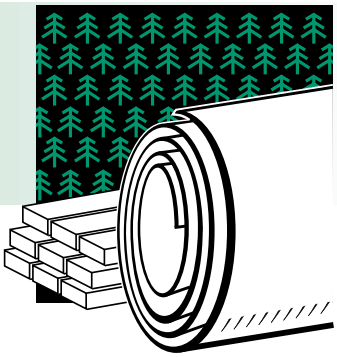
FOREST PRODUCTS

Project Fact Sheet



Experimental Assessment of Low-Temperature Plasma Technologies for Treating Volatile Organic Compound (VOC) Emissions from Pulp Mills and Wood Products Plants

Benefits

- Avoids unnecessary and wasteful heating of the entire stream
- Uses 99.9 percent of the electrical energy to selectively destroy pollutants
- Decreases energy costs by up to $500,000 annually in each operating unit
- Reduces capital costs by one-fifth to one-half compared to those of an RTO system
- Lowers the forest products industry's annual maintenance and operating expenses
- Eliminates production of 2 million tons of CO_2 emissions
- Offers other industries an economical method for controlling VOC emissions

Applications

The first commercial installation of this technology is not expected before 2003. It will also be applicable to VOC emissions from other industries, such as chemicals.

The Most Cost-Effective Technology Will Be Identified and Tested on In-Mill Slipstreams

Pulp mills and wood products plants are under increasing pressure from the U.S. Environmental Protection Agency to control the emissions of volatile organic compounds (VOCs) generated during their operations. The present-day control technology, regenerative thermal oxidizers (RTOs), is energy-intensive and dependent on combustion technologies that heat the entire waste stream.

An emerging technology using nonthermal plasmas can selectively and cost-effectively destroy VOCs by producing excited species (free radicals and ions) that oxidize, reduce, or decompose molecules of pollutant(s). The new technology is easily installed with little follow-on maintenance. It is expected to use small amounts of energy compared to RTOs, saving, for example, 2 trillion Btu/year for the three streams in the forest products industry that produce VOCs, which will be studied in this project. The technology will also avoid producing about 2 million tons of carbon dioxide each year from treatment of the same three streams.

Plasma Technology for VOCs

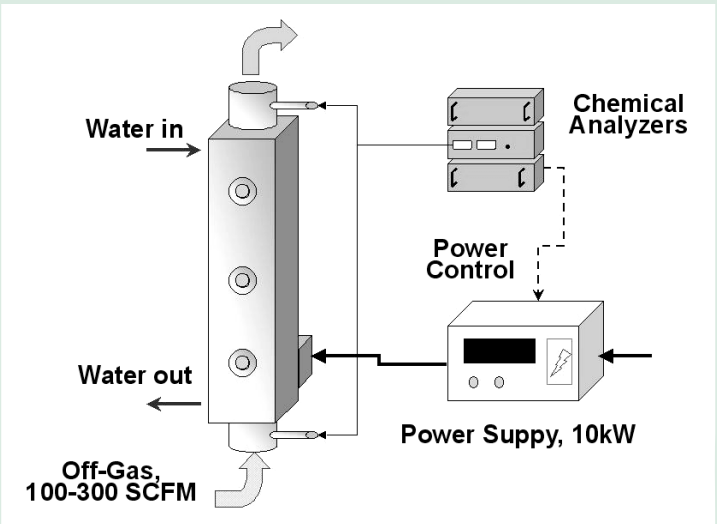


Figure 1. Pilot-scale Wet-Corona Reactor for Treatment of Brownstock Washer Vent Emissions

Project Description

Goal: To identify and demonstrate the best low-temperature plasma technology for controlling VOCs in pulp mills and wood products plants.

Four plasma systems have been identified as candidates for use in the forest resources industry: the high energy electron beam, nonthermal gliding arc, dielectric packed-bed corona, and pulsed corona with water injection. Researchers will conduct a three-year study to explore the advantages and disadvantages of these systems for various stream conditions and VOC concentrations.

Streams believed best suited for plasma technologies are brownstock washer vents in pulp mill applications and press vents and dryer vents in the wood products industry. Press vents are particularly attractive because they are intermittent in nature and the VOCs are easily handled by the pulsed operation of nonthermal plasmas. Simulated VOC emissions that represent these three target streams will be prepared in the laboratory. Each VOC stream will be treated with each of the four technologies over a range of power levels and flow rates, using analytical techniques to ensure the plasmas do not generate new VOCs. Engineering data will be obtained for scaling up to industrial demonstrations of selected technologies and VOC concentrations will be increased by a factor of three to determine the effect of the recent "tightening" of vent systems and recirculating vent gases at certain facilities.

Researchers will work closely with industry in conducting engineering tasks and demonstrations. Georgia-Pacific will select mills for demonstrating the selected technology.

Progress & Milestones

- Four candidate technologies were identified by a literature survey.
- Georgia-Pacific introduced a possible future modification of the brownstock process that could potentially have a major impact on the composition of the HVLC brownstock washer vent emissions.
- Laboratories have assembled and/or modified their respective laboratory systems to determine the energy consumption and destruction efficiencies for controlling HVLC brownstock washer vent emissions with low-temperature plasma technologies.
- In cooperation with Ecos, Ltd., the University of Illinois - Chicago has designed a laboratory system for testing the wet heterogeneous pulsed-corona discharge and, furthermore, is extending this process concept to the gliding-arc low-temperature plasma technology.
- Pacific Northwest National Laboratory is designing and fabricating a large-scale test system of their gas-phase corona reactor (GPCR).
- Data from a nine-month laboratory study of brownstock washer vent emissions will be used to select the best low-temperature plasma technology for this stream and to determine whether or not to proceed with a mill demonstration.
- Laboratory studies of oriented strandboard press vent emissions will proceed in parallel with the above mill demonstration.
- A final report will be produced at the end of the third year, summarizing laboratory studies and results of the demonstration.

Project Partners

University of Illinois
Chicago, Illinois
Argonne National Laboratory
Argonne, IL

Pacific Northwest
National Laboratory
Richland, WA

Georgia-Pacific Corporation
Atlanta, GA

Current Environmental Solutions
Irving, CA

ECOS Ltd.
Moscow, Russia

American International
Technologies
Torrance, CA

For Additional Information, Please Contact:

Mark Paster
Office of Industrial Technologies
Phone: (202) 586-2821
E-mail: mark.paster@ee.doe.gov

Dr. Alexander Fridman
Dept. Mechanical Engineering
University of Illinois at Chicago
Chicago, IL 60607
Phone: (312) 996-5517
E-mail: afridman@uic.edu

Dr. John B.L. Harkness
Dept. Mechanical Engineering
University of Illinois at Chicago
Chicago, IL 60607
Phone: (312) 996-5096
E-mail: harkness@mcs.net

Visit our homepage at
www.oit.doe.gov

Office of Industrial Technologies
Energy Efficiency and
Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

OIT

February 2001