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Expert Report of Charles G. Simon, Ph.D.

Comments on Louisiana Pacific Swan Valley, Manitoba oriented strandboard facility's proposal to permanently eliminate abatement of hazardous air pollutant and volatile organic compound emissions from flake dryers and the board press.

Submitted to: Mr. Byron Williams, Public Interest Law Centre, 610-294 Portage Avenue, Winnipeg, Manitoba R3C 0B9

1. Introduction

This report was prepared at the request of the Public Interest Law Centre. This report is composed of my professional opinions based on evidence gathered to date and examined in the allotted contract period. Items and documents that I considered prior to authoring this report are listed in Attachment 1. This report may be amended if warranted by new information not previously considered. The report describes the following:

1. introduction,
2. the qualifications of the author,
3. summary of the author's conclusions,
4. general discussion,
5. hazardous air pollutant (HAP) and volatile organic compound (VOC) emissions from the flake dryers and board presses at the Louisiana Pacific (LP) Swan Valley oriented strand board (OSB) facility in Manitoba, with and without operation of the regenerative thermal oxidizers (RTOs) to treat emissions, and at LP-OSB facilities in the United States (US) using Best Available Control Technologies (BACT) to treat the same emissions, as required by current US regulations,
6. summary of discussions and interviews with Swan Valley citizens,
7. modern bioreactor technology as a cost-effective alternative organic HAP and VOC abatement technology for LP Swan Valley, and
8. author's conclusions.

2. Qualifications of the Author

For the past 33 years I have worked in scientific fields directly involving the measurement of atoms, molecules and small particles in ambient air, in stationary source emissions, and in low earth orbit. For five of those years, 1980-1985, I was employed as a research chemist by the National Council of the Paper Industry for Air and Stream Improvement, known by the acronym NCASI. Most of my work with

NCASI consisted of measuring and reporting VOC, carbon monoxide (CO) and total reduced sulfur compounds (TRS) emission factors for panel board and paper manufacturing sources such as wood dryers, press vents, wood-fired boilers and electrostatic precipitators.

In the last 15 years I've provided technical consulting services to the United States Environmental Protection Agency's Office of Enforcement and Compliance Assurance (USEPA-OECA), the US Department of Justice Environmental and Natural Resource Division (USDOJ-ENRD), and the Ontario Ministry of the Environment (MOE). In that time I've been directly involved with nearly a hundred facility settlements for violations of the US Clean Air Act and Canadian air emission regulations. Over fifty of those facilities were panel board manufacturing operations where I took the technical lead in the investigations.

During that time I also interacted extensively with forest product industry representatives, as well as consulted extensively with EPA personnel responsible for publication of panel board facility emission factors, and EPA personnel working to develop the plywood and composite wood products National Emission Standards for Hazardous Air Pollutants (PCWP-NESHAP) utilizing Maximum Available Control Technology (MACT). Concurrent with those activities, I established a VOC analytical laboratory in 1995, which continues to provide support to over one hundred industrial stationary sources across the United States each year.

I hold a Bachelor of Science degree in Chemistry from Jacksonville University, a Master of Science degree in Environmental Analytical Chemistry from the University of South Carolina, and a Doctor of Philosophy degree in Physical Chemistry from the University of Florida. My curriculum vitae, publication list, and list of US and Canadian cases with summaries of my activities are presented in Attachment 2.

3. Summary of Author's Conclusions

It is understandable in the recent economic environment that LP would propose to eliminate controls for VOC and HAP emissions from the flake dryers and board press at the Swan Valley OSB mill. Instead of replacing or refurbishing the RTOs, LP is requesting the Manitoban Government to allow a permanent 33-fold increase in actual VOC emissions from the dryers and press at the Swan Valley mill, from about 25 tons per year (tpy) with properly operating RTO controls, to over 825 tpy when operating only wet electrostatic precipitators [1]. As discussed and referenced below, the actual increase in VOC emissions, based on emission testing, could be over 40-fold, up to a max of 1,140 tpy.

The LP request of the Manitoban Government will also allow a 100-fold increase in actual emissions of hazardous air pollutants from the dryers and press, from about 4 tpy with properly operating RTO controls, to over 400 tpy when operating only wet electrostatic precipitators [2].

With the RTOs off, LP-Swan Valley's total nitrogen oxide (NOx) emissions from the dryers, board press and thermal oil heater will be reduced by 50 tons per year, from about 200 tpy to about 150 tpy [3]. Carbon dioxide emissions from the combustion of fossil fuel to heat the RTOs will be eliminated.

The LP-Swan Valley OSB mill is currently a low-VOC, high NOx emitting facility. When the RTOs are not operational the Swan Valley OSB mill is a high-VOC, high-NOx emitting facility. The potential for formation of tropospheric ozone and smog is significantly greater without control of dryer and press VOC emissions at Swan Valley.

In my experience with forest products companies, the strong motivation to externalize air pollutant costs can only be overcome by regulation. In the US, LP OSB flake dryers and board presses are required to use best available control technologies (RTO, RCO, biological) to control VOC and organic HAP emissions [4]. A number of panelboard facilities in the United States use biological controls as part of BACT [5].

A modern bioreactor may be able to provide BACT at Swan River for about the same, or less, cost of replacing the RTOs, and about one-fourth of the cost of operating the RTOs and WESPs [6]. A modern bioreactor also may be able to replace the existing wet electrostatic precipitators (WESPs) at Swan River for control of particulate matter emissions [7]. If this is possible, it would be cheaper to operate the modern bioreactor than the WESPs, air emissions of particulate matter (PM), VOC and HAP would be reduced by 95% or more, and the cost of operating the RTOs would be eliminated along with their carbon dioxide and nitrogen oxide emissions.

There are hundreds of modern bioreactors operating today around the world, reducing VOC emissions without greenhouse gas emissions [8]. One modern bioreactor has operated successfully for several years at a large medium density fibreboard mill in the US, meeting or exceeding all vendor guarantees of efficacy and operation costs [9]. Several board mills in the US use more antiquated biofiltration technology that would not be appropriate for the LP Swan Valley mill

In my opinion, LP-Swan River should be required to investigate application of modern bioreactor technology with the required intention of installing one or more units to control dryer and press VOC and HAP emissions. This technology has the potential to reduce VOC, HAP, NOx and greenhouse gas emissions while lowering operation costs for the mill to less than the costs of operating with WESPs alone.

4. General Discussion

4.1 Economic considerations

It is understandable in the recent economic environment that LP would propose to eliminate controls for VOC and HAP emissions from the flake dryers and board press at the Swan Valley OSB mill. Like all other industries in Canada and the United States, LP management has a fiduciary responsibility within the laws and regulations where it operates to seek maximum profits for its owners, its principals, its employees and its shareholders. The citizens of Manitoba should expect no less dedication to this ideal from the LP facility located in their home province.

The economic environment the past two years has resulted in losses for LP on the corporate level since their revenue is tied to the building industry [9]. In the past two quarters LP has seen a resurgence in its stock prices as it continues to close the gap between operating costs and revenues [10]. This may provide additional impetus for LP management to externalize or otherwise eliminate all conceivable costs. Although LP OSB mills continue to operate in the US with RTOs and other BACT controlling VOC and HAP emissions, it is only because the controls are required by US law [11]. Without legal requirements for the LP OSB mill in Swan Valley to operate RTOs, there is no economic reason for LP to do so.

4.2 Brief history on panelboard industry VOC emission control compliance

When LP- Swan Valley was first built in 1994, LP management agreed to install RTOs to control the nearly 1,000 tons/year of potential VOC and HAP that would be emitted to the atmosphere from the flake dryers and board presses under full operation [12]. In the US at that time, LP had recently paid a fine of more than US $11,000,000 and had signed a consent decree (Attachment 3) that required installation of best available control technology to control VOC emissions from OSB flake dryers and press vents [13]. This was the result of enforcement of the requirement in the US for a facility to apply BACT if the VOC emission potential under permitted full production of a new facility is greater than 250 tons/yr, or if an existing facility makes a modification that results in an increase in the potential to emit VOC under maximum permitted production rates of more than 40 tpy [14].

US law is cited in this report only as a comparison with Manitoban law. Under current US law, a facility must apply BACT to control HAP emissions to the atmosphere if the potential to emit any single HAP under full permitted production is greater than 10 tons/yr, or the potential to emit any combination of HAPs is greater than 25 tons/yr [15]. For VOC and organic HAP emissions from OSB flake dryers and board presses, RTOs, regenerative catalytic oxidizers (RCOs), and bioreactors are recognized as best available control technologies [16]. However, the current US regulations regarding HAP control in panel board mills are not federally enforceable yet [17].

Starting in 1979, Forest Product Industry representatives directed NCASI to measure and report VOC emissions from panel board manufacturing operations and means for their control. Results of a multi-year study on VOC emissions from plywood mills were published in 1983 [18]. In 1986 NCASI published two studies on formaldehyde and VOC emissions from OSB flake dryers and press vents [19, 20]. All of these studies showed relatively high levels of VOC emissions which would require a large number of panel board facilities to install BACT. When EPA looked at state permits for these types of facilities, they found that the amount of VOC emissions listed in many permits were drastically understated [21]. NCASI repeated and expanded VOC and HAP emission studies of panelboard facilities in the 1990s and again found high levels of both pollutant categories from OSB flake dryers and presses [22].

4.3 Competition considerations

LP cites low product demand in the current market as economic justification for reducing operating costs [23], but they make no mention of the disposition of profits over the many years of high demand and high prices they enjoyed while operating the Swan Valley facility from 1995 through 2006, other than their original assurances that all LP employees would share in profits [24].

In Canada, no other LP OSB facility is required to apply BACT for VOC and HAP emissions control [25]. It is highly likely that each of those mills is emitting up to ~1,000 tons of VOC per year, including ~500 tons per year of hazardous air pollutants. LP cites this situation as further justification to allow its Swan River plant to emit similar levels of VOC and HAP on the surrounding citizens. In contrast, LP OSB facilities in the US currently use BACT to control VOC and HAP emissions from flake dryers and board press vents continuously.

Air emission control costs produce no return. If these costs can be externalized and passed on to the local communities, then they don't have to be borne by the manufacturing plant and profits will be higher, along with stock prices and employee bonuses.

5. Wood Dryer and Board Press HAP & VOC Emissions at LP-Swan Valley and US mills.

Instead of replacing or refurbishing the RTOs, LP requests the Manitoban Government to allow a 33-fold increase in actual VOC emissions from the dryers and press at the Swan Valley mill, from about 25 tons per year (tpy) with properly operating RTO controls, to 825 tpy when operating only wet electrostatic precipitators [1]. The LP request of the Manitoban Government will also allow a 100-fold increase in actual emissions of hazardous air pollutants from the dryers and press, from about 4 tpy with properly operating RTO controls, to over 400 tpy when operating only wet electrostatic precipitators [2].

5.1 Comparison of dryer & press VOC emissions LP-Swan Valley and LP at LP mills in the US

LP OSB plants in the US must employ BACT to control VOC and HAP emissions from flake dryers and board presses. The Table below shows the emission limits for these processes at a number of LP facilities. The data in Table 1 are only meant to show that LP Swan Valley would continue to be one of the cleanest OSB mills in North America if it continues to utilize BACT to control its dryer and press emissions, and it would be one of the highest VOC/HAP emitting mills in the continent if it does not control its emissions.

Table 1. LP OSB mill flake dryer and board press VOC emissions in Swan Valley, MB and in the United States. (Not all listings are in the same terms.)

Louisiana Pacific OSB/L Mill Location	Total Dryer + Press VOC emissions tpy
Swan Valley aspen without BACT	***825, as VOC (requested) [26]***
Swan Valley aspen without BACT	***1140, as VOC (test results) [27]***
Swan Valley aspen with BACT-RTOs	*25, as VOC (test results) [1]*
Swan Valley aspen with BACT-Bioreactor	*57, as VOC (@95% efficiency)*
Roxboro, NC s. pine with BACT	33 (test results) [28]
Athens, GA s. pine with BACT	53 (permit limits) [29]
Sagola, MI aspen with BACT	50 (permit limits) [30]
Carthage, TX s. pine with BACT	~100 (>90% control required) [31]
Jasper, TX s. pine with BACT	37 (test results) [32]
Limerick, M (OSL) hardwood with BACT	52 (permit limits) [33]

5.2 VOC mass emission calculation for hardwood drying and pressing

Some of the VOC emissions in Table 1 are expressed in different terms than "actual VOC" emissions. A common practice for drying and pressing pine wood species is to express VOC "as propane plus formaldehyde" [35]. This is based on EPA guidance for calculating VOC emissions from pine tree processing when using Method 25A at less than 10% moisture (dilution probe required when necessary) and an independent measurement of formaldehyde, since it does not respond to the flame ionization detector (FID) used in Method 25A. This is an appropriate and accurate way to calculate and report VOC mass emissions from pine dryers and presses, which emit mostly terpene compounds with lesser amounts of methanol and formaldehyde. *However, it is neither appropriate nor accurate to apply this methodology to calculate VOC emissions from drying and pressing hardwood species.*

Hardwood (like aspen) VOC emissions are made of acetic acid, methanol, formaldehyde, and lesser amounts of other oxygenated hydrocarbons [36, 37]. None of these compounds responds to an FID very well, and formaldehyde doesn't respond at all. For oxygenated organic compounds, Method 25A requires the use of response factors, or an appropriate calibration gas, that assures the relationship between the FID signal and the actual concentration of organic compounds in the gas stream is known [38]. In addition, both Manitoban and US definitions clearly define VOC as "…organic compounds that participate in atmospheric photochemical reactions…" [39]. The mass emission rates of these organic compounds are the subject of regulation and emission limits, not the carbon content of the organic compounds, and not the raw FID signal without the use of response factors.

For the VOC emitted from drying and pressing hardwood species, the average response factor for the FID signal in the analyzer used to measure emissions at LP-Swan Valley is 0.7, conservatively [40]. That means that the carbon atoms in the hardwood VOC compounds produce a signal on the Method 25A FID analyzer that is only about 70% (or less) of the corresponding signal produced by the same number of carbon atoms in the propane calibration gas. So, the propane-calibrated FID signal must be divided by 0.7 to yield the concentration of hardwood VOC carbon atoms in the sample gas.

Next, the VOC concentration signal must be used along with the ratio of the average molecular weight of the actual VOC compounds divided by the carbon weight contained in the compounds to arrive at the actual VOC mass emissions. For hardwood drying and pressing, the average molecular weight to carbon weight ratio for acetic acid, methanol and formaldehyde is ~2.5. So, the concentration of hardwood VOC (minus formaldehyde) is easily calculated from the M25A signal as follows:

Equation 1.

$$\frac{\text{(lbs/hr propane-calibrated FID signal expressed as carbon))(2.5 lbs VOC/lb carbon)}}{\text{(0.7 per carbon response of oxygenated organic compounds in hardwood VOC vs. propane)}}$$

= lbs actual VOC emissions (without formaldehyde).

As an example, consider the VOC mass emissions from the WESPs serving the dryers at LP-Swan Valley. In May of 2006 LP conducted emission tests for VOC and HAP on these sources and reported a total VOC emission rate of 51.6 lb/hr expressed as carbon and as measured with a VIG Method 25A FID based analyzer without response factors [41]. There was also 32.5 lbs/hr of formaldehyde emissions from the dryer WESPs. Applying the average response factor and the average molecular weight to carbon weight ratio to this result, and adding the formaldehyde emissions, yields the actual total VOC mass emissions from the dryer WESPs.

Equation 2.

$$\frac{(51.6 \text{ lb VOC as C/hr, propane-calibrated FID signal}))(2.5 \text{ lbs VOC/lb carbon})}{(0.7 \text{ per carbon FID response for oxygenated organic compounds versus propane})} + 32.5 \text{ lb/hr formaldehyde}$$

$$= (51.6)(2.5) / (0.7) + 32.5 = 217 \text{ lbs/hr actual total VOC mass emission, or } 950 \text{ tons/year}$$

The VOC emissions from the press vent (RTO inlet) at LP-Swan Valley in the May 2006 tests were reported as 10.4 lb/hr expressed as carbon and as measured with a VIG Method 25A FID based analyzer without response factors [41]. There was also 6.5 lbs/hr of formaldehyde emissions from the press. Applying the average response factor and the average molecular weight to carbon weight ratio to this result, and adding the formaldehyde emissions, yields the actual total VOC mass emissions from the press.

Equation 3.

$$\frac{(10.4 \text{ lb VOC as C/hr from propane-calibrated FID signal})(2.5 \text{ lbs VOC/lb carbon})}{(0.7 \text{ per carbon FID response for oxygenated organic compounds versus propane})} + 6.5 \text{ lb/hr } CH_2O$$

$$= (10.4)(2.5) / (0.7) + 6.5 = 43.6 \text{ lbs/hr actual total VOC mass emission, or } 191 \text{ tons/year}$$

As the VOC mass emission calculations show, there is a large discrepancy between the FID raw signal and the actual, accurately calculated, VOC mass emissions. Since there are no Manitoban regulations that rely on VOC mass emission levels, this calculation is only useful in addressing VOC mass emission limits expressed in g/s. The May 2006 engineering tests at LP-Swan Valley were performed at maximum production conditions and showed that the total VOC emission rate from the dryers and press without RTOs can be as great as 261 lbs/hr, or 1,140 tons per year, or 32.9 g/s. *Consequently, LP should request, and the Clean Environment Commission (CEC) should consider, a higher allowed VOC emission limit of 33 g/s instead of the current request for a total of 23.7 g/s from its dryer e-tubes and press vent at Swan Valley*.

The same tests showed formaldehyde emission rates from the press and e-tubes of 4.92 g/s, or 171 tpy. This is consistent with LP's request for a formaldehyde limit of 5.1 g/s from these sources without emission controls. *The CEC should consider that an additional 7.3 g/s, or 253 tpy, of other hazardous air pollutants will also be emitted without emission controls on the dryers and press.*

5.3 Comparison of LP-Swan Valley VOC and HAP emission test results with historic data

For verification purposes, I compared LP-Swan Valley flake dryer and OSB board press VOC and HAP emission rates to other similar mills tested by NCASI and reported in Technical Bulletin No. 772 entitled, "Volatile Organic Compound Emissions from Wood Products Manufacturing Facilities Part V – Oriented Strandboard" [42]. The results from this study formed an important part of the MACT data base used by the USEPA to develop the PCWP-NESHAP (Attachment 4).

Two mills in the NCASI study used 100% hardwood furnish, mainly aspen with small amounts of either maple or birch. The dryer and press emissions at both facilities were controlled by either RTOs or biofiltration. Concentrations of hazardous air pollutants and total VOC were made before and after the control devices. The two mills used triple pass rotary dryers instead of the single pass rotary dryer currently used by LP-Swan Valley. Although both types of dryers are very similar and have high inlet temperatures, the single pass dryer has a lower potential for producing wood fines from tumbling of the wood flakes. While the total thermally-extractable volatile organic compound emissions from both types of dryers is the same, there is the theoretical potential for less overheating of wood fines in the single pass dryer. (However, testing at LP-Swan Valley before and after installation of single pass dryers did not confirm this, as discussed and referenced below.)

Since overheating of small wood particles in dryers can be a significant source of VOC/HAP emissions from flake dryers, there should be the potential for a measurable difference (>20%) in these emissions between the two types of dryers processing the same types of wood flakes. However, the May 2006 tests on the single pass dryers at Swan Valley did not support this assumption under maximum (worst-case) production conditions [43]. VOC and formaldehyde missions were the same or higher than the old dryers [44]. Subsequent tests in September of 2006 at a little lower production rate showed about 1/3 less VOC emissions and about the same formaldehyde emissions as the old dryers [45]. ***The average results from both tests do not support the position that the new single pass dryers provide substantially lower VOC and HAP emissions.***

Based on the LP-Swan Valley January 2009 interim License No. 2861, maximum volatile organic compounds (VOC) emissions from the LP Swan Valley dryers are calculated to be 700 tons per year. Based on the May 2006 stack tests at LP Swan Valley, the maximum dryer VOC emission rate is actually 950 tpy [43]. This compares well with hardwood dryer VOC emission rates derived from the NCASI database of 750 to 1180 tpy [46]. Thus, the test results at Swan Valley appear to be accurate and reliable.

LP-Swan Valley's request for maximum uncontrolled total VOC emissions from the press are listed as 97 tpy, which is substantially less than the 190 tpy actual VOC emissions, calculated from the May 2006 test results [43]. However, the Swan Valley May 2006 test result is close to the upper end of the range of 177 tpy actual VOC emissions from the press under full production of 488 MMSF(3/8")/yr calculated from NCASI data [46].

Using NCASI TB 772 data and the maximum production rate of 488 MMSF(3/8")/yr, LP-Swan Valley's maximum uncontrolled dryer and press total organic HAP emissions are calculated to be 369 tons per year. This compares well with the May 2006 total of 424 tpy HAP emissions from Swan Valley uncontrolled dryers and press. In my opinion the tests at LP Swan Valley appear to be accurate measurements of the maximum HAP emissions.

In the United States a facility is considered a major source of HAP emissions if it has any single HAP emission potential >10 tpy, or an emission potential of all HAP combined of >25 tpy. For VOC under the Federal guidelines in the US Clean Air Act, a source is considered major if it has potential emissions >250 tpy. Major sources must implement Best Available Control Technology (BACT), if applicable, to control air pollutant emissions regardless of point of impingement concentrations across the fence line. LP's OSB facilities in the US have such controls in place, typically RTOs, RCO/RTOs, or biofiltration. Under US law, the solution to pollution cannot be dilution.

6. Summary of interviews and discussions with citizens of Manitonas, Swan River and surrounding farms in Swan Valley, Manitoba.

I visited this community on August 12-14, 2009. LP-Swan Valley employs nearly 200 people in a community of a few thousand. Everyone either has a relative or friend who works at the mill or knows someone else who does. Even the hotel staff in Swan River knew my planned schedule better than I did!

Every citizen with whom I spoke first mentioned their concern for the jobs of their compatriots. LP's threat to close the mill if forced to operate the RTOs for VOC and HAP emission control has been taken seriously by Manitobans. The citizens appear to be faced with the choice to either agree to allow their air shed to be polluted far beyond what any comparable community would have to bear in the US, or see their family and friends suffer the catastrophe of job loss with immediate cessation of family income sources that have been present for nearly 15 years. *A question that has not been addressed is whether LP will close its largest state-of-the-art OSB mill in Canada if required to continue to clean their air emissions, especially if they are presented with a cost-effective alternative to RTOs.*

Each of five citizens living on properties in the vicinity of the mill complained of nuisance odors from the mill, particularly during winter inversion days. One citizen complained of noise preventing sleep on many nights. One citizen who commuted to work daily complained of the daily log truck traffic in the winter contributing substantial risks to motorists. One citizen was concerned about livestock eating chemicals deposited by the LP plume. I noted that this citizen-farmer employed no artificial pesticides, herbicides or fertilizers to animal feed crops.

7. Modern bioreactor technology as a cost-effective alternative organic HAP and VOC abatement technology for LP Swan Valley

Modern bioreactor technology offers a compromise technology that would seem to fit both parties' goals. LP could decommission the RTOs permanently, thus eliminating their natural gas usage with associated high costs. A modern bioreactor may also be able to replace the WESPs, relieving LP of the high electrical and maintenance costs of those units. The citizens of Manitoba could enjoy the continued abatement of 95% or more of the hazardous and non-hazardous organic compounds emitted by the facility's dryers and press, and LP Swan Valley could eliminate greenhouse gas and NOx emissions from the RTOs while providing the community with the cleanest OSB mill in the country at an operating cost below the cost of operating the WESPs alone.

Hundreds of modern bioreactors are in operation around the world and routinely meet vendor performance guarantees [47]. Based on my experience investigating the use of these technologies in the Forest Products and other industries in the US, operational costs of bioreactors for the LP facility would appear to be about one fourth, or less, of the cost to operate the RTOs and WESPs. Installation cost of modern bioreactors at LP Swan Valley would probably be similar to the cost of replacing the existing

RTOs. However, the lifetime of the bioreactors is 20+ years. In addition, depending on the characteristics of the emission streams, it may be possible to eliminate the wet electrostatic precipitators at LP Swan Valley as modern bioreactors are very effective at controlling most types of particulate matter.

Operation of modern bioreactors in cold climates has not been a problem since there is typically a massive amount of incoming process heat. Even in sub-zero climates, cooling of the gas stream is the main issue to be resolved. Treated water from the bioreactor is recirculated to cool incoming gases. Clean water is used for makeup if required.

Standard brochures, corporate white papers, reference lists and published scientific articles from two modern bioreactor vendors, Tri-Mer Corporation and MEGTEC, are presented in Attachment 5. A careful review of these items by the reader is essential to understanding the conclusions of this report.

These technologies are in use at panel board facilities and meet vendor guarantees and MACT standards for VOC and HAP removal efficiencies [48]. If LP is reluctant to install bioreactor technology for VOC and HAP control, then the only viable alternative BACT is the wet electrostatic precipitators followed by RTOs currently installed at the facility. In my opinion, a simple older-technology biofilter will not work at Swan Valley, nor will RCOs.

(Note: LP-Swan Valley is the major customer of Manitoba Hydro's gas transmission service, accounting for ~80% of all gas usage prior to shutting down the RTOs and gas-fired boilers recently [49]. The affect of this action on the community is unknown, but it would not change if LP installed modern bioreactors at Swan Valley. The bioreactors reactors would use no natural gas.)

8. Author's Conclusions

1. It is understandable in the recent economic environment that LP would propose to eliminate controls for VOC and HAP emissions from the flake dryers and board press at the Swan Valley OSB mill. Like all other industries in Canada and the United States, LP management has a fiduciary responsibility within the laws and regulations where it operates to seek maximum profits and sustainability for its owners, its principals, its employees and its shareholders.

2. Instead of replacing or refurbishing the RTOs, LP is requesting the Manitoban Government to allow a permanent 33-fold increase in actual VOC emissions from the dryers and press at the Swan Valley mill, from about 25 tons per year (tpy) with properly operating RTO controls, to 825 tpy when operating only wet electrostatic precipitators. (Based on testing their new dryers and press in 2006, actual VOC mass emissions can be expected to be greater than 1,100 tons per year.) The LP request of the Manitoban Government will also allow a 100-fold increase in actual emissions of hazardous air pollutants from the dryers and press, from about 4 tpy with properly operating RTO controls, to over 400 tpy when operating only wet electrostatic precipitators.

3. In my experience with forest products companies, the strong motivation to externalize air pollutant costs can only be overcome by regulation.

4. In the United States LP OSB flake dryers and board presses are required to use best available control technologies to control VOC and organic HAP emissions.

5. A modern bioreactor may be able to perform as BACT at Swan River for less than the cost of replacing the RTOs, and about one-fourth of the cost of operating the RTOs and WESPs.

6. A modern bioreactor may be able to replace the existing wet electrostatic precipitators (WESPs) at Swan River for control of particulate matter emissions. If this is possible, it would be cheaper to operate the modern bioreactor than to operate the WESPs, and the cost of operating the RTOs would be eliminated along with their carbon dioxide and nitrogen oxide emissions.

7. LP-Swan River should be required to obtain bids from one or more modern bioreactor vendors with the intention of installing one or more units to control dryer and press emissions.

8. Table 2 below lists the amounts of VOC, HAP and NOx emissions at LP Swan Valley with:

- WESPs and RTOs operational,
- WESPs operational and RTOs non-operational, and
- WESPs and RTOs replaced by modern bioreactors.

The thermal oil heater stack NOx emissions are included in Table 2 since it is a major source of NOx at the facility. The Table clearly shows that modern bioreactors offer the best VOC and HAP control with the least deleterious impacts on other air emissions.

Table 2. VOC, HAP and NOx emissions from the dryers, press and thermal oil heater stack at LP Swan Valley without RTOs, with RTOs and with bioreactors.

Pollutant	without RTOs or other VOC/HAP controls	with RTO	with bioreactor
NOx, tpy	151	198	151
VOC, tpy	1,140	25	57
HAP, tpy	424	4.3	21

Notes: All annual emission rates in this report are based on 8760 hrs/yr operation. Panelboard facilities typically operate 7200-8400 hrs/yr. All annual mass emission rates are expressed in tons. To convert to tonnes, multiply tons by 0.9072.

Definitions of acronyms used in this report.

Acronym	Definition
BACT	best available control technology
CEC	Clean Environment Commission
DOJ	Department of Justice
ENRD	Environment and Natural Resources Division
EPA	Environmental Protection Agency
FID	flame ionization detector
HAP	hazardous air pollutants
LP	Louisiana Pacific
M25A	Method 25A
MACT	maximum achievable control technology
MOE	Ministry of the Environment
NCASI	National Council of the Paper Industry for Air and Stream Improvement
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NOx	nitrogen oxides
OECA	Office of Enforcement and Compliance Assurance
OSB	oriented strandboard
PCWP	plywood and composite wood products
PM	particulate matter
RCO	regenerative catalytic oxidizer
RTO	regenerative thermal oxidizer
TRS	total reduced sulfur
US	United States
VOC	volatile organic compounds
WESP	wet electrostatic precipitators

References

(1) Interpoll Laboratories, Inc Report Number 6-22964 "Results of the May 16-18, 2006 Air Emission Engineering Testing at the Louisiana-Pacific OSB Plant in Minitonas, Manitoba" pp. 5-8; July 6, 2006.

(2) Ibid.

(3)
- Interpoll Laboratories, Inc Report Number 0-14950 "Results of the September 11-15 2000 Air Emission Compliance Testing at the Louisiana-Pacific OSB Plant in Minitonas, Manitoba", pp. 7-9; November 27, 2000.
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