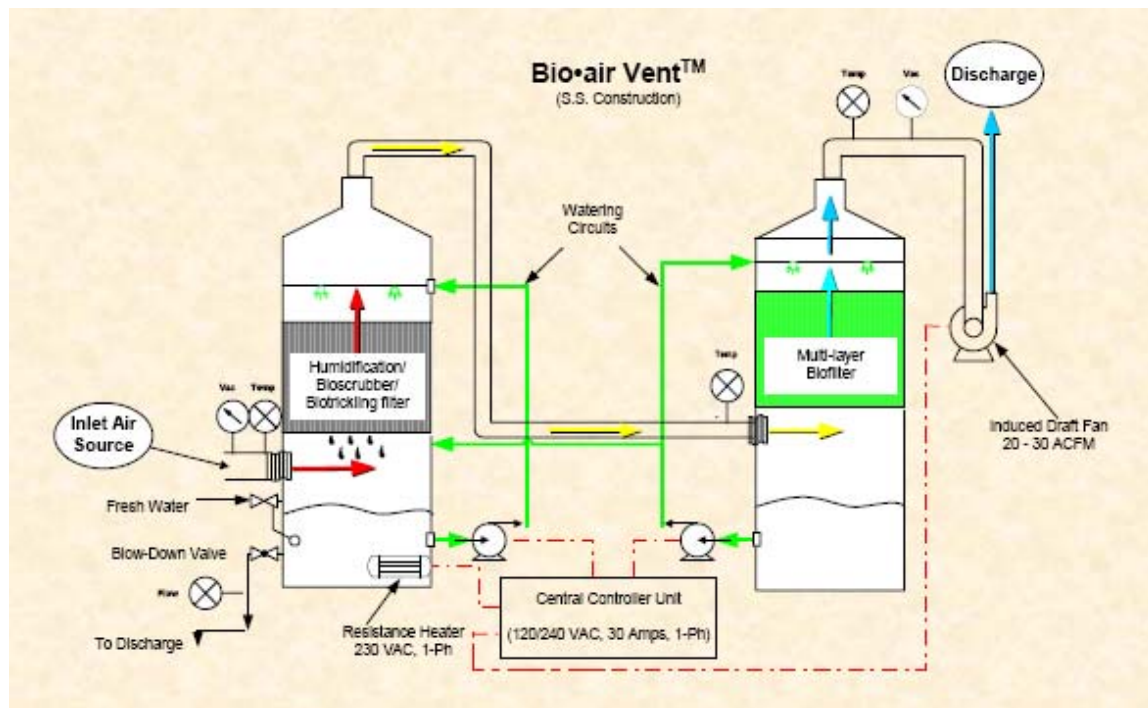


## Innovative Biological Air Filtration Technology Demonstrates Energy-Efficient VOC Emissions Control at Lumber Mill

The gaseous emissions from hardboard presses at lumber mills contain volatile organic compounds (VOCs), condensable organic compounds (COCs), hazardous air pollutants (HAPs), and very small particulate material – all of which are regulated by the government. In order to comply with environmental regulations and air quality standards, it is critical for the wood products industry to control its emissions of these pollutants. Of particular importance to the industry are the control of formaldehyde and methanol, and the reduction of visual emissions (opacity) from press vents.

Biological systems that employ microorganisms to oxidize organic and inorganic pollutants into nontoxic byproducts are emerging as a promising alternative control technology to costly emission control techniques such as regenerative thermal oxidation (RTO) and regenerative catalytic oxidation (RCO), which require significant amounts of energy and generate secondary pollutants such as nitrogen oxides and excess carbon dioxide. In a project sponsored by the Industrial Technologies Program, researchers from Texas A&M University-Kingsville and Bio•Reaction Industries LLC have recently completed field-scale tests of a biological oxidation and air filtration system at Stimson Lumber Company in Forest Grove, Oregon. The testing has shown that a multi-stage bio-oxidation system is a viable control technology that uses less energy and costs less to operate than conventional systems.



**Schematic of a biological oxidation system (courtesy of Bio•Reaction Industries LLC).**

At the foundation of the bio-oxidation system are biofilms made up of bacteria and fungi that absorb and metabolize hazardous compounds. By breaking down the hazardous

compounds into water and carbon dioxide, the system achieves the oxidation result obtained by RTOs and RCOs without producing secondary pollutants. In the multi-stage bio-oxidation system design that was tested during the project, biological activity is employed in multiple filtration environments in order to optimize the ability of the system to remove a diverse mixture of hazardous pollutants.

The design of the 10,000 cfm capacity unit combined a three-stage treatment process for the VOC, HAP, and particulate emissions in the press exhaust airstream: (1) water soluble compound and particulate removal in the bioscrubber/biotrickling filter, (2) biodegradation in the biofilm of the biotrickling filter and in the sump waters, and (3) hydrophobic compound adsorption and biodegradation in the multi-layer biofilter.

Previous bio-oxidation systems have been hampered by their large footprint size and the loss of structural integrity. The engineered materials used in this project were designed to maximize air to biofilm surface contact, allowing biofilters to be much smaller than previous designs with the same capacity. Secondly, the structure of the filters were designed so as not to be subject to problems of compaction and collapse that have occurred in the compost-based media of previous bio-oxidation systems.



**Cross-flow media in the biotrickling module**



**Bio•AIRSPHERES™ in the multi-layer biofilter**

Pilot scale testing completed in 2006 successfully demonstrated the performance of the bio-oxidation system design, treating emissions ranging from 1,500 to 3,500 cfm while achieving Maximum Available Control Technology (MACT) compliance. The system consistently removed VOCs to less than 5 ppm at the outlet and met project objectives for opacity reduction to 0-5%. Furthermore, the consortium of microorganisms within the unit proved to be robust, oxidizing a broad range of VOCs and withstanding fluctuations in vent gas composition. The results of the field trial indicate that a scale up of the biological treatment technology to where it can handle all of Stimson's press vent emissions output of almost 75,000 cfm is feasible.

The energy savings opportunity that the bio-oxidation system offers to the wood products industry is substantial. For the entire US panel board industry, the natural gas usage for VOC and HAP control is estimated at 3.85 trillion Btu per year. At \$7 per million Btu, that translates into an annual cost to industry of \$27 million that could be avoided through the use of biological pollution control systems.

Because regulatory agencies compare pollution control devices to standards for maximum-available or best-available control technology, and because biological systems have been viewed with skepticism in the past by regulatory agencies, industrial facilities have been reluctant to install them. The successful demonstration of the multi-stage bio-oxidation system lent data that supported a determination by USEPA Region IV that the BRI bio-oxidation system was acceptable as a best available control technology for press emissions. It therefore marks an important achievement in paving the way toward the greater acceptance and adoption of bio-oxidation systems throughout the Forest Products industry.

HAPs and VOCs are released by a number of processes within the Forest Products industry. As a result the biological systems control technology has a wide range of potential applications. Several more field tests are planned, promising continued progress in bio-oxidation technology.

A fact sheet on this project is available from:

[http://www.eere.energy.gov/industry/forest/pdfs/biological\\_emissions.pdf](http://www.eere.energy.gov/industry/forest/pdfs/biological_emissions.pdf)

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