

used when the tank is *more than 4 ft wide*

Control velocity over a wider tank can sometimes be obtained by a *push-pull* system, that is, by blowing air from a nozzle at one side into a hood on the other side of the tank. A jet of air under pressure can be confined to a much narrower angle than can be obtained from a suction hood, so that a wider tank can be served. The jets will entrain material rising from the tank surface and carry it into the hood. The velocity of air must be spent before it reaches the exhaust hood.

Jets should be used only with great caution, because it is possible for them to blow contamination over the working area as well as into the hood. In particular, if material is lowered into and raised from the tank, passing through the air jet, the latter is almost certain to be broken up in such a way as to spread the contamination. The exhaust hoods must be adequately sized, exhaust enough air, and the jet air stream must be pointed in the proper direction.

Employee participation Finally, the hood must not interfere with the employee's job—it is there to *help* the employee, not hinder him. If an employee finds a hood gets in his way, he is likely to take off part of it, if not all of it.

A job must be analyzed thoroughly in advance: the operator's motions studied, and even process changes considered. Wherever possible, the man on the job should be consulted and his opinions solicited. It may be wise to explain to him exactly how the proposed hood will work to help him.

After the hood is installed, the employee should utilize it to its fullest degree. He should not place a mancooling fan where it interferes with the effectiveness of the exhaust hood, nor should he be allowed to make adjustments in the exhaust system. He should tell his supervisor when he notices a decline in exhaust control.

Hoods must be fixed in position wherever possible, as it is false security to depend on employees to move them around as needed.

Ducts

After contaminated air has been drawn into a hood, ducts serve the purpose of guiding the air to an air cleaner or to the outdoors. When air passes through any duct or pipe, friction

must be overcome, that is, energy must be expended. The amount of this friction loss must be calculated before the system is installed, so the proper size fan and motor can be purchased. However, this is a task for a plant engineer, not for the safety director.

Several excellent references have been published, which remove the guesswork from dust design. (See "References" at the end of this chapter, especially Brandt, DallaValle, and Hemeon, and the publications of American Foundrymen's Society and the American Conference of Governmental Industrial Hygienists.)

Some general comments on sizing of ducts will be helpful to the safety professional in appraising the merits of a given system.

Starting point in designing a local exhaust system is determining how many cubic feet of air per minute (cfm) must be handled by each hood to control the contaminant released in the workroom (see the topic "Hoods," just before this section). Based on such data, careful duct design accomplishes these objectives: maintains proper transport velocity so the contaminant, if it is a dust or fume, will not settle out and plug the pipe, holds power consumption to a minimum, keeps the system "balanced" at all times.

Multiple ducts Local exhaust systems with multiple hoods pose problems. After settling on how much air flow is needed at each hood to control the contaminant in question, the task of the duct designer is to select pipe sizes and fittings (such as elbows, Y's, enlargements) so that air will distribute itself from hood to hood as he wants it to. When two branches coming from two hoods, hood A and hood B, for example, join at a Y to form a single main (or sub-main or header), the static pressure between this junction point and the face or inlet of hood A is of necessity the same as between this point and the face of hood B. If he wants the same rate of air flow from both hoods, the friction loss in each branch must be the same. But if the branch to hood A is longer than the one to hood B, or has more elbows, its friction loss, for the same diameter pipe in both branches, will be more than in branch B. The velocity of air in branch A will be less, and so less air will flow into hood A than hood B.

How can the hoods be made to handle equal