3.0
ANALYSIS OF CONTROL ALTERNATIVES

3.1 SURVEY OF EXISTING LEVELS OF CONTROL AT SIMILAR U.S. PLANTS

To offer perspective to what could be deemed as RACT for SierraPine, an informal survey of companies operating existing MDF plants in the U.S. was conducted during May 1994. The list of survey candidates was obtained with the assistance of the National Particleboard Association (NPA), an industry association. This survey asked four simple questions:

- Are there any existing VOC emission controls for fiber dryers or board presses?
- If so, what are these devices and the estimated or measured control efficiency?
- Why were the VOC controls applied (e.g., comply with existing rules, meet best available control technology (BACT) requirements, create ERCs, etc.)?
- What is the ozone attainment status of the area where the plant is located?

The results of this survey are presented in Table 3-1. While many of the surveyed companies have existing controls for particulate matter, only one had quantifiable controls for VOC. This company, Louisiana-Pacific (L-P), said that the wet ESP at their Arcata plant was installed to control particulate emissions, but it also controlled formaldehyde emissions sufficiently to reduce potential public health risks. VOC controls have been installed at other L-P plants as a result of consent decrees. One of these facilities is an MDF plant in Urania, Louisiana. All of the facilities surveyed are located in ozone attainment areas.

The area in which the SierraPine facility is located is currently classified as a serious nonattainment area for ozone. While RACT is generally considered to be the average of existing control levels achieved in practice for similar sources, and the above survey of MDF facilities might suggest that little or no controls would be representative of this average, it is reasonable to expect that some higher level of VOC controls be deemed RACT for SierraPine due to the ozone nonattainment status of the area in which SierraPine is located.

TABLE 3-1
SURVEY OF EXISTING LEVELS OF VOC CONTROLS AT SIMILAR U.S. PLANTS

'	Location	Contact	Required VOC Controls?	Type of Control Equipment	VOC Reductions	Ozone Attainment Status	Other Comments
ırniture Industries	Basset, VA	Jim Franklin	No			Attainment	
Pacific	Holly Hill, SC	Bob Jennings	No			Attainment	Source has permits to conduct pilot test of electric RTO on a 4,000 cfm subset of the total 120,000 cfm system, not designed or installed yet.
ı-Pacific	Arcata, CA	Elizabeth Smith	No	E-tube Wet ESP	Controls applied to reduce particulate emissions. However, also controlled formaldehyde emissions enough to avoid AB2588 notification (air toxics).	Attainment	Arcata facility is a particleboard plant, achieving approx. 98% formaldehyde control with wet ESP. Other LP facilities have been required to apply RTO as part of a consent decree for emission controls (e.g., MDF plant in Urania, LA), not RACT-based.
:orporation	Medford, OR	Bill Allen	No			Attainment	Source has wet scrubber/ESP controls for PM (BACT determination); some VOC control possible, but not measured.
f New Mexico	Las Vegas, NM	James Stone	No			Attainment	Source has cyclone/wet scrubber for PM (est. 80% control); some VOC control possible, but not measured.
Industries	Deposit, NY	Darren Winchester	No				
:ek Manufacturing	Columbia Falls, MT	Jack Hinman Mitchell Liu	No			Attainment	Source has high efficiency cyclones on fiber dryers.
:euser Company	Moncure, NC	Joe Kloaker	No			Attainment	Source has cyclone for dryers, has pilot tested a bio-filtration unit and may install full scale bio-filtration for Moncure operations.
:e Industries	Bennetsville, SC	Ted Peters	No			Attainment	

3.2 COMPARISON OF ALTERNATIVE CONTROL OPTIONS

This section focuses on the fiber dryers and fiberboard press vents, since VOC emissions from the wood waste-fired boiler and fugitive sources were found to be small and not conducive to additional control.

3.2.1 Candidate VOC Controls

The possible VOC control techniques analyzed by the EPA (Pechan 1994) in its TSD document were:

- Process modifications
- Incineration
- Boiler Co-Firing
- Adsorption
- Absorption
- Condensation
- Biofiltration

Process modifications are often a very cost-effective means to control VOC emissions. For the fiberboard industry, these would include reduced wood fiber drying temperatures, use of low excess formaldehyde UF resins, excess formaldehyde scavengers, resin catalysts, reformulated resin usage, and adjustments to the resin application rate. In the case of SierraPine, drying temperatures in the fiber dryers were already lowered in 1989, the facility already uses a low excess formaldehyde resin and a formaldehyde scavenger, and it is not economically feasible to switch to an alternative resin. Therefore, process modifications will not result in significant additional VOC reductions.

Incineration directly destroys (oxidizes) VOC via combustion, and can achieve a high degree of control. The principal drawback of a direct-flame afterburner is high operating costs due to fuel (natural gas) consumption. A second, depending on air quality in the area, is added combustion emissions, especially NO_x, from the control system. Catalytic incinerators achieve a high level of destruction at lower temperatures (and hence less fuel), but typically have a higher capital cost. One incineration technology, regenerative thermal oxidation (RTO), recycles heat from incinerator combustion to reduce operating costs without the use of a catalyst.

Boiler co-firing is the routing of VOC-laden exhaust to existing facility combustion sources. For the SierraPine facility, this type of control is not a viable option because the wood waste-fired boiler is not sized to handle the large volumetric flowrates that would be exhausted from either the wet ESPs or the packed towers. Thus, boiler co-firing is not a technically feasible option.

Adsorption of VOC on carbon beds can achieve a high degree of control, but could not be used as a primary VOC control method because particulates and resinous organics would plug the carbon beds. However, since the wet ESPs and packed towers would remove particulate matter and scrub out resinous organics, use of carbon beds as a supplemental emissions control technique would probably be technically feasible.

Absorption is the primary VOC control mechanism that will remove VOCs in the wet ESPs and packed towers that are currently being installed. VOC removal will be limited by the solubility of the gaseous VOC constituents in the scrubbing liquid. Since VOC removal via absorption will be maximized in the wet ESPs and packed towers, it is not a viable alternative as an add-on VOC control technique.

Condensation is the conversion of a gaseous VOC to a liquid VOC by temperature reduction. This control mechanism will be another factor in the removal of condensable VOCs in the wet ESPs and packed towers currently being installed. Further gas cooling that could be achieved by standard cold-water industrial condensers downstream of the wet ESPs and packed towers would not be sufficient to cause appreciable additional condensation of VOCs.

Biofiltration removes VOC by passing the contaminated air stream through an enclosed compost bed, comprised of a mixture of wood waste, soil, and/or peat moss, so that the VOC can be degraded by microbial action. This technology would require a large space for the biofilter bed, which is not available at the SierraPine facility.

3.2.2 Feasible VOC Controls

Of the technologies described above, regenerative thermal oxidation (RTO) and carbon adsorption are the most technically viable technologies for consideration as control systems that could be added downstream to those being installed at SierraPine. Both potential add-on technologies are capable of 95% control efficiency. The next section (Section 3.3) analyzes the cost-effectiveness of these two technologies and concludes with a proposed RACT determination.

3.3 RACT FINDING

3.3.1 Analysis

RACT is required for major existing sources of nonattainment pollutants in nonattainment areas, and is generally taken to be the average level of air pollution control achievable among similar sources. RACT determinations are typically made on a case-by-case basis after taking into account the technical and economic feasibility of the control option, and can be more stringent in more severe nonattainment areas.

3.3.1.1 Wood Waste-Fired Boiler. As discussed in Section 2.3.1, the wood waste-fired boiler was considered by the EPA to be an insignificant source of VOC emissions at the SierraPine facility, and no required emission reductions were proposed. Therefore, VOC emission controls are not investigated further for the wood waste-fired boiler in this document.

3.3.1.2 Fiber Dryers and Fiberboard Press Vents. As was presented in Section 3.1, a survey of nine companies operating MDF plants in the United States showed that while many have emission controls for particulate matter, none have been required to control VOC emissions from fiber dryers or press vents, except for one company by consent decree.

Therefore, any level of VOC emissions control imposed on the SierraPine facility would be more stringent than what is required for other MDF plants. Since, however, SierraPine is located in a serious ozone nonattainment area, some degree of VOC control would appear to be appropriate under the 1990 Clean Air Act Amendments, *if cost-effective*.

There are currently no regulatory limits placed on SierraPine's VOC emissions. As discussed in Section 2.2, SierraPine has voluntarily committed to control emissions from the wood waste-fired boiler and fiber dryer exhausts, primarily to create PM_{10} ERCs for which SierraPine has entered into a binding agreement to sell to SMUD, and to control formaldehyde emissions from the press vents to reduce potential public health risks in the surrounding community. Financial commitments for this equipment were made and installation of this equipment commenced prior to EPA's FIP proposal. Total capital costs for this equipment are approximately $3,104,455 (Matteson 1994); annualized costs over an estimated 10-year equipment lifetime are approximately $698,000, as shown in Table A-1 of Appendix A. It is conservatively estimated that 53.7% overall VOC control will be achieved by this equipment, or a reduction of about 117.6 tpy. This represents a cost effectiveness of about $5,935 per ton of VOC controlled, if all equipment costs are attributable to VOC control, as was done in EPA's analysis (Pechan 1994). If after the installed equipment is source tested, the overall VOC control efficiency turns out to be more on the order of, say, 80%, then the cost effectiveness could be as low as $4,000 per ton.

The cost-effectiveness values calculated by the EPA for the control systems that they analyzed for an uncontrolled SierraPine facility ranged from $2,903 to $4,752 per ton (Pechan 1994). The high end of EPA's range was for an RTO system, which did not include potential costs associated with an upstream particulate filter that could be needed to remove particulate matter and resinous organics prior to incineration. Since at least one of EPA's proposed systems would remove both particulate matter and VOC, EPA's cost effectiveness range is comparable to the range calculated above for SierraPine's current system, which would also remove both particulate matter and VOC. On a tonnage basis, approximately 37% to 47% of the pollutants removed by SierraPine's current system could be VOC. If total control system costs were apportioned by the tonnage of pollutants controlled, then annualized costs would range from about $258,000 to $328,000 per ton of VOC controlled, yielding a cost-effectiveness range of about $1,900 to $2,200 per ton, as shown in Table A-2 of Appendix A.

Technically feasible options for additional VOC emissions control would include a regenerative thermal oxidizer (RTO) and a carbon adsorption system, as discussed in Section 3.2.

Using the economic analysis presented by the EPA for a RTO system installed at SierraPine (Pechan 1994), further emissions control of an add-on RTO system on the remaining 97 tpy VOC emissions from the fiber dryers and press vents (assuming 53.7% overall VOC control by the wet ESP and packed towers) would yield a cost effectiveness of approximately $10,253 per ton, as calculated in Table A-3 of Appendix A. Should the VOC emissions control by the wet ESPs and packed towers approach 80%, then the cost effectiveness of an add-on RTO system could rise to as much as $24,000 per ton of additional VOC controlled.

Estimates of add-on carbon adsorption control costs, based on best engineering judgement (Ray 1994), are also presented in Table A-3 of Appendix A. Based on these cost assumptions, control of the remaining 97 tpy VOC emissions (assuming 53.7% overall VOC control by the wet ESP and packed towers) would yield a cost effectiveness of approximately $3,057 per additional ton of VOC controlled. Should the VOC emissions control by the wet ESPs and packed towers approach 80%, then the cost effectiveness of an add-on carbon adsorption system could be up to $6,800 per ton of additional VOC controlled.

3.3.2 Conclusion

3.3.2.1 Wood Waste-Fired Boiler. It is proposed that the boiler's current operations represent RACT for VOC emissions. The proposed rule presented in Appendix B contains emission limits for the wood waste-fired boiler reflective of the boiler's current operations. SierraPine is in the process of installing a wet ESP to control PM_{10} (and Cr+6) emissions, for which permit conditions have been issued. Compliance with these new permit conditions will achieve some limited additional VOC control, however, it is proposed that boiler operation with this wet ESP not be included in the proposed rule since this additional VOC control is difficult to estimate prior to an emissions source test and is not needed to ensure that VOC emissions remain at or below current levels, which is considered to be RACT.

3.3.2.2 **Fiber Dryers and Fiberboard Press Vents.** The cost effectiveness of the emissions control currently being installed at SierraPine is estimated to be $4,000 to $6,000 per ton, depending on the final degree of VOC control that is determined by emissions source testing. Since SierraPine's system would control both particulate matter and VOC emissions, costs associated with VOC control, alone, run about $1,900 to $2,200 per ton. These ranges are comparable to the range of $2,900 to $4,750 per ton calculated by the EPA in its RACT analysis for SierraPine (Pechan 1994). In the air quality attainment plan (AQAP) prepared by the Sacramento Metropolitan Air Quality Management District (SMAQMD), most cost-effectiveness estimates were in the $2,000 to $5,000 per ton range (SMAQMD 1991); the SMAQMD established an "average" range of costs of $4,000 to $10,000 per ton. Given that a substantial emissions reduction will soon be achieved by the equipment currently being installed, and this reduction is within a cost effectiveness range that is representative of RACT, its installation should be considered for RACT.

Supplemental emissions control would come at an additional cost to SierraPine. It is estimated that the addition of a RTO to the current systems being installed could add annualized costs of $10,000 to $24,000 per ton of VOC controlled, depending on the degree of emissions control achieved by the equipment now being installed. This range is high for RACT. In addition, initial capital costs would run approximately $2,970,000 on top of the $3,104,455 expended for the current system, which would represent an economic burden. Given the uncertainty in the emissions control that will be achieved by the equipment being installed, it appears premature to require RTO as RACT, either as an augment to or a substitute for the current system.

The addition of a carbon adsorption system would come at an additional cost of between $3,000 and $6,800 per ton, depending on the degree of emissions control achieved by the equipment now being installed. This range of annualized costs is closer to typical RACT costs, however the outlay of an additional capital cost of $850,000 on top of the $3,104,455 expended for the current system represents an economic burden. It is believed that a requirement of further controls is premature at this time, until emissions tests are performed on the equipment being installed.

For the purposes of a RACT determination under the federal Clean Air Act, it is proposed that the degree of reduction achieved by the current control equipment be deemed as RACT. The cost-effectiveness of this level of control is within an acceptable range for RACT, and this level of control is required no where else in the United States for this source category. A proposed rule that would codify these limits appears in Appendix B.

3.4 BARCT FINDING

It is proposed that the emissions control equipment currently being installed at SierraPine and the accompanying proposed rule in Appendix B also satisfy the BARCT requirement of the California Clean Air Act of 1988. BARCT is required for existing sources in serious and severe nonattainment areas, and is defined as "...an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source" (California Health & Safety Code §40406). Since the California Air Resources Board (ARB) has not issued BARCT guidance for VOC emissions from fiberboard or particleboard manufacturing, BARCT must be evaluated in terms of the single source that is subject to this proposed rule. The RACT analysis, done for federal purposes and presented in Section 3.3, demonstrates that the current control equipment will achieve a maximum degree of emissions reduction at an economically feasible cost level, and that further VOC control at this time would be either burdensome or not cost-effective. It is proposed that the analysis in Section 3.3 supports a finding of BARCT for the SierraPine facility. This BARCT finding is applicable only to the SierraPine facility and does not necessarily set a precedent for other pollutants, other sources, or the categories of sources to which SierraPine belongs.