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Project Summary

Wood Products in the Waste Stream-Characterization and Combustion Emissions

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Waste wood is wood separated from a solid-waste stream and processed into a uniform-sized product that is reused for other purposes such as fuel. As an alternative to the combustion of fossil fuels, it has raised concerns that, if it is "contaminated" with paints, resins, preservatives, etc., unacceptable environmental impacts may be generated during combustion. Given the difficulty of separating contaminated material from waste wood and the large energy potential existing in the resource, it is important to identify possible problems associated with contaminated waste-wood combustion. This project:

- **Identifies the quantity and quality of waste wood;**
- **Summarizes regulatory issues affecting the processing and combustion of waste wood for energy;**
- **Characterizes waste-wood processing and combustion facilities;**
- **Characterizes representative waste-wood samples; and**
- **Collects and analyzes emissions data from operating combustion facilities**.

Types of waste wood described include pallets; construction and demolition waste; wood treated with paints or stains; wood containing glues, binders, or resins; wood containing plastics or vinyl wood treated with preservatives such as creosote, chloropentaphenol, and chromium copper arsenate; and wood treated with pesticides or fungicides.

This study, completed in mid-1992, describes research of technical, public policy, and regulatory issues that affect the processing and combustion of waste wood for fuel.

The report provides environmental regulators, project developers, and others with data to make informed decisions on the use of waste-wood materials as a combustion resource. Potential environmental problems and solutions were identified.

One project result was the identification of combustion-system operating parameters and air pollution control technologies that can minimize emissions of identified air and solid-waste contaminants from the combustion of waste wood.

This Project Summary was developed by EPA's National Risk Management Research Laboratory's, Air Pollution Prevention and Control Division, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

This report emphasizes understanding the differences in air emissions and ash characteristics from the combustion of “clean” wood compared to “treated” wood. Clean and treated wood are produced by a variety of municipal, commercial, industrial, agricultural, construction, and demolition activities. Treated wood is commonly referred to as “urban,” “recycled,” “treated,” “dirty,” and/or “demolition” wood. “Clean” wood is a by-product of harvesting activities connected with forest management, commercial logging, and site conversion. Harvested wood may be in the form of chips or stumps.

In most states evaluated in this study, the source and type of wood fuel affect

the environmental permitting of facilities. Each state or province has developed definitions for different wood fuels, or classifies combustion facilities according to the type of wood fuel burned. For this report, wood-fuel types are divided into "clean" or "treated" wood. "Clean" wood is untreated and uncontaminated natural wood.

In this report, wood is referred to as "waste wood" when it is in its preprocessed form and as "processed wood" when it has been prepared for fuel.

Federal, State, and Provincial Regulations

The project (1) reviewed existing federal, state, and provincial air, solid waste and energy policies, and regulations that relate to waste-wood processing and combustion facilities; (2) identified major trends in policies that affect the processing and use of waste wood for energy; and (3) investigated ash disposal from waste-wood combustion facilities.

Major air quality regulatory issues that affect waste-wood combustion facilities include:

- Regulatory implications for permitting a "treated" or a "clean" wood combustion facility;
- The level of control and/or control equipment currently considered best available control technology; and
- Implications of the 1990 Clean Air Act Amendments for new and existing wood-combustion facilities.

Types and Amounts of Waste Wood Available for Fuel

This study compiled data on the types and amounts of waste wood currently generated and used for fuel in the eight-state, one-province study area to estimate the amount of wood separated from the waste stream and processed into fuel. This wood is derived from a variety of forest harvesting, municipal, commercial, industrial, agricultural, construction, and demolition activities. Identifying the types and amounts of waste wood that may contain non-wood materials or "contaminants," such as paint, stain, and preservatives, is emphasized. Information from state energy offices, forestry and wood use experts, solid-waste managers, forest products industries, and published research on forestry and waste-wood resources is included.

Composition of Waste Wood

The study identified specific types of treated waste-wood materials that are commonly found in solid-waste streams including:

- Wood products manufactured with glues, binders, or resins, such as structural and non-structural panels (e.g., plywood, particleboard, masonite, waferboard, and wood laminates);
- Wood products treated with paints, stains, or coatings; and
- Wood products impregnated with preservatives such as creosote, pentachlorophenol, or chromium copper arsenate (CCA) (e.g., railroad ties, utility poles, and exterior grade lumber).

Information and product-specific data were obtained from industry reports, sales representatives, research chemists, state and federal government research scientists, and others. A summary of common wood products and the levels and types of non-wood contaminants is provided.

Major issues affecting the use of waste wood (especially treated wood) for fuel are the types and amounts of potential contaminants contained in the material and the physical, chemical, and environmental characteristics of the contaminant.

Waste-Wood Processing Facilities

The study investigated facilities that collect, sort, and process waste wood for fuel. Six processing facilities in the U.S. and Canada were visited. In addition, processing equipment manufacturers, solid-waste regulators, and facility owners and operators that were not visited were interviewed.

Research focused on investigating regulatory and economic issues that affect the ability of processors to use wood from the waste stream; determining the types and sizes of facilities that process waste wood in the study area; and identifying the major types and capabilities of equipment and systems used to process wood for fuel.

The study determined that operation of a waste-wood processing facility is contingent on many factors including the economic and regulatory climate that affects the types of waste wood available to processing facilities; ways in which recycling and solid-waste management authorities permit a processing facility; and the size and specifications of markets that use processed waste wood for fuel or other uses.

Waste-wood processing methodologies, equipment, and systems are evolving to meet the requirements of various end-use markets. Facility operators are becoming more specific about the types of wood accepted for processing. The level of inspection and enforcement of unacceptable materials prior to processing is an important step in achieving and maintaining the quality and specifications required for fuel and other end-use products.

Waste-Wood Combustion Facilities

Combustion facilities that burn, or intend to burn, processed waste wood for fuel were researched and identified in the study area. Data on the capacity of the facility, type of fuel handling, combustion, pollution control equipment used, and stack emissions and ash characteristics were collected. Research techniques included surveying commercial and industrial wood energy facilities; visiting two combustion facilities in the U.S. and Canada; completing telephone interviews with plant engineers, equipment manufacturers, and air-quality regulators; and reviewing published research about the performance of various wood-combustion systems.

The study identified key issues concerning fuel specifications and procurement, fuel delivery and feeding equipment, and furnace and boiler designs for combustion facilities that use processed wood for all or part of their feedstock. The study focused on utility-scale power plants that burn processed wood exclusively for electrical generation, and industrial facilities that burn processed wood to produce thermal and/or electrical energy. In particular, the project team investigated the issues that affect the decision to procure and burn processed waste wood.

The decision to use processed waste wood for fuel, especially treated wood, is primarily affected by the fuel requirements of the combustion system; availability of fuel from untreated waste wood; local air quality conditions and local environmental regulations and standards; and the familiarity of state, provincial, or local regulatory authorities with waste-wood combustion technologies and facilities.

Chemical and Physical Properties of Waste Wood and Its Ashes

The chemical and physical properties of waste woods and the ashes produced from their combustion were evaluated. There is limited information available in the technical literature. There is some information on "clean" wood but it is also extremely limited and not completely applicable to waste-wood combustion. Since there is

increased interest in using waste wood to produce energy, it is important to understand its properties to predict the environmental impact from its burning.

The type of information gathered for this study is needed to evaluate the emission of trace metals due to combustion of waste wood and to understand the metal contaminants in the ash. The waste-wood data collected can be used by developers, regulators, and others.

This study used random sampling techniques to obtain waste wood and ash samples from six waste-wood processing and two combustion facilities that employed various processing and combustion methods. Samples gathered at these facilities were then finely ground, blended, and analyzed to obtain information on their chemical and physical properties. Ash samples were obtained from combustion facilities and also by laboratory ashing the collected waste-wood samples.

As part of this study, homogeneous waste-wood samples were collected and analyzed. Some of these samples were collected from facilities also burning these homogeneous materials. In those instances, ash samples were also collected and studied. The following types of homogeneous waste woods were collected and analyzed:

- plywood
- CCA pressure-treated wood
- particle board
- creosote-treated wood
- furniture scraps
- laminated wood

Environmental Impacts of Waste-wood Combustion - Air

Emissions of heavy metals, sulfur, and chloride from the combustion of waste wood in boilers can be approximated using wood and ash concentration data developed for this study. These data, and conservative observations about partitioning these compounds between bottom and fly ash, can be used to estimate air emissions. Worst case assumptions about the partitioning (e.g., 100% of metals are contained in the fly ash) can be used for overestimates of emission rates; however, emissions of organic compounds cannot be estimated from wood and ash composition data.

Actual emissions data from testing existing wood boilers have been compiled to supplement the wood and ash concentration data gathered for this study. While emissions data for criteria pollutants such as particulate matter, nitrogen oxides, carbon monoxide, sulfur dioxide, and total hydrocarbons were obtained, this study focused on non-criteria pollutants such as metals and various organic compounds that are regulated as hazardous air pollutants (HAPs) by most state agencies.

In the absence of HAP emissions data for wood boilers, regulators have used test data from residential wood combustion appliances to quantify emissions. Although these data may be useful in identifying the types of pollutants that may be products of wood combustion, the emission rates from industrial wood-fired boilers are significantly lower due to the differences in combustor design, combustion efficiencies, and operating conditions. The overall objective of compiling emissions data for this project, therefore, was to summarize available HAP emissions data that are more applicable to commercial or industrial wood boiler facilities.

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***Robert C. McCrillis** is the EPA Project Officer (see below).*
The complete report consists of two volumes, entitled "Wood Products in the Waste Stream-Characterization and Combustion Emissions."
Volume 1. "Technical Report," (Order No. PB93-198950; Cost: $49.00, subject to change).
Volume 2. "Appendices," (Order No. PB93-198968; Cost: $28.00, subject to change).
The above reports will be available only from:
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