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CONTACT REPORT--MRI Project No. 6502-83

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Person(s) Contacted/Title(s)

Robert Kaufmann, Director, Air Quality Program, AFPA
Dave Mumper, Chairman of Solid Waste Subcommittee, AFPA (Weyerhaeuser)
Lawrence Otwell, Georgia-Pacific
Uday Singh, Woodward-Clyde
Rod Pennington, REECO
Steve Langseth, P.E., Engineering Manager, Weyerhaeuser, Grayling, MI
Dr. Jim Boswell, Louisiana-Pacific
Michael Hunt, Monsanto Enviro-Chem
Earl Atkinson, Ethyl Corporation

Also attending:
Dallas Safriet, USEPA/EIB
Conrad Chin, USEPA/ESD
Laxmi Kesari, USEPA/SSCD

CONTACT SUMMARY:

Richard Marinshaw and David Bullock of MRI attended the American Forest and Paper Association's BACT Technologies Workshop held at the Omni Hotel in Durham, North Carolina on Tuesday, October 12-Wednesday, October 13, 1993. The purpose of the workshop was to provide a technical forum for industry, State, and Federal (EPA) representatives to discuss the strengths, weaknesses, and current knowledge of potential solid wood BACT technologies.

Tuesday, October 12, 1993

Dave Mumper (Weyerhaeuser), Chairman of the solid wood subcommittee opened the meeting. He indicated that the wood products industry had three major concerns at this time: (1) the definition of VOC and whether or not it includes condensible organic PM; (2) the lack of a standardized test method for VOC; and (3) what is BACT for the wood products industries? He mentioned a meeting with OAQPS held in May 1993. He also indicated that a proceedings of this (October) workshop may be published.

Wellons Recirculation

Lawrence Otwell, Georgia-Pacific

Georgia-Pacific has worked with Wellons on this multicell fuel burner for direct fired applications.

The system reduces VOC and CO emissions from dryer exhausts via burner and dryer exhaust recirculation.

A pilot scale installation was not feasible. G-P is building a full-scale OSB facility in Mt. Hope, West Virginia. Another plant in Virginia is planned.

This is not a good retrofit option. The burner oversizing, etc. needs to be integrated into the entire facility design.

All dryer exhaust (100%) is recirculated as combustion air.

There is a provision (proprietary) for reheat in the ductwork to prevent condensation.

The system allows for start-up and shut down without redirecting dryer exhaust, i.e., the exhaust is always controlled.

The burner allows a 2 second residence time at 1600°F. The temperature and residence time modulate based on dryer demand.

The Mt. Hope system is 225,000 acfm at 400°F. The exhaust is controlled by a dry ESP.

Q:Why 400°F exhaust temperature?
A:Result of other system parameters.

Burner fuel is hogged fuel and bark. Nitrogen content is slightly higher than that of wood due to resin in the hogged fuel.

The burner in this system uses more hogged fuel (30-40%) per dryer than standard Wellons burners.

The combustion unit (Wellons burner) is substantially oversized as compared with typical units for the same size dryers. The burners are operated at a steady-state at a higher temperature than typical units. Basically operated as an incinerator.

Noted that firing the Wellons with wood will require more wood fuel than the plant will generate, i.e., wood shortfall. Purchasing additional wood fuel is a consideration.

Recirculated air is 18-20% moisture by volume.

There is no good way to measure the level of VOC in recirculated air.

VOC levels vary with the season and with changes in wood species and locale.

Stated that emissions are different for hardwood versus softwood species.

Air passes through the system only 1 time; 100% bleed off with each pass.

Combustion air and process exhaust are entirely mixed. Do not want to be designated as boiler. Some at EPA want to call this system a boiler and make it subject to NSPS for boilers.

This is a 240 MMBtu/hr installation (3 dryers) drying primarily soft hardwoods.

90% VOC reduction
60% CO removal
.1 lb/MMBtu PM (per M5)
.1 lb/MMBtu VOC (per M25A)
.2 lb/MMBtu CO
.23 lb/MMBtu NOx
.02 lb/MMBtu SO2

Q:Is exhaust exposed to flame or only hot gas?
A:Exhaust is exposed to flame.

Q:Controls VOC from dryer, what about from combustion?
A:Also incinerates burner VOC emissions along with dryer VOC. VOC emission rates given earlier include both dryer and Wellons emissions.

Wellons burner features two-stage combustion. First stage incinerates dryer VOC's. Second stage incinerates VOC's from the Wellons combustion.

Both of the planned facilities will be minor stationary sources (less than 250 TPD). Would have been major sources. Noted that if plants control CO, NOx, and VOC they can bring a source from major status to minor source status.

Suggested that BACT for press vents = uncontrolled.

Heat exchanger (proprietary) developed by G-P and Wellons. High temperature exhaust (1600°F) on one side; clean, ambient air on the other side.

Anticipate no additional installations by Wellons until the 2 G-P installations are proven.

Q:Capital costs?
A:Expensive. Good in comparison to other options.

Q:Does the Wellons still have primary and secondary air?
A:Those volumes have been adjusted.

Q:Could the Wellons be fired with natural gas or other fuels?
A:Yes.

Q:Any change in product quality?
A:No change.

Explained why the system is not regenerative thermal oxidation or recuperative thermal oxidation. But that it is basically a thermal incinerator.

Ultraviolet Oxidation

Uday Singh, Woodward-Clyde

Currently only aerospace industry applications (up to 300,000 acfm). These streams have no a- or b-pinenes. Do handle chlorinated hydrocarbons with no secondary treatment.

Requires fine PM filtration prior to unit.
Liquid phase VOC removal
Photolytic cells break down VOC's

Advantages of UV OX:
- -uses UV light, O3, and hydrogen peroxide
- -responsive to variations in inlet VOC concentration
- -efficient at low VOC concentrations (50-100 ppm)
- -no catalyst
- -can have downstream activated carbon
- -no secondary pollutants

Four existing UV OX systems (only aerospace in southern California)

Press vent VOC - proposed UV OX pilot
18,000-20,000 acfm per press vent

More efficient at lower VOC concentrations

Currently only 1 manufacturer: Ter Aqua (?spelling?)

UV OX is not temperature driven

Cost compares to RTO
operating costs are substantially lower (for aerospace)
maintenance costs - ??
major costs associated with the aqua reactor

All ESP's (wet and dry) produce ozone; quantities?

Q:(There was a question about some test data indicating that ESP's produce formaldehyde, i.e., outlet concentrations higher than inlet concentrations.
A:Jim Boswell, L-P, stated that this was due to Method 0011 having no filter. This allowed an interference which resulted in the higher formaldehyde measurements.

Q:Do the condensibles in wood products exhaust streams reduce the efficiency of the UV OX process by obstructing the UV light surfaces?
A:No. Uday says preventive maintenance cleans the surfaces. Jim Boswell stated that his graduate school work showed that the UV light oxidizes the material quickly, i.e., no buildup.

Q:Regarding the "tuning" of the UV frequency, what if there is a range of hydrocarbons?
A:The light is tuned to avoid VOC interference, not to a specific frequency to destroy a given compound.

Q:Why use liquid phase VOC removal?
A:To facilitate ozonation.

Q:John Pinkerton, NCASI, asked about cost per ton of VOC removed.
A:Not available, don't know.

Q:What about disposal of the wastewater?
A:Stated that wastewater quantity was small. Blowdown from the aqua reactor is 3-5 GPM per 100,000 acfm. [Is this a small quantity on an annual basis?]

Regenerative Thermal Oxidation (RTO)

Rod Pennington, REECO
(Rick has requested a printed copy of this presentation)

The RTO features packed ceramic beds for heat recovery. Typically saddle or interlock packed bed media.

OSB pilot incorporates both horizontal and vertical flow.

95% thermal efficiency

3% LEL energy requirement. OSB streams typically contain 1 - 1.5 percent of LEL, so auxiliary fuel required to reach the 3%.

Designed with an odd number of chambers to allow changeover from preheat to recovery mode without process interruption.

An Oregon "plywood" mill uses RTO's. (Discussion revealed that the facility is a paper impregnation facility - produces the paper overlay for plywood) The facility has 2 units: one installed in 1983-84, 20,000 scfm; one installed in 1987-88, 80,000 scfm.

Maintenance issue: plugging and fusion of materials in beds and ducts. "Bake out" - holds the chamber in outlet mode and raises the temperature of the bed toward 1500°F. This burns off the organics and particulate.

Q:Are emissions from bake out exhausted to the atmosphere?
A:Yes(??)

Q:Does this [bake out] create an opacity problem?
A:For five to 10 minutes. Jim Boswell stated that the opacity during this period is approximately 5 percent.

Q:Does this [bake out] generate excessive CO emissions?
A:Depends on material in the bed.

Q:What about ash accumulation?
A:

Q:How often do you bake out?
A

Bake out period takes about 1 to 1.5 hours, depending on the accumulation of material in the bed.

Bake out is effective at removing organic materials from the bed.

Issues for wood products dryer application:
- -minimize inorganic PM
- -means for cleaning beds
    - in-place cleaning
    - easy access
    - minimum down time and cost

Some type of PM control is required between the dryer/multiclone and the RTO.

The OSB dryer pilot installed in April 1993 has a proprietary prefilter.

With inlet PM grain loadings of 0.070 - 0.117 gr/dscf, bed life is about 2 years[??].

Issues for wood products press application:
- -collection of exhaust
- -reducing exhaust volume

The RTO is not self sustaining: it requires the 3% LEL, which the wood products streams typically do not have. You do need to add additional fuel (typically natural gas or propane?).

Biofiltration

Steve Langseth, P.E., Engineering Manager, Weyerhaeuser, Grayling, MI (517) 348-3457

There is a full-scale installation on an OSB dryer in Germany, 100,000 m^3/hr.

There are pilots on OSB presses and dryers in the United States.

Typical parts of a biofiltration system:
- -humidification system (maintains 85-90% humidity)
- -temperature control
- -air distribution system
- -filter media (can be wood bark)
- -condensate return
- -pH control

Moncure facility has 12,000 m^3 of bark material. 1 minute retention time. Blend air 1:1 with dryer exhaust (for temperature control). Experimenting with different bed temperatures, retention times, etc.

Dilution air is required for the dryer only, not for press vent streams.

Press and dryer streams can be combined, reducing the need for additional dilution air.

Don't need recirculation or humidification systems.

Percent reductions:

	OSB press	OSB dryer
VOC	90%	70-90%
CO	30%	50%
NOx	--	80-95%
HCHO	93%	85-98%
Resin/fatty acids	83%	99%

Press exhaust 120,000 acfm. (16-opening press)
Dryer <1100°F (drying 30% pine; remainder hardwoods)

Must be designed on a site-specific basis.

[In response to a question about CO emissions from the press, I believe Jim Boswell said that CO emissions from the press are the result of capture of CO emissions from the vehicles used to move stock in the press area.]

Bark already has the right microorganisms in it for wood products applications. Testing regarding the use of different types of bark is ongoing, but so far has shown no effect.

At Moncure (?) 1 ft^3 of bark per cfm of air.

75 percent of the bark is straight bark (i.e., straight from the debarker, no grinding); the other 25% is aged bark, i.e., has decomposed to some degree resulting in smaller size particles.

Biofilter requires the use of a prefilter to remove PM.

Bed life for the dryer is about 1 year.
Bed life for the press is about 2 years.

As the filter media decomposes, particles become smaller and pressure drop increases, therefore fan horsepower requirements increase.

They try to maintain the bed at about 110°F for optimum efficiency. At higher temperatures the microorganisms are even more active and would break down the organics faster, however they also begin to break down the filter media faster.

In the initial pilot the pit walls were completely vertical. This allowed channeling of the exhaust near the walls which bypassed the filter. Subsequent designs used walls at 45° angles; the weight of the filter media pressing against the walls prevented this type of channeling.

The support system for the bed is reinforced concrete flooring (for hog farming), has slots in it. There is about 2 feet of clearance between the bottom of the pit and the bottom of the bed.

The blend air fan is the only moving part.

Have had no problems with pH; they use no additives.

Controls organic and inorganic emissions. Some of the inorganic material actually enhances the biofilter operation, serving as additional nutrients.

VOC	90% removal
NO_x	80%
CO	30-50%
Odor	earthy
Opacity	0

Biofiltration is a good option because:
- -handles large air volume at low cost
- -handles low contaminant levels
- -handles a wide range of contaminants
- -handles a wide range of concentrations

Biofilter effectiveness is dependent on:
- -process gas dew point
- -pollutant species
- -pollutant concentrations
- -retention time
- -media material

Biofiltration is a simple system; doesn't require an engineer or scientist to maintain.

Cost: $3 million for a 350,000 acfm system; $8-$9/cfm

Colder climates are better - less dilution air required, therefore smaller units are necessary

Higher terpene levels may require larger units.

Monsanto Chemical Scrubbing

Jim Boswell, L-P, introduced the speakers.

Michael Hunt, Monsanto Enviro-Chem

VOLATEX VOC removal system - non-plugging scrubber; removes PM, quenches gas stream, and uses a bromine solution to capture VOC's

TEST - May 1992, L-P, Corrigan, Texas: achieved 70% VOC removal

TEST - June 1993, L-P, Urania, Louisiana: achieved 90% VOC removal

TEST - September 1993, L-P, Urania, Louisiana: achieved >90% VOC removal

A 100,000 cfm unit is about 14' in diameter, and 60' high.

This system is basically a three-stage scrubber:

Stage 1 - reverse jets for PM removal and quenching the exhaust stream
If you already have PM control (e.g., ESP, etc.) you don't need the reverse jets

Stage 2 - Packed section (Volatex section) - organics are removed in a brominated solution

Stage 3 - a final scrubber section

Q:(there was a question regarding outlet bromine concentrations)
A:Outlet concentrations less than 5 ppm bromine.

Q:What about bromoform emissions?
A:PM removal up front results in no bromoform generation.

The liquid from the packed section goes to a separator and then to an incinerator.

Reverse jet blowdown is about .1 GPM

Only one regenerator is necessary per plant.
There is a potential for VOC recovery (instead of incineration) - VOC's could be reused or sold.

Earl Atkinson, Ethyl Corporation

Pilot plant has been operating for about 30 days.

Types of VOC's removed:
- Terpenes
- Resin compounds
- Fatty acids
- Formaldehyde

Chemicals on-site:
- Aqueous hydrogen bromide
- Bromine (in situ)
- Brominated organics

Brominated organics are sent to an on-site incinerator for recovery and reuse of the bromine.
Potential for VOC recovery.

Pollutant removal efficiencies:

VOC	90%
formaldehyde	>90%
opacity	<20%
PM	<0.02 gr/dscf
CO	30%

Creates no NO_x

Commercial units available second quarter 1994.
Central bromine recovery and VOC recovery system developed by end of 1994.

Capital costs: $15/cfm

Annual costs: \$6/cfm

May be additional requirements for facilities with bromine inventories.