CHAPTER 5
COMPARISON OF AIR STRIPPERS

5-1. General. The advantages and disadvantages of each type of stripper should be considered when making a selection. Either packed column or low profile air stripper will work in most situations, and are used extensively, but one may be more appropriate for the particular application. Diffused aeration strippers are less efficient for most applications, but their simplicity, ability to handle higher suspended solids, and better resistance to fouling are advantages. It may be necessary to do an economic analysis to help make the decision. Institutional factors, such as height restrictions or architectural restrictions, may require that a low profile air stripper be chosen even if a packed column stripper is more cost effective (see Table 5-1).

5-2. Efficiency. Packed column and low profile air strippers are capable of removing more than 99% of most VOC contaminants. Increasing the depth of the packing or the number of trays will increase the stripping. Increasing the airflow through a packed column may increase the efficiency. However, increasing the airflow beyond a certain point will induce a high pressure drop and will cause flooding.

5-3. Fouling. Air strippers frequently become fouled by mineral deposits when calcium exceeds 40 mg/L, iron exceeds 0.3 mg/L, magnesium exceeds 10 mg/L, or manganese exceeds 0.05 mg/L, or from biological growth. Air strippers may become plugged with solids that must be removed (Jaeger, Paragraph A-5). Packed column air strippers must either have the packing removed for cleaning or the packing must be washed with an acid solution (Jaeger, Paragraph A-5). Both operations are time consuming and costly. Low profile air strippers are often desirable when fouling is expected. Low profile units are often fastened together, tray by tray. Small units can easily be dissembled to physically remove the biological or mineral deposits. Larger units have access ports on the side of each tray for cleaning with a high-pressure water spray. Pre-treatment of the water prior to stripping is often required. Foaming control agents may be required for some liquids.

Table 5-1
Comparison of Air Strippers

	Packed Column	*Low Profile*
Efficiency	Increases as packing height increases; 99%+	Increases as number of trays increases; 99%+
Cost	Lower at higher liquid flow rates	
Foam	Less foaming	
Air flow rates	Often use less air so air pollution devices, if needed, are smaller; wider range of air flow rates	
Fouling from calcium, iron, manganese suspended solids and biological growth		Easier to clean
Size	Tall	Compact; less conspicius; better appearance

5-4. Airflow Rate. The ratio of air to water flow rates is generally lower for a packed column stripper than for a low profile air stripper for the same level of VOC removal. Packed column air strippers are typically operated at 5 to 250 cfm/ft^2 (1.5 to 76 (m^3/min)/m^2) of column cross-sectional area (Iowa State University, 1988) Low profile air strippers typically operate at 30 to 60 cfm/ft^2 (9 to 18 (m^3/min)/m^2) of tray area. Thus, the tray area of a low profile air stripper will usually be much larger than the tower cross-sectional area for the same treatment conditions. Low profile units are designed to operate over a fairly narrow range of airflow rates. If the airflow rate is too high for a low profile unit, the air blowing through the trays will form a jet and disperse most of the water. This results in low removal of the VOCs. If the airflow rate is too low, the water will flow down through the holes in the sieve trays. If the water flow rate decreases to a sieve tray as the result of changed operating conditions, the airflow rate through a low profile stripper cannot be reduced correspondingly, as it will be outside the operating range specified by the manufacturer. The cost of treating the off-gas will not be decreased in proportion with the liquid loading. Packed column air strippers can operate over a wide range of airflow rates. The advantage of this is that, if the water flow rate to the column decreases, the airflow rates can also be decreased. This will reduce the cost of treating the off-gas.

5-5. Water Flow Rate. In contrast to the airflow rate, the flow rate of water through a sieve tray unit will be between 1 and 15 gpm/ft^2 (0.04 to 0.6 (m^3/min)/m^2). Packed column strippers operate most efficiently over a narrow range of water flows, between 20 to 45 gpm/ft^2 (0.8 to 1.8 (m^3/min)/m^2) of tower cross-sectional area (Iowa State University, 1988). The manufacturer usually designs sieve tray air strippers. Items such as the length, location, and height of the

overflow weirs, weir geometry, clearance under the downcomer, fractional hold area, etc., are very important and must be designed by a manufacturer who is experienced with sieve tray columns. Additional trays can be added to many low profile air strippers if additional treatment is needed and the blower and motor are capable of handling the additional pressure drop from additional trays. Combining the airflow rate and the water flow rate results in an air-to water-ratio as low as 30 to as high as several hundred (volume to volume) (Carbonair, North East Environmental Products, Paragraph A-5) for sieve tray units.

5-6. Pressure Drop and Power Consumption. The pressure drop through the packing of a packed tower air stripper is often lower than the pressure drop through a comparable low profile unit. This allows a smaller blower and motor, with reduced electrical operating costs.