	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.00012	A
228-091792B	3D228	STYRENE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	2	0.00036	B
030-012093F	2D030	T1-4-DCBUT	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	1	2.4E-05	D
030-011993F	1D030	TOLUENE	DFIRE	WREF	PINE SP	95	HWOOD	5	20.6	8.4	258	127	CYC	3	0.00031	A
030-012093F	2D030	TOLUENE	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	3	0.0031	A
228-091792A	1D228	TOLUENE	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	8.0	630	220	EFB	3	0.0012	A
228-091792B	3D228	TOLUENE	DFIRE	SDUST	PINE SP	100	NA		111.0	2.6	1003	260	EFB	3	0.021	A
030-011993A	1D030	VALALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.6	8.2	237	125	CYC	3	0.0016	A
030-012093A	2D030	VALALD	DFIRE	WREF	PINE SP	95	HWOOD	5	22.2	6.6	418	159	CYC	3	0.0074	C
228-091692C	1D228	VALALD	DFIRE	SDUST	PINE SP	60	HWOOD	40	85.2	6.6	730	230	EFB	3	0.0040	A

TABLE 4-5. (continued)

Test code	Unit code	Pollutant[b]	Firing type[c]	Fuel type[d]	Wood species[e]				Moisture content, %		Temp., °F		Emission control device[f]	No. of runs	Emission factor, lb/ODT	Data rating
					Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
228-091692E	3D228	VALALD	DFIRE	SDUST	PINE SP	100	NA		105.3	2.5	973	253	EFB	3	0.014	A
030-012093F	2D030	VINYLACET	DFIRE	WREF	PINE SP	95	SWOOD	5	20.2	6.5	459	155	CYC	1	2.9E-05	D

[a]Reference 8. NS = not specified; NA = not applicable. Lb\ODT = pounds of pollutant per oven-dried ton of wood material out of dryer.
[b]Pollutant codes are identified in Table 4-6.
[c]Firing types: DFIRE = direct firing; BOTH = combination of direct and indirect firing .
[d]Fuel types: SDUST = sanderdust; WREF = wood residue; NGAS = natural gas.
[e]Wood species: SY PINE = Southern Yellow Pine; PINE SP = unknown pine species; DFIR = Douglas Fir; UFIR = unspecified fir; SWOOD = unspecified softwood; ASPEN = Aspen; HWOOD = unspecified hardwood; UWOOD = unspecified wood from urban recycling.
[f]Emission control devices: CYC = cyclone; MCLO = multiclone; EFB = electrified filter bed.

TABLE 4-6. POLLUTANT CODES

Code	Pollutant
111-T-CH-E	1,1,1-Trichloroethane
124TMBENZ	1,2,4-Trimethyl benzene
2-5-DMBENZ	2,5 Dimethyl benzaldehyde
4-M-2-PENT	4-Methyl-2-pentanone
44METDIAN	4,4 Methylene dianiline
A-PINENE	Alpha ainene
A-TERPENE	Alpha terpeneol
ACETALD	Acetaldehyde
ACETONE	Acetone
ACETPH	Acetophenone
ACROLEIN	Acrolein
ACRYLNIT	Acrylonitrile
ALD/KET	Aldehydes/Ketones
B-PINENE	Beta pinene
BENZALD	Benzaldehyde
BENZENE	Benzene
BIPHENYL	Biphenyl
BIS-2EH-PH	Bis-(2-ethylhexyl phthalate)
BROMOMET	Bromomethane
BUTBENPHTH	Butylbenzyl phthalate
BUTYLALDEH	Butylaldehyde
CARBDIS	Carbon disulfide
CARBTETCHL	Carbon tetrachloride
CHLOROFORM	Chloroform
CHLOROMET	Chloromethane
CO	Carbon monoxide
CO2	Carbon dioxide
CPM	Condensible PM
CPM-I	Inorganic fraction of condensible PM
CPM-O	Organic fraction of condensible PM
CROTONALDE	Crotonaldehyde
D-N-BUT-PH	Di-n-butyl phthalate
DBM	Dibromomethane
DMS	Dimethyl sulfide
ETYLBENZ	Ethyl benzene
FOR	Formaldehyde

Code	Pollutant
HEXALD	Hexaldehyde
HYDROQUIN	Hydroquinone
ISOOCTANE	Isooctane
ISOVALALD	Isovaleraldehyde
M-P-XYLENE	m,p xlene
M-TOLALD	m-tolualdehyde
MDI	Methylene bisphenyl isocyanate
MEK	Methyl ethyl ketone
METH	Methane
METHENECHL	Methylene chloride
N-BUTYRALD	N-butyraldehyde
N-HEXANE	N-hexane
NAPHTHALENE	Naphthalene
NITROBENZ	Nitrobenzene
NOX	Nitrogen oxides
O-TOLALD	o-tolualdehyde
O-XYLENE	o-xylene
P-CYMEME	p-cymene
P-TOLALD	p-tolualdehyde
PHENOL	Phenol
PM	Filterable particulate matter
PM10	PM-10, PM less than 10 micrometers
PM2.5	PM less than 2.5 micrometers
PM1.0	PM les than 1.0 micrometers
PM10&CPM	PM-10 and condensible PM
PROPIONALD	Propionaldehyde
SO2	Sulfur dioxide
STYRENE	Styrene
T-FL-METH	Trichlorofluoromethane
T1-4-DCBUT	Trans 1,4 dichlorobutene
TOLUENE	Toluene
VALALD	Valeraldehyde
VINYLACET	Vinyl acetate
VOC	Volatile organic compounds

TABLE 4-7. SUMMARY OF PARTICLEBOARD PRESS DESIGN AND EMISSION DATA FROM NCASI DATA BASE[a]

Test code	Unit code	Press size		No. of vents	Pollutant[b]	Test method[c]	No. of runs	Stack parameters			Pollutant concentration		Emission rate, lb/hr	Process rate, MSF 3/4/hr	Emission factor, lb/MSF 3/4
		Dim., ft	No. of open.					Flow, dscfm	Temp., °F	Moist., %	ppm	gr/dscf			
030-012193B	1P030	4x24	14	3	PM	M5	1	119,304	80	1.9	NA	NS	1.43	17.4	0.082
228-091992J	1P228	10x25	5	6	PM	M5	3	60,905	111	2.9	NA	0.482	0.467	15.8	0.030
228-091992J	1P228	10x25	5	6	PM10	M201A	3	60,905	111	2.9	NA	0.00063	0.249	15.8	0.016
166-100892A	1P166	4x16	10	4	PM&CPM	OD8	3	120,430	NS	NS	NA	0.0055	6.50	7.4	0.93
166-100892B	2P166	5x24	14	4	PM&CPM	OD8	2	122,660	NS	NS	NA	NS	6.00	19.2	0.30
228-091992J	1P228	10x25	5	6	PM10&CPM	M201A/202	3	60,905	111	2.9	NA	0.00294	1.19	15.8	0.077
030-012193C	1P030	4x24	14	3	VOC	M25A	3	121,425	NS	NS	73.1	NA	17.6	14.3	1.2
039-102692E	1P039	8x28	14	7	VOC	M25A	3	177,200	NS	NS	NS	NA	20.2	33.0	0.58
166-100892A	1P166	4x16	10	4	VOC	M25A	2	120,430	NS	NS	17.2	NA	5.20	7.4	0.87
166-100892B	2P166	5x24	14	4	VOC	M25A	2	122,660	NS	NS	31.5	NA	9.70	19.2	0.49
167-102190B	1P167	NS	NS	4	VOC	M25A	3	27,441	92	3.5	30.5	NA	1.44	10.0	0.15
167-102588B	1P167	NS	NS	4	VOC	M25	3	29,503	86	1.4	84.9	NA	4.29	8.3	0.52
228-091992K	1P228	10x25	5	6	VOC	M25A	3	56,533	NS	NS	104.3	NA	13.0	16.1	0.82
039-102692E	1P039	8x28	14	7	CO	M10	3	177,200	NS	NS	NS	NA	3.69	33.0	0.11
166-100892A	1P166	4x16	10	4	CO	M10	1	120,430	NS	NS	1.0	NA	0.400	7.4	0.057
166-100892B	2P166	5x24	14	4	CO	M10	1	122,660	NS	NS	1.0	NA	0.500	19.2	0.025
030-012193A	1P030	4x24	14	3	2-5-DMBENZ	M0011	2	122,572	77	1.33	0.0328	NA	0.00419	14.7	0.00032
030-012193A	1P030	4x24	14	3	ACETALD	M0011	3	122,572	77	1.33	0.492	NA	0.414	14.7	0.034
228-091992H	1P228	10x25	5	6	ACETALD	M0011	3	56,546	113	3.2	0.198	NA	0.0767	16.1	0.0049
030-012193A	1P030	4x24	14	3	ACETONE	M0011	3	122,572	77	1.33	0.219	NA	0.235	14.7	0.017
228-091992H	1P228	10x25	5	6	ACETONE	M0011	3	56,546	113	3.2	0.2673	NA	0.134	16.1	0.0082
030-012193A	1P030	4x24	14	3	ACROLEIN	M0011	3	122,572	77	1.33	0.0347	NA	0.0369	14.7	0.0025
228-091992H	1P228	10x25	5	6	ACROLEIN	M0011	3	56,546	113	3.2	0.0414	NA	0.0200	16.1	0.0013
030-012193A	1P030	4x24	14	3	BENZALD	M0011	3	122,572	77	1.33	0.0210	NA	0.0420	14.7	0.0030
228-091992H	1P228	10x25	5	6	BENZALD	M0011	3	56,546	113	3.2	0.0242	NA	0.0224	16.1	0.0015

TABLE 4-7. (continued)

Test code	Unit code	Press size: Dim., ft	Press size: No. of open.	No. of vents	Pollutant[b]	Test method[c]	No. of runs	Stack parameters: Flow, dscfm	Stack parameters: Temp., °F	Stack parameters: Moist., %	Pollutant concentration: ppm	Pollutant concentration: gr/dscf	Emission rate, lb/hr	Process rate, MSF 3/4/hr	Emission factor, lb/MSF 3/4
030-012193A	1P030	4x24	14	3	BUTYLALDEH	M0011	3	122,572	77	1.33	0.0321	NA	0.0439	14.7	0.0031
228-091992H	1P228	10x25	5	6	BUTYLALDEH	M0011	3	56,546	113	3.2	0.0361	NA	0.0225	16.1	0.0014
228-091992H	1P228	10x25	5	6	CROTONALDE	M0011	3	56,546	113	3.2	0.0133	NA	0.00794	16.1	0.00050
030-012193A	1P030	4x24	14	3	FOR	M0011	3	122,572	77	1.33	12.1	NA	6.87	14.7	0.49
039-102692E	1P039	8x28	14	7	FOR	TO-5	3	177,200	NS	NS	NS	NA	1.84	33.0	0.056
166-100892A	1P166	4x16	10	4	FOR	N3500	3	120,430	NS	NS	NS	NA	2.03	7.4	0.28
166-100892B	2P166	5x24	14	4	FOR	N3500	2	122,660	NS	NS	NS	NA	5.55	19.2	0.29
167-102190B	1P167	NS	NS	4	FOR	N3500	3	27,441	92	3.5	1.5	NA	0.177	10.0	0.018
167-102588B	1P167	NS	NS	4	FOR	N3500	3	29,503	86	1.4	11.9	NA	1.50	8.3	0.18
202-030194A	1P202	NS	NS	4	FOR	M0011	1	77,300	NS	NS	6.85	NA	0.980	12.2	0.077
202-030194B	2P202	NS	NS	5	FOR	M0011	1	48,100	NS	NS	5.88	NA	1.58	14.2	0.11
228-091992H	1P228	10x25	5	6	FOR	M0011	3	56,546	113	3.2	23.4	NA	6.20	16.1	0.40
030-012193A	1P030	4x24	14	3	HEXALD	M0011	3	122,572	77	1.33	0.155	NA	0.292	14.7	0.020
228-091992H	1P228	10x25	5	6	HEXALD	M0011	3	56,546	113	3.2	0.0886	NA	0.0773	16.1	0.0047
030-012193A	1P030	4x24	14	3	ISOVALALD	M0011	3	122,572	77	1.33	0.00923	NA	0.0149	14.7	0.00094
228-091992H	1P228	10x25	5	6	ISOVALALD	M0011	3	56,546	113	3.2	0.0240	NA	0.0204	16.1	0.0013
228-091992H	1P228	10x25	5	6	MEK	M0011	2	56,546	113	3.2	0.00819	NA	0.00513	16.1	0.00032
228-091992H	1P228	10x25	5	6	PROPIONALD	M0011	2	56,546	113	3.2	0.00410	NA	0.00105	16.1	7.2E-05
030-012193A	1P030	4x24	14	3	VALALD	M0011	3	122,572	77	1.33	0.0514	NA	0.0834	14.7	0.0058
228-091992H	1P228	10x25	5	6	VALALD	M0011	3	56,546	113	3.2	0.0433	NA	0.0323	16.1	0.0020

[a]Reference 8. NS = not specified; NA = not applicable. MSF = thousand square feet. Lb/MSF 3/4 = pounds of pollutant per thousand square feet of 3/4-in. thick panel.
[b]Pollutant codes are identified in Table 4-6. Factors for VOC on a carbon basis.
[c]Test methods: M5 = EPA Method 5; OD7 = Oregon Department of Environmental Quality (ODEQ) Method 7; OD8 = ODEQ Method 8; M201A = EPA Method 201A; M202 = EPA Method 202; M3 = EPA Method 3; M10 = EPA Method 10; M7 = EPA Method 7; M7C = EPA Method 7C; M7E = EPA Method 7E; M25A = EPA Method 25A; M25AM = Modified EPA Method 25A; M6 = EPA Method 6; M18 = EPA Method 18; M0010 = SW-846 Method 0010 (semi-VOST); M0011 = BIF Method 0011 (aldehydes and ketones); M0030 = SW-846 Method 0030 (VOST); T0-5 = TO-5 (from Compendiuim of Methods for the Determination of Toxic Organic Compounds in Ambient Air); N3500 = NIOSH Method 3500.

TABLE 4-8. PARTICLEBOARD PRESS EMISSION FACTOR SUMMARY FROM NCASI DATA BASE[a]

Test code	Unit code	Press: Temp., °F	Press: Cycle, min	Board: Thick, in.	Board: Density, lb/ft^3	Moist. cont., %	Wood species[b]: Primary	%	Second.	%	Adhesive/resin: Type	Applic. rate	Cat/ Sav.?[c]	Wax applic. rate	Pollutant[d]	Emission factor, lb/MSF 3/4	Data rating
030-012193B	1P030	310	NS	3/4	53	NA	SY PINE	NS	NS	NS	UF	7.1%	Y	NS	PM	0.082	D
228-091992J	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.42 Mlb/hr	Y	123 lb/hr	PM	0.030	B
228-091992J	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.42 Mlb/hr	Y	123 lb/hr	PM10	0.016	B
166-100892A	1P166	NS	NS	NS	NS	NS	NS	NS	NS	NS	UF	NS	NS	NS	PM&CPM	0.93	B
166-100892B	2P166	NS	NS	NS	NS	NS	NS	NS	NS	NS	UF	NS	NS	NS	PM&CPM	0.30	B
228-091992J	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.42 Mlb/hr	Y	123 lb/hr	PM10&CPM	0.077	B
030-012193C	1P030	310	NS	NS	53	NS	SY PINE	NS	NS	NS	UF	7.5%	Y	NS	VOC	1.2	A
039-102692E	1P039	330	3.8	5/8	43	10	HWOOD	55	SWOOD	45	UF	10.4 lb/ 100 lb	Y	0.6%	VOC	0.58	B
166-100892A	1P166	NS	NS	NS	NS	NS	NS	NS	NS	NS	UF	NS	NS	NS	VOC	0.87	B
166-100892B	2P166	NS	NS	NS	NS	NS	NS	NS	NS	NS	UF	NS	NS	NS	VOC	0.49	B
167-102190B	1P167	0	NS	1.625	NS	45	ASPEN	NS	MAPLE	NS	UF	NS	NS	NS	VOC	0.15	B
167-102588B	1P167	NS	NS	1.5	NS	NS	HWOOD	100	NS	NS	UF	NS	NS	NS	VOC	0.52	A
228-091992K	1P228	350	4.21	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	116 lb/hr	VOC	0.82	A
039-102692E	1P039	330	3.8	5/8	43	10	HWOOD	55	SWOOD	45	UF	10.4 lb/ 100 lb	Y	0.6%	CO	0.11	B
166-100892A	1P166	NS	NS	NS	NS	NS	NS	NS	NS	NS	UF	NS	NS	NS	CO	0.057	D
166-100892B	2P166	NS	NS	NS	NS	NS	NS	NS	NS	NS	UF	NS	NS	NS	CO	0.025	D
030-012193A	1P030	310	NS	9/16	53	NS	SY PINE	NS	NS	NS	UF	7.8%	S	NS	2-5-DMBENZ	0.00032	B
030-012193A	1P030	310	NS	9/16	53	NS	SY PINE	NS	NS	NS	UF	7.8%	S	NS	ACETALD	0.034	A
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	ACETALD	0.0049	B
030-012193A	1P030	310	NS	9/16	53	NS	SY PINE	NS	NS	NS	UF	7.8%	S	NS	ACETONE	0.017	A
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	ACETONE	0.0082	B
030-012193A	1P030	310	NS	9/16	53	NS	SY PINE	NS	NS	NS	UF	7.8%	S	NS	ACROLEIN	0.0025	A
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	ACROLEIN	0.0013	B
030-012193A	1P030	310	NS	9/16	53	NS	SY PINE	NS	NS	NS	UF	7.8%	S	NS	BENZALD	0.0030	A
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	BENZALD	0.0015	B
030-012193A	1P030	310	NS	9/16	53	NS	SY PINE	NS	NS	NS	UF	7.8%	S	NS	BUTYLALDEH	0.0031	A
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	BUTYLALDEH	0.0014	B

TABLE 4-8. (continued)

		Press		Board			Wood species[b]				Adhesive/resin						
Test code	Unit code	Temp., °F	Cycle, min	Thick, in.	Density, lb/ft^3	Moist. cont., %	Primary	%	Second.	%	Type	Applic. rate	Cat/ Sav.?[c]	Wax applic. rate	Pollutant[d]	Emission factor, lb/MSF 3/4	Data rating
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	CROTONALDE	0.00050	B
030-012193A	1P030	310	NS	9/16	53	NS	SY PINE	NS	NS	NS	UF	7.8%	S	NS	FOR	0.49	A
039-102692E	1P039	330	3.8	5/8	43	10	HWOOD	55	SWOOD	45	UF	10.4 lb/ 100 lb	Y	0.6%	FOR	0.056	B
166-100892A	1P166	NS	NS	NS	NS	NS	NS	NS	NS	NS	UF	NS	NS	NS	FOR	0.28	D
166-100892B	2P166	NS	NS	NS	NS	NS	NS	NS	NS	NS	UF	NS	NS	NS	FOR	0.29	D
167-102190B	1P167	0	NS	1.625	NS	45	ASPEN	NS	MAPLE	NS	UF	NS	NS	NS	FOR	0.018	D
167-102588B	1P167	NS	NS	1.5	NS	NS	HWOOD	100	NS	NS	UF	NS	NS	NS	FOR	0.18	D
202-030194A	1P202	320	5.6	3/4	NS	NS	PINE SP	70	SWOOD	30	UF	NS	NS	NS	FOR	0.077	D
202-030194B	2P202	320	5.5	3/4	NS	NS	PINE SP	70	SWOOD	30	UF	NS	NS	NS	FOR	0.11	D
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	FOR	0.40	B
030-012193A	1P030	310	NS	9/16	53	NS	SY PINE	NS	NS	NS	UF	7.8%	S	NS	HEXALD	0.020	A
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	HEXALD	0.0047	B
030-012193A	1P030	310	NS	9/16	53	NS	SY PINE	NS	NS	NS	UF	7.8%	S	NS	ISOVALALD	0.00094	A
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	ISOVALALD	0.0013	B
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	MEK	0.00032	C
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	PROPIONALD	7.2E-05	C
030-012193A	1P030	310	NS	9/16	53	NS	SY PINE	NS	NS	NS	UF	7.8%	S	NS	VALALD	0.0058	A
228-091992H	1P228	350	2.63	0.625	42.5	3	PINE SP	80	HWOOD	20	UF	2.30 Mlb/hr	Y	105 lb/hr	VALALD	0.0020	A

[a]Reference 8. NS = not specified; NA = not applicable. Lb/MSF 3/4 = pounds of pollutant per thousand square feet of 3/4-in. thick panel.
[b]Wood species: SY PINE = Southern Yellow Pine; PINE SP = unknown pine species; DFIR = Douglas Fir; UFIR = unspecified fir; SWOOD = unspecified softwood; ASPEN = Aspen; HWOOD = unspecified hardwood; UWOOD = unspecified wood from urban recycling.
[c]Cat/Scav.? = Y indicates either a catalyst or formaldehyde scavenger was used. Cat/Scav.? = S indicates a formaldehyde scavenger was used.
[d]Pollutant codes are identified in Table 4-6. Factors for VOC on a carbon basis.

TABLE 4-9. SUMMARY OF EMISSION FACTORS FOR PARTICLEBOARD COOLERS FROM NCASI DATA BASE[a]

Test code	Unit code	Pollutant[b]	No. of runs	Test method[c]	Stack parameters			Pollutant concentration		Cat./scav.?[d]	Emission rate, lb/hr	Production rate, MSF 3/4/hr	Emission factor, lb/MSF 3/4	Data rating
					Flowrate, dscfm	Temp., °F	Moist., %	ppm	gr/dscf					
228-092392A	1C228	PM	1	M5	32,144	108	1.7	NA	NS	Y	0.186	13.25	0.014	D
228-092392A	1C228	PM10	1	M201A	32,144	108	1.7	NA	1.6E-05	Y	0.0444	13.25	0.0034	D
228-092392A	1C228	PM10&CPM	1	M201A/202	32,144	108	1.7	NA	0.00061	Y	0.167	13.25	0.013	D
228-092292A	1C228	VOC	2	M25A	31,237	118	2.5	41.0	NA	Y	2.30	12.83	0.16	B
167-102090D	1C167	VOC	3	M25A	3,540	102	2.3	6	NA	NS	0.120	9.986	0.012	B
167-102588C	1C167	VOC	3	M25	20,551	89	0.9	88.5	NA	NS	3.39	8.29	0.41	A
166-100892C	1C166	FOR	2	N3500	20,171	NS	NS	NS	NA	NS	0.0850	20.16	0.0040	D
167-102090D	1C167	FOR	3	N3500	3,540	102	2.3	1.25	NA	NS	0.0210	9.986	0.0021	D
167-102588C	1C167	FOR	3	N3500	20,551	89	0.9	6.83	NA	NS	0.443	8.29	0.050	D
202-030194C	1C202	FOR	1	M0011	41,200	NS	NS	2.7	NA	NS	0.210	12.16	0.017	D
202-030194D	2C202	FOR	1	M0011	48,200	NS	NS	1.7	NA	NS	0.150	14.22	0.011	D
228-092292A	1C228	ACETALD	3	M0011	31,237	118	2.5	0.0850	0.0182	Y	0.0170	12.83	0.0013	A
228-092292A	1C228	ACETONE	3	M0011	31,237	118	2.5	0.0978	0.0272	Y	0.0252	12.83	0.0020	A
228-092292A	1C228	ACROLEIN	3	M0011	31,237	118	2.5	0.0181	0.00498	Y	0.00463	12.83	0.00036	A
228-092292A	1C228	BENZALD	3	M0011	31,237	118	2.5	0.0112	0.00572	Y	0.00541	12.83	0.00042	A
228-092292A	1C228	BUTYLALDEH	3	M0011	31,237	118	2.5	0.0168	0.00822	Y	0.00769	12.83	0.00060	A
228-092292A	1C228	CROTONALDE	3	M0011	31,237	118	2.5	0.0118	0.00400	Y	0.00372	12.83	0.00029	A
228-092292A	1C228	FOR	3	M0011	31,237	118	2.5	5.18	NS	Y	0.748	12.83	0.0541	C
228-092292A	1C228	HEXALD	3	M0011	31,237	118	2.5	0.0306	0.0148	Y	0.014	12.83	0.0011	A
228-092292A	1C228	ISOVALALD	3	M0011	31,237	118	2.5	0.0132	0.00550	Y	0.00512	12.83	0.00040	A
228-092292A	1C228	MEK	3	M0011	31,237	118	2.5	0.00448	0.00157	Y	0.00144	12.83	0.00011	A
228-092292A	1C228	VALALD	3	M0011	31,237	118	2.5	0.0189	0.00791	Y	0.019	12.83	0.0015	A

[a]Reference 8. NS = not specified; NA = not applicable. MSF 3/4/hr = thousand square feet of 3/4-in. thick panel per hour. Lb/MSF 3/4 = pounds of pollutant per thousand square feet of 3/4-in. thick panel.
[b]Pollutant codes are defined in Table 4-6. Factors for VOC on a carbon basis.
[c]Test methods: M5 = EPA Method 5; M201A = EPA Method 201A; M202 = EPA Method 202; M25A = EPA Method 25A; N3500 = NIOSH Method 3500; M0011 = BIF Method 0011 (aldehydes and ketones).
[d]Cat./scav.? = Y indicates either a catalyst of formaldehyde scavenger was used.

TABLE 4-10. SUMMARY OF EMISSION FACTORS FOR PARTICLEBOARD FROM NCASI DATA BASE--MISCELLANEOUS EQUIPMENT[a]

Test code	Unit code	Description	Emission control[b]	Wood species[c]	Poll.[d]	No. of runs	Test method[e]	Concentration, ppm	Concentration, gr/dscf	Emission rate, lb/hr	Production rate	Emission factor lb/ODT	Emission factor lb/MSF 3/4	Data rating
022-102689A	1E022	Rock drop out (west)	CYC	SY PINE	PM	2	M5		0.0045	1.16	NS			NR
022-082190A	1F022	Forming machine	FFIL	SY PINE	PM	1	M5		NS	0.12	NS			NR
043-032692A	1F043	Former classifier baghouse	FFIL	SY PINE	PM	3	M5		0.00267	0.263	NS			NR
043-032492A	1I043	Boiler fuel bin cyclone	CYC	SY PINE	PM	3	M5		0.491	7.18	7.23 ODTH	0.99		NR
043-032592A	3I043	Hog fuel bin	FFIL	SY PINE	PM	3	M5		0.00267	0.080	0.79 wet TH	0.10[f]		NR
022-102689E	2M022	# 1 & 2 Bauer	CYC	SY PINE	PM	2	M5		0.029	7.58	NS			NR
022-112790A	3M022	# 3 & 4 Bauer	CYC	SY PINE	PM	3	M5		0.00433	1.04	NS			NR
022-102689D	1M022	# 3 & 4 Bauer	CYC	SY PINE	PM	2	M5		0.033	8.81	NS			NR
022-112790B	4M022	# 1 & 2 Bauer	CYC	SY PINE	PM	3	M5		0.005	1.20	NS			NR
043-032592B	1M043	Pallman mills	CYC	SY PINE	PM	3	M5		0.0153	4.80	9.4 ODTH	0.53		NR
043-040992A	2M043	Bauer mills	CYC	SY PINE	PM	3	M5		0.0917	23.2	NS			NR
202-071393D	2M202	Bauer mill	CYC	NS	PM	2	OD8		0.04	15.45	11.0 ODTH	1.4		NR
202-071393C	1M202	Bauer mills	CYC	NS	PM	2	OD8		0.035	1.7	13.1 ODTH	0.13		NR
043-040193B	4M043	Pallman mills	CYC	SY PINE	PM	3	M5		0.0025	0.677	13.6 ODTH	0.050		NR
043-040193A	3M043	Bauer mills	CYC	SY PINE	PM	3	M5		0.00183	0.487	15.0 ODTH	0.032		NR
043-040192B	3S043	Fine grit sander	FFIL	SY PINE	PM	3	M5		0.00733	2.10	28.0 MSF3/4 /hr		0.10	NR
043-042392A	1S043	Sander baghouse	FFIL	SY PINE	PM	3	M5		0.0053	0.893	20.6 MSF3/4 /hr		0.038	NR
043-042392B	2S043	Fine grit sander	FFIL	SY PINE	PM	3	M5		0.010	2.76	20.6 MSF3/4 /hr		0.12	NR
043-040192A	1W043	Globe trim saw	CYC	SY PINE	PM	3	M5		0.0363	7.13	28.9 MSF3/4 /hr		0.31	NR
167-102190A	1Z167	Press steam vent	NONE	ASPEN	FOR	3	N3500	2.1	NA	0.0044	9.986 MSF 3/4		0.018	NR

TABLE 4-10. (continued)

Test code	Unit code	Description	Emission control[b]	Wood species[c]	Poll.[d]	No. of runs	Test method[e]	Concentration, ppm	Concentration, gr/dscf	Emission rate, lb/hr	Production rate	Emission factor lb/ODT	Emission factor lb/MSF 3/4	Data rating
167-102190A	1Z167	Press steam vent	NONE	ASPEN	VOC	3	M25A	80.4	NA	0.066	9.986 MSF 3/4		0.027	NR
043-040992B	1Z043	Forming line reject system	FFIL	SY PINE	PM	3	M5		0.0070	1.99	31.7 MSF 3/4 /hr		0.063	NR

[a]Reference 8. NS = not specified; NA = not applicable; NR = not rated. Because these emission factors are in units of lb/ton of material collected by a control device and cannot be related to the process rates for the operation served by the control device, or the process operation and configuration are not clearly identified, these factors are not incorporated in the AP-42 section.
[b]Control devices: CYC = cyclone; FFIL = fabric filter.
[c]Wood species: SY PINE = southern yellow pine; ASPEN = aspen.
[d]Pollutants: PM = filterable PM; FOR = formaldehyde; VOC = volatile organic compounds. Factors for VOC on an as carbon basis.
[e]Test methods: M5 = EPA Method 5; OD8 = Oregon Department of Environmental Quality Method 8; M25A = EPA Method 25A; N3500 = NIOSH Method 3500.
[f]Factor in units of pounds per wet tons per hour.

TABLE 4-11. SUMMARY OF EMISSION FACTORS FOR PARTICLEBOARD DRYERS FROM EMISSION TEST REPORTS[a]

Ref. No.	Unit code	Pollutant[b]	Firing type[c]	Fuel type[d]	Wood species[e]				Moisture content, %		Temp., °F		Emission control[f]	No. of runs	Emission factor, lb/ODT	Data rating
					Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
1	1-1	PM	DFIRE	NGAS	OAK	86	SWOOD	14	7.8	4.6	218	117	CYC	3	10	A
1	1-1	PM10	DFIRE	NGAS	OAK	86	SWOOD	14	6.7	4.6	218	117	CYC	3	3.1	C
1	1-1	PM10	DFIRE	NGAS	OAK	86	SWOOD	14	6.7	4.6	218	117	MCLO	3	1.6	C
1	1-1	PM1.0	DFIRE	NGAS	OAK	86	SWOOD	14	6.7	4.6	218	117	CYC	3	2.0	C
1	1-1	PM2.5	DFIRE	NGAS	OAK	86	SWOOD	14	6.7	4.6	218	117	CYC	3	2.5	C
1	1-1	CPM	DFIRE	NGAS	OAK	86	SWOOD	14	7.8	4.6	218	117	CYC	3	0.12	A
1	1-2	PM	DFIRE	NGAS	OAK	86	SWOOD	14	7.8	4.6	218	117	MCLO	3	6.4	A
1	1-2	PM1.0	DFIRE	NGAS	OAK	86	SWOOD	14	6.7	4.6	218	117	CYC	3	0.86	C
1	1-2	PM2.5	DFIRE	NGAS	OAK	86	SWOOD	14	6.7	4.6	218	117	CYC	3	1.6	C
1	1-2	CPM	DFIRE	NGAS	OAK	86	SWOOD	14	7.8	4.6	218	117	MCLO	3	0.39	A
1	1-2	CO	DFIRE	NGAS	OAK	86	SWOOD	14	7.3	4.6	218	120	MCLO	7	1.2	A
1	1-2	NOX	DFIRE	NGAS	OAK	86	SWOOD	14	7.3	4.6	218	120	MCLO	7	0.024	A
1	1-2	VOC	DFIRE	NGAS	OAK	86	SWOOD	14	7.3	4.6	218	120	MCLO	7	0.21	A
1	1-2	A-PINENE	DFIRE	NGAS	OAK	86	SWOOD	14	7.1	4.6	215	117	MCLO	3	0.013	A
1	1-2	A-PINENE	DFIRE	NGAS	OAK	86	SWOOD	14	7.1	4.6	225	118	MCLO	3	0.019	A
1	1-2	A-PINENEM/Z13	DFIRE	NGAS	OAK	86	SWOOD	14	7.1	4.6	225	118	MCLO	3	0.036	A
1	1-2	A-TERPINE	DFIRE	NGAS	OAK	86	SWOOD	14	7.1	4.6	215	117	MCLO	3	0.0052	A
1	1-2	ACETALD	DFIRE	NGAS	OAK	86	SWOOD	14	7.6	4.6	215	117	MCLO	3	0.00098	A
1	1-2	B-PINENE	DFIRE	NGAS	OAK	86	SWOOD	14	7.1	4.6	225	118	MCLO	3	0.0099	A
1	1-2	B-PINENE	DFIRE	NGAS	OAK	86	SWOOD	14	7.1	4.6	215	117	MCLO	3	0.0039	A
1	1-2	B-PINENEM/Z13	DFIRE	NGAS	OAK	86	SWOOD	14	7.1	4.6	225	118	MCLO	3	0.013	B
1	1-2	BENZALD	DFIRE	NGAS	OAK	86	SWOOD	14	7.6	4.6	215	117	MCLO	3	0.00031	A
1	1-2	D-N-BUT-PH	DFIRE	NGAS	OAK	86	SWOOD	14	7.6	4.6	215	117	MCLO	3	0.00015	A
1	1-2	FOR	DFIRE	NGAS	OAK	86	SWOOD	14	7.6	4.6	215	117	MCLO	3	0.036	A
1	1-2	HEXALD	DFIRE	NGAS	OAK	86	SWOOD	14	7.6	4.6	215	117	MCLO	3	0.00049	A
1	1-2	P-CYMENE	DFIRE	NGAS	OAK	86	SWOOD	14	7.1	4.6	215	117	MCLO	3	0.00013	A
1	1-2	TOL	DFIRE	NGAS	OAK	86	SWOOD	14	7.1	4.6	225	118	MCLO	3	0.00059	A
4	3D228	PM	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	CYC	3	1.9	B

TABLE 4-11. (continued)

Ref. No.	Unit code	Pollutant[b]	Firing type[c]	Fuel type[d]	Wood species[e] Primary	%	Secon.	%	Moisture content, % Inlet	Outlet	Temp., °F Inlet	Outlet	Emission control[f]	No. of runs	Emission factor, lb/ODT	Data rating
4	3D228	CPM-I	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	CYC	3	0.47	B
4	3D228	CPM-O	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	CYC	3	0.35	B
4	3D228	CPM	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	CYC	3	0.83	B
4	3D228	CO2	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	CYC	3	570	B
4	3D228	PM	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	EFB/FFIL	3	0.20	B
4	3D228	CPM-I	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	EFB/FFIL	3	0.46	B
4	3D228	CPM-O	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	EFB/FFIL	3	0.38	B
4	3D228	CPM	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	EFB/FFIL	3	0.84	B
4	3D228	CO2	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	EFB/FFIL	3	610	B
4	3D228	FOR	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	EFB/FFIL	3	0.00024	D
4	3D228	PM	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	FFIL	3	1.4	B
4	3D228	CPM-I	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	FFIL	3	0.50	B
4	3D228	CPM-O	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	FFIL	3	0.47	B
4	3D228	CPM	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	FFIL	3	0.97	B
4	3D228	CO2	DFIRE	SDUST	PINE SP	100	NA	NA	NS	2	1075	270	FFIL	3	660	B
4	1D228	PM	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	2	750	200	FFIL	3	1.3	B
4	1D228	CPM-I	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	2	750	200	FFIL	3	0.25	B
4	1D228	CPM-O	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	2	750	200	FFIL	3	0.18	B
4	1D228	CPM	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	2	750	200	FFIL	3	0.43	B
4	1D228	CO2	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	2	750	200	FFIL	3	330	B
4	1D228	FOR	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	2	750	200	EFB/FFIL	3	0.00023	D
5	1D228	PM	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	NS	750	200	CYC	3	2.3	B
5	1D228	CPM-I	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	NS	750	200	CYC	3	0.80	B
5	1D228	CPM-O	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	NS	750	200	CYC	3	0.30	B
5	1D228	CPM	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	NS	750	200	CYC	3	1.10	B
5	1D228	CO2	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	NS	750	200	CYC	3	700	B
5	1D228	PM	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	NS	750	200	EFB/FFIL	3	0.15	B

TABLE 4-11. (continued)

Ref. No.	Unit code	Pollutant[b]	Firing type[c]	Fuel type[d]	Wood species[e]				Moisture content, %		Temp., °F		Emission control[f]	No. of runs	Emission factor, lb/ODT	Data rating
					Primary	%	Secon.	%	Inlet	Outlet	Inlet	Outlet				
5	1D228	CPM-I	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	NS	750	200	EFB/FFIL	3	0.43	B
5	1D228	CPM-O	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	NS	750	200	EFB/FFIL	3	0.29	B
5	1D228	CPM	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	NS	750	200	EFB/FFIL	3	0.72	B
5	1D228	CO2	DFIRE	SDUST	PINE SP	60	HWOOD	40	NS	NS	750	200	EFB/FFIL	3	730	B
6	XD167	PM	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	CYC	3	2.2	B
6	XD167	CPM-I	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	CYC	3	0.045	B
6	XD167	CPM-O	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	CYC	3	0.015	B
6	XD167	CPM	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	CYC	3	0.060	B
6	XD167	CO2	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	CYC	3	530	B
6	XD167	NOX	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	CYC	3	2.2	B
7	XD167	PM	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	EFB	3	0.23	B
7	XD167	CPM-I	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	EFB	3	0.10	B
7	XD167	CPM-O	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	EFB	3	0.061	B
7	XD167	CPM	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	EFB	3	0.166	B
7	XD167	CO2	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	EFB	3	400	B
7	XD167	NOX	DFIRE	SDUST	NS	NS	NS	NS	35.4	2.8	903	204	EFB	3	2.2	B

[a]NS = not specified; NA = not available. Lb/ODT = pounds of pollutant per oven-dried ton of wood material out of dryer.
[b]Pollutant codes are defined in Table 4-6. Factors for VOC on an as carbon basis.
[c]DFIRE = direct fired.
[d]Fuel type: NGAS = natural gas, SDUST = sanderdust.
[e]Wood species: OAK = oak; PINE SP = unspecified pine; SWOOD = unspecified softwood, HWOOD = unspecified hardwood.
[f]Emission controls: CYC = cyclone; MCLO = multicyclone; EFB = electrified filter bed; FFIL = fabric filter.

TABLE 4-12. SUMMARY OF EMISSION DATA FOR PARTICLEBOARD PRESSES AND BOARD COOLERS FROM EMISSION TEST REPORTS[a]

Press	Pollutant[b]	No. of runs	Test method	Wood species				Emission factor, lb/MSF 3/4			Rating
				Primary	%	Secondary	%	Minimum	Maximum	Average	
PARTICLEBOARD PRESS											
1-1	Formaldehyde	3	M0011	Oak	86	Softwood	14	0.099	0.13	0.11	A
1-1	Acetaldehyde	3	M0011	Oak	86	Softwood	14	0.0033	0.0039	0.0035	A
1-1	Benzaldehyde	3	M0011	Oak	86	Softwood	14	0.00078	0.00095	0.00088	A
1-1	Hexaldehyde	3	M0011	Oak	86	Softwood	14	0.0054	0.0057	0.0055	A
1-1	n-Butylaldehyde	3	M0011	Oak	86	Softwood	14	0.00089	0.00094	0.00092	A
1-1	Methyl ethyl ketone	3	M0011	Oak	86	Softwood	14	0.0022	0.0026	0.0025	A
1-1	CO	4	M10	Oak	86	Softwood	14	0.060	0.093	0.068	A
1-1	VOC	5	M25A	Oak	86	Softwood	14	0.075	0.097	0.084	A
1-1	Filterable PM-10	2	M201A	Oak	86	Softwood	14	0.016	0.11	0.063	C
9-1	Filterable PM	3	M5	Softwood	100	NA	NA	0.28	0.69	0.44	A
9-1	Condensible PM	3	M202	Softwood	100	NA	NA	0.33	0.36	0.35	A
9-1	CO	3	M10	Softwood	100	NA	NA	0.39	0.45	0.42	A
9-1	Formaldehyde	3	M0011	Softwood	100	NA	NA	0.0062	0.0081	0.0069	A
9-1	VOC	3	M25A	Softwood	100	NA	NA	0.32	0.78	0.48	B
VENEER PRESS											
1-2	Formaldehyde	3	M0011	Oak	86	Softwood	14	0.0052	0.0067	0.0062	A
1-2	Acetaldehyde	3	M0011	Oak	86	Softwood	14	5.5E-05	0.00015	9.9E-05	A
1-2	Hexaldehyde	3	M0011	Oak	86	Softwood	14	0.00014	0.00023	0.00017	A
1-2	n-Butylaldehyde	3	M0011	Oak	86	Softwood	14	0.00007	0.00023	0.00014	A
1-2	Methyl ethyl ketone	3	M0011	Oak	86	Softwood	14	0.00011	0.00071	0.00035	A
1-2	1,1,1-Trichloroethane	3	M0030	Oak	86	Softwood	14	0.00010	0.00030	0.00022	A

TABLE 4-12. (continued)

Press	Pollutant[b]	No. of runs	Test method	Wood species				Emission factor, lb/MSF 3/4			Rating
				Primary	%	Secondary	%	Minimum	Maximum	Average	
1-2	2-Butanone	3	M0030	Oak	86	Softwood	14	6.7E-05	0.00038	0.00020	A
1-2	Toluene	3	M0030	Oak	86	Softwood	14	0.00021	0.00069	0.00047	A
1-2	a-Pinene	3	M0030	Oak	86	Softwood	14	0.00035	0.00084	0.00054	A
1-2	b-Pinene	3	M0030	Oak	86	Softwood	14	6.1E-05	0.00018	0.00011	A
BOARD COOLER											
9-1	Filterable PM	3	M5	Softwood	100	NA	NA	0.13	0.24	0.20	A
9-1	Condensible PM	3	M202	Softwood	100	NA	NA	0.077	0.095	0.089	A
9-1	CO	3	M10	Softwood	100	NA	NA	0.16	0.20	0.18	A
9-1	Formaldehyde	3	M0011	Softwood	100	NA	NA	0.0060	0.011	0.0076	B
9-1	VOC	3	M25A	Softwood	100	NA	NA	0.021	0.043	0.035	B

[a]Lb/MSF 3/4 = pounds of pollutant per thousand square feet of 3/4-in. thick panel.
[b]Factors for VOC on an as carbon basis.

TABLE 4-13. SUMMARY OF CANDIDATE EMISSION FACTORS FOR PARTICLEBOARD DRYERS--CRITERIA POLLUTANTS

Pollutant[a]	Emission control device[b]	No. of tests	Wood species	Fuel type	Type of firing[c]	Emission factor, lb/ODT[d]			Stan. dev.	Rating	Ref.
						Minimum	Maximum	Average			
Filterable PM	None[e]	2	Southern yellow pine	Sanderdust	Direct	4.8	11	8.0		D	8
Filterable PM	None[e]	6	Unspecified pines	Wood refuse	Direct	0.79	11	3.9	3.8	D	8
Filterable PM	None[e]	2	Unspecified pines	Natural gas	Both	0.91	1.7	1.3		D	8
Filterable PM	None[e]	2	Hardwoods	Sanderdust	Direct	2.3	2.7	2.5		D	8
Filterable PM	EFB	2	Unspecified pines	Sanderdust	Direct	0.20	1.5	0.85		D	4,8
Filterable PM	EFB	1	Unspecified pines	Natural gas	Both			0.14		E	8
Filterable PM	EFB	4	Hardwoods	Sanderdust	Direct	0.16	0.21	0.19		D	8
Filterable PM	Fabric filter	1	Unspecified pines	Sanderdust	Direct			1.4		E	4
Filterable PM[f]	Incineration[m]	1	Douglas fir	Sanderdust	Direct			0.22		E	8
Filterable PM[g]	Multiclone	3	Douglas fir	Sanderdust	Direct	0.50	1.0	0.74		D	8
Filterable PM	Multiclone	1	Unspecified pines	Sanderdust	Direct			2.5		E	8
Filterable PM	Multiclone	2	Hardwoods	Sanderdust	Direct	1.4	2.9	2.1		D	8
Filterable PM	PBA	2	Hardwoods	Sanderdust	Direct	0.60	1.3	0.93		D	8
Filterable PM[g]	WESP	2	Douglas fir	Sanderdust	Direct	0.063	0.16	0.11		D	8
Filterable PM-10	None[e]	2	Southern yellow pine	Sanderdust	Direct	0.65	1.1	0.90		D	8
Filterable PM-10	None[e]	4	Unspecified pines	Wood refuse	Direct	0.18	1.1	0.69		D	8
Filterable PM-10	EFB	1	Unspecified pines	Sanderdust	Direct			0.64		E	8
Condensible PM	None[e]	2	Southern yellow pine	Sanderdust	Direct	0.34	0.51	0.43		D	8
Condensible PM	None[e]	6	Unspecified pines	Wood refuse	Direct	0.019	0.83	0.30	0.32	D	8
Condensible PM	None[e]	1	Hardwoods	Sanderdust	Direct			0.13		E	8
Condensible PM	EFB	2	Unspecified pines	Sanderdust	Direct	0.84	1.8	1.3		D	8

TABLE 4-13. (continued)

Pollutant[a]	Emission control device[b]	No. of tests	Wood species	Fuel type	Type of firing[c]	Emission factor, lb/ODT[d]			Stan. dev.	Rating	Ref.
						Minimum	Maximum	Average			
Condensible PM	EFB	1	Unspecified pines	Natural gas	Both			0.064		E	8
Condensible PM	EFB	4	Hardwoods	Sanderdust	Direct	0.046	0.13	0.087		D	8
Condensible PM	Fabric filter	1	Unspecified pines	Sanderdust	Direct			0.97		E	4
Condensible PM[f]	Incineration[m]	1	Douglas fir	Sanderdust	Direct			0.015		E	8
Condensible PM	Multiclone	2	Hardwoods	Sanderdust	Direct	0.048	0.21	0.13		D	8
Condensible PM	PBA	2	Hardwoods	Sanderdust	Direct	0.023	0.025	0.024		D	8
Condensible PM[g]	WESP	5	Douglas fir	Sanderdust	Direct	0.039	0.39	0.15	0.15	D	8
VOC as propane	(h)	2	Southern yellow pine	Sanderdust	Direct	1.0	1.1	1.1		D	8
VOC as propane	(h)	3	Unspecified pines	Natural gas	Both	0.12	1.5	0.90		D	8
VOC as propane[n]	(h)	6	Unspecified pines	Wood refuse	Direct	0.063	1.5	0.95	0.51	D	8
VOC as propane[p]	(h)	2	Unspecified pines	Wood refuse	Direct	7.6	8.8	8.2		D	8
VOC as propane	(h)	5	Hardwoods	Sanderdust	Direct	0.061	0.72	0.35	0.33	D	8
CO[g]	(h)	3	All species[k]	Wood refuse	Direct	0.019	1.8	0.94		D	8
CO[j]	(h)	3	All species[k]	Wood refuse	Direct	0.63	0.89	0.75		D	8
CO	(h)	17	All species[k]	Wood refuse	Direct	0.071	10	1.6	2.4	C	8
CO	(h)	2	All species[k]	Natural gas	Both	0.030	0.20	0.12		D	8
CO_2	(h)	8	All species[k]	Sanderdust	Direct	330	730	570	140	D	4,5,6,7
NO_x	(h)	20	All species[k]	Wood refuse	Direct	0.074	2.2	1.1	0.72	B	6,7,8
NO_x	(h)	3	All species[k]	Natural gas	Both	0.010	0.90	0.31		D	8

TABLE 4-13. (continued)

Pollutant[a]	Emission control device[b]	No. of tests	Wood species	Fuel type	Type of firing[c]	Emission factor, lb/ODT[d]			Stan. dev.	Rating	Ref.
						Minimum	Maximum	Average			
NO_x[g]	(h)	2	All species[k]	Sanderdust	Direct	1.5	2.6	2.1		D	8
SO_2	(h)	1	All species[k]	Sanderdust	Direct			0.0020		E	8

[a] Factors for VOC on a propane basis and have been adjusted for formaldehyde and nonVOC compounds.
[b] EFB = electrified filter bed; WESP = wet electrostatic precipitator; PBA = packed bed absorber
[c] Direct = direct-fired; Both = combination of direct and indirect firing.
[d] Emission factors in units of pounds of pollutant per oven-dried ton of wood material out of dryer.
[e] Cyclones are used as product recovery devices and are not considered to be emission control equipment.
[f] Tube final dryer.
[g] Rotary predryer.
[h] Emission controls used are for PM; effects on gaseous emissions are considered negligible.
[j] Rotary final dryer.
[k] Average of all available data.
[m] Incineration = dryer exhasut used as cooling air and as inlet air for COEN burner.
[n] Dryer inlet temperature less than 730°F.
[p] Dryer inlet temperature greater than 900°F.

TABLE 4-14. SUMMARY OF CANDIDATE EMISSION FACTORS FOR PARTICLEBOARD DRYERS--SPECIATED ORGANICS

Pollutant	No. of tests	Wood species	Fuel type	Type of firing[a]	Emission factor, lb/ODT[b]			Standard deviation	Rating	Ref.
					Minimum	Maximum	Average			
1,1,1-Trichloroethane[c]	2	Unspecified pines	Wood refuse	Direct	7.5E-06	1.6E-05	1.2E-05		E	8
1,2,4-Trimethyl benzene[c]	2	Unspecified pines	Wood refuse	Direct	6.4E-05	0.00011	9.0E-05		E	8
2,5-Dimethyl benzaldehyde[c]	1	Unspecified pines	Wood refuse	Direct			3.3E-05		E	8
2,5-Dimethyl benzeldehyde[d]	1	Unspecified pines	Wood refuse	Direct			0.0053		E	8
4-Methyl-2-pentanone[c]	2	Unspecified pines	Wood refuse	Direct	3.3E-05	0.00013	8.1E-05		E	8
4,4-Methylene dianiline[c]	1	Unspecified pines	Wood refuse	Direct			3.3E-05		E	8
Alpha pinene[c]	4	Unspecified pines	Wood refuse	Direct	0.017	1.7	0.46		E	8
Alpha pinene[d]	2	Unspecified pines	Wood refuse	Direct	1.6	2.3	1.9		E	8
Alpha terpeneol[c]	2	Unspecified pines	Wood refuse	Direct	0.032	0.10	0.066		E	8
Alpha terpeneol[d]	1	Unspecified pines	Wood refuse	Direct			0.17		E	8
Acetaldehyde[c]	1	Unspecified pines	Wood refuse	Direct			0.010		E	8
Acetaldehyde[d]	2	Unspecified pines	Wood refuse	Direct	0.070	0.074	0.072		E	8
Acetone[c]	3	Unspecified pines	Wood refuse	Direct	0.0018	0.011	0.0079		E	8
Acetone[d]	3	Unspecified pines	Wood refuse	Direct	0.092	0.29	0.16		E	8
Acetophenone[c]	2	Unspecified pines	Wood refuse	Direct	3.1E-05	9.8E-05	6.4E-05		E	8
Acrolein[c]	4	Unspecified pines	Wood refuse	Direct	0.00041	0.0083	0.0033		E	8
Acrolein[d]	2	Unspecified pines	Wood refuse	Direct	0.022	0.024	0.023		E	8
Acrylonitrile[c]	2	Unspecified pines	Wood refuse	Direct	4.3E-05	0.00013	8.9E-05		E	8
Beta pinene[c]	4	Unspecified pines	Wood refuse	Direct	0.010	0.59	0.16		E	8
Beta pinene[d]	2	Unspecified pines	Wood refuse	Direct	0.79	0.85	0.82		E	8
Benzaldehyde[c]	2	Unspecified pines	Wood refuse	Direct	0.00088	0.0044	0.0026		E	8
Benzaldehyde[d]	1	Unspecified pines	Wood refuse	Direct			0.12		E	8
Benzene[c]	2	Unspecified pines	Wood refuse	Direct	0.00011	0.00033	0.00022		E	8
Biphenyl[c]	2	Unspecified pines	Wood refuse	Direct	1.6E-05	6.1E-05	3.9E-05		E	8
Bis-(2-ethylhexyl phthalate)[c]	2	Unspecified pines	Wood refuse	Direct	6.4E-05	0.00058	0.00032		E	8
Bromomethane[c]	2	Unspecified pines	Wood refuse	Direct	9.4E-06	4.6E-05	2.8E-05		E	8

TABLE 4-14. (continued)

Pollutant	No. of tests	Wood species	Fuel type	Type of firing[a]	Emission factor, lb/ODT[b] Minimum	Maximum	Average	Standard deviation	Rating	Ref.
Butylbenzyl phthalate[c]	1	Unspecified pines	Wood refuse	Direct			1.4E-05		E	8
Butylaldehyde[c]	2	Unspecified pines	Wood refuse	Direct	0.00067	0.0054	0.0031		E	8
Butylaldehyde[d]	1	Unspecified pines	Wood refuse	Direct			0.029		E	8
Carbon disulfide[c]	2	Unspecified pines	Wood refuse	Direct	1.2E-05	2.4E-05	1.8E-05		E	8
Carbon tetrachloride[c]	2	Unspecified pines	Wood refuse	Direct	7.8E-06	1.6E-05	1.2E-05		E	8
Chloroform[d]	1	Unspecified pines	Sanderdust	Direct			0.00010		E	8
Chloromethane[c]	2	Unspecified pines	Wood refuse	Direct	4.5E-05	0.00018	0.00011		E	8
Crotonaldehyde[d]	2	Unspecified pines	Sanderdust	Direct	0.010	0.010	0.010		E	8
Cumene[c]	2	Unspecified pines	Wood refuse	Direct	3.7E-05	0.00010	6.9E-05		E	8
Cumene[d]	1	Unspecified pines	Wood refuse	Direct			0.0020		E	8
Di-n-butyl phthalate[c]	2	Unspecified pines	Wood refuse	Direct	1.4E-05	3.3E-05	2.3E-05		E	8
Dimethyl sulfide[c]	1	Unspecified pines	Wood refuse	Direct			1.4E-05		E	8
Ethyl benzene[c]	1	Unspecified pines	Wood refuse	Direct			3.8E-06		E	8
Formaldehyde	2	Southern yellow pine	Sanderdust	Direct	0.017	0.025	0.021		E	8
Formaldehyde[c]	4	Unspecified pines	Wood refuse	Direct	0.015	0.064	0.030		E	8
Formaldehyde[d]	1	Unspecified pines	Wood refuse	Direct			0.17		E	8
Hexaldehyde[c]	1	Unspecified pines	Wood refuse	Direct			0.016		E	8
Hexaldehyde[d]	1	Unspecified pines	Wood refuse	Direct			0.022		E	8
Hydroquinone[c]	1	Unspecified pines	Wood refuse	Direct			6.0E-05		E	8
Isovaleraldehyde[c]	2	Unspecified pines	Wood refuse	Direct	0.00024	0.00080	0.00052		E	8
Isovaleraldehyde[d]	1	Unspecified pines	Wood refuse	Direct			0.018		E	8
m-, p-Xylene[c]	2	Unspecified pines	Wood refuse	Direct	7.9E-05	0.00015	0.00011		E	8
m-, p-Xylene[d]	1	Unspecified pines	Wood refuse	Direct			0.0076		E	8
m-Tolualdehyde[c]	2	Unspecified pines	Wood refuse	Direct	0.00025	0.00045	0.00035		E	8
Methyl ethyl ketone[c]	3	Unspecified pines	Wood refuse	Direct	0.00017	0.0031	0.0013		E	8
Methyl ethyl ketone[d]	1	Unspecified pines	Wood refuse	Direct			0.0092		E	8

TABLE 4-14. (continued)

Pollutant	No. of tests	Wood species	Fuel type	Type of firing[a]	Emission factor, lb/ODT[b] Minimum	Maximum	Average	Standard deviation	Rating	Ref.
Methane	2	Unspecified pines	Natural gas	Both	0.19	0.35	0.27		E	8
Methylene chloride[c]	2	Unspecified pines	Wood refuse	Direct	0.00060	0.00071	0.00066		E	8
Methylene chloride[d]	1	Unspecified pines	Wood refuse	Direct			0.0022		E	8
n-Butyraldehyde[d]	1	Unspecified pines	Sanderdust	Direct			0.030		E	8
n-Hexane[c]	1	Unspecified pines	Wood refuse	Direct			2.6E-05		E	8
Nitrobenzene[c]	1	Unspecified pines	Wood refuse	Direct			1.7E-05		E	8
o-Tolualdehyde[d]	1	Unspecified pines	Sanderdust	Direct			0.011		E	8
o-Xylene[c]	2	Unspecified pines	Wood refuse	Direct	5.9E-06	2.3E-05	1.4E-05		E	8
o-Xylene[d]	1	Unspecified pines	Wood refuse	Direct			0.00045		E	8
p-Cymene[c]	4	Unspecified pines	Wood refuse	Direct	0.0011	0.013	0.0062		E	8
p-Cymene[d]	2	Unspecified pines	Wood refuse	Direct	0.0066	0.015	0.011		E	8
p-Tolualdehyde[d]	1	Unspecified pines	Sanderdust	Direct			0.026		E	8
Propionaldehyde[d]	2	Unspecified pines	Sanderdust	Direct	0.010	0.011	0.011		E	8
Styrene[c]	1	Unspecified pines	Wood refuse	Direct			0.00012		E	8
Styrene[d]	1	Unspecified pines	Wood refuse	Direct			0.00036		E	8
Trans 1,4 dichlorobutene[c]	1	Unspecified pines	Wood refuse	Direct			2.4E-05		E	8
Toluene[c]	2	Unspecified pines	Wood refuse	Direct	0.00031	0.0031	0.0017		E	8
Toluene[d]	1	Unspecified pines	Wood refuse	Direct			0.021		E	8
Valeraldehyde[c]	2	Unspecified pines	Wood refuse	Direct	0.0016	0.0074	0.0045		E	8
Valeraldehyde[d]	1	Unspecified pines	Wood refuse	Direct			0.014		E	8
Vinyl acetate[c]	1	Unspecified pines	Wood refuse	Direct			2.9E-05		E	8

[a]Direct = direct-fired; BOTH = combination of direct and indirect firing.
[b]Emission factors in units of pounds of pollutant per oven-dried ton of wood material out of dryer.
[c]Inlet air <730°F. Direct wood-fired rotary dryer.
[d]Inlet air >900°F. Direct wood-fired rotary dryer.

TABLE 4-15. SUMMARY OF CANDIDATE EMISSION FACTORS FOR PARTICLEBOARD PRESSES AND BOARD COOLERS[a]

Pollutant	No. of tests	Resin type[c]	Emission factor, lb/MSF 3/4[b] Minimum	Maximum	Average	Standard deviation	Rating	Ref.
PARTICLEBOARD PRESSES								
Filterable PM	1	UF			0.030		E	8
Filterable PM-10	1	UF			0.016		E	8
Condensible PM	1	UF			0.061		E	8
VOC as propane[d]	8	UF	0.35	1.8	0.94	0.48	D	1,8
CO	2	UF	0.068	0.11	0.090		D	1,8
2,5 Dimethyl benzaldehyde	1	UF			0.00032		E	8
Acetaldehyde	3	UF	0.0035	0.034	0.014		E	1,8
Acetone	2	UF	0.0082	0.017	0.013		E	8
Acrolein	2	UF	0.0013	0.0025	0.0019		E	8
Benzaldehyde	3	UF	0.00088	0.0030	0.0018		E	1,8
Butylaldehyde	3	UF	0.00092	0.0031	0.0018		E	1,8
Crotonaldehyde	1	UF			0.00050		E	8
Formaldehyde	4	UF	0.056	0.49	0.26		D	1,8
Hexaldehyde	3	UF	0.0047	0.11	0.045		E	1,8
Isovaleraldehyde	2	UF	0.00094	0.0013	0.0011		E	8
Methyl ethyl ketone	2	UF	0.00032	0.0025	0.0014		E	1,8
Alpha pinene	1	UF			0.00054		E	1
Beta pinene	1	UF			0.00011		E	1
Propionaldehyde	1	UF			7.2E-05		E	8
Toluene	1	UF			0.00047		E	1
Valeraldehyde	2	UF	0.0020	0.0058	0.0039		E	8
VENEER PRESSES								
1,1,1-Trichloroethane	1	UF			0.00022		E	1
Acetaldehyde	1	UF			9.9E-05		E	1
Butylaldehyde	1	UF			0.00014		E	1
Formaldehyde	1	UF			0.0062		E	1
Hexaldehyde	1	UF			0.11		E	1
Methyl ethyl ketone	2	UF	0.00020	0.00035	0.00028		E	1

TABLE 4-15. (continued)

Pollutant	No. of tests	Resin type[c]	Emission factor, lb/MSF 3/4[b] Minimum	Maximum	Average	Standard deviation	Rating	Ref.
BOARD COOLERS								
Filterable PM	1	UF			0.014		E	8
Filterable PM-10	1	UF			0.0034		E	8
Condensible PM	1	UF			0.0092		E	8
VOC as propane[d]	3	UF	0.040	0.52	0.27		E	8
Formaldehyde	3	UF	0.011	0.054	0.027		D	8
Acetaldehyde	1	UF			0.0013		E	1,8
Acetone	1	UF			0.0020		E	8
Acrolein	1	UF			0.00036		E	8
Benzaldehyde	1	UF			0.00042		E	1,8
Butylaldehyde	1	UF			0.00060		E	1,8
Crotonaldehyde	1	UF			0.00029		E	8
Hexaldehyde	1	UF			0.0011		E	1,8
Isovaleraldehyde	1	UF			0.00040		E	8
Methyl ethyl ketone	1	UF			0.00011		E	8
Valeraldehyde	1	UF			0.0015		E	8

[a]Uncontrolled emissions. Factors for VOC on a propane basis. Emissions not dependent on wood species.
[b]Emission factors in units of pounds of pollutant per thousand square feet of 3/4-inch thick panel.
[c]UF = urea-formaldehyde.
[d]Factors for VOC on a propane basis and have been adjusted for formaldehyde and nonVOC compounds.

REFERENCES FOR SECTION 4

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3. *Particleboard Production Facility Emission Test Report: Georgia-Pacific Corporation, Vienna, Georgia*, EMB Report 93-PAR-03 prepared for U. S. Environmental Protection Agency, Research Triangle Park, NC, April 1993.

4. *Stationary Source Sampling Report, Reference No. 6393A, Weyerhaeuser Company, Moncure, North Carolina, Formaldehyde Emissions, Particulate Emissions, and Plume Opacity Testing, Core Line EFB Inlet, Core Line Stack, and Surface Line Stack, August 9 and 11, 1989,* Entropy Environmentalists, Inc., Research Triangle Park, North Carolina, September 21, 1989.

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7. *Report to Weyerhaeuser Company, Marshfield, Wisconsin, for Particulate & NOx Emissions Testing, Door Core Dryer EFB Stack, December 20, 1991*, Environmental Technology & Engineering Corporation, Elm Grove, Wisconsin, 1992.

8. *Particleboard and Medium Density Fiberboard Air Emission Databases, Technical Bulletin No. 693*, the National Council of the Paper Industry for Air and Stream Improvement, New York, New York, April 1995.

9. *Results of the May 9-12, 1994 Air Emission Compliance Tests at the Louisiana-Pacific [Particleboard] Plant in Missoula, Montana*, Report No. 4-2837, Interpoll Laboratories, Inc., Circle Pines, Minnesota, June 8, 1994.

5. PROPOSED AP-42 SECTION

The final AP-42, Section 10.6.2, Particleboard Manufacturing, is presented on the following pages as it would appear in the document.