(1) Review of Process

Basic raw materials used for the production of asbestos-cement (A/C) pipe include asbestos fiber, portland cement, silica sand, and water. After fiber introduction to the process (see Section D.1.b.), conveying equipment carries the raw fiber to a dry mixing step. Agitation in this step serves two purposes: opening or fluffing the fiber, and mixing the cement constituents. Sand and portland cement are added at this point, typically being conveyed pneumatically to an enclosed, live-bottom mixer.

The dry mix next passes by a conveyor to a wet-mixing operation just upstream of the pipe-forming machine. The wet mortar flows to the pipe-forming machine vats, where the asbestos cement slurry is picked up on a rotating, screened cylinder mold and transferred on a traveling belt over suction boxes, where, as a wet mat, it is wrapped on a mandrel. Wrapping continues to attain proper thickness. Pipe sections generally are cast in 10- to 15-foot lengths. After an initial setting time, the pipe is stripped from the mandrel, then air cured, and final cured in an autoclave using saturated steam.

Cured pipe sections are transported to the finishing operations. Here the pipe is cut to uniform lengths and machined in a variety of ways (sawing, lathing, drilling) and outfitted with a coupling. To insure a tightly fitted pipe joint, the ends of the pipe sections are machined smooth on a lathe. The finished pipe is inspected, and each section of "pressure pipe" (pipe used for conveying water under pressure) is tested hydrostatically.

In addition to full and partial lengths, pipe plants also produce a variety of standard and special fittings. Pipe coupling is the most widely used fitting. To mate with the machined pipe, inside surfaces of the coupling must be grooved to hold a rubber seal. Other fittings (tees, elbows, reducers, etc.) are produced on a less frequent schedule. Most pipe plants also produce specialty fittings and pieces on an individual basis. Operations required for fittings production include sawing, drilling, machining, boring, and bonding. Some specialty applications require pipe lengths to be machined over their entire length with a lathe.

(2) Current Controls and Work Practices

Fiber loss to the work environment at the dry-mixing stage is controlled by maintaining negative pressure inside the mixer--itself an appendage to a local-exhaust dust-control system. The mixer generally receives and dispenses raw material by a screw conveyor. Local exhaust is also employed at the wet-mixing operation. Introduction of the dry mortar into the mixer and initial agitation until the solids become wet produce the dust at this

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step. Once the mortar becomes wet, little additional fiber becomes airborne. A significant portion of the fiber emitted between fiber introduction and wet mixing may result from material handling equipment (such as screw conveyors and bucket elevators). Dust control in conveying equipment is obtained by using continuous exhaust of hoods and maintaining negative pressure within the closed mixing equipment.

No special control equipment is used during pipe formation, air curing, and steam curing. Nevertheless, good housekeeping is essential at these steps because spills of mortar or fragments of pipe will dry and ultimately result in fiber release due to pedestrian and vehicular traffic.

Aside from fiber introduction, pipe-finishing machining operations represent the major potential source of airborne fibers in an A/C pipe plant. Extensive local exhaust and hooding must be used near the tool cutting surface to capture and control fibrous solids, including chips. Using single-point cutting tools (instead of saws or cutting and machining equipment that use abrasion) substantially reduces fiber emissions at the finishing step.

Control equipment for coupling and fittings production is essentially the same as that described for pipe finishing. Local exhaust near the working point of the tool is used to capture and remove solids. Variability in production techniques and in pipe size makes designing tight-fitting hoods difficult.

As a dust control measure in the finishing end of the production of asbestos-cement pipe, Johns-Manville's Denison, Texas, plant has adapted its existing exhaust ventilation system to provide local vacuuming at all of its pipe finishing operations. A typical arrangement is illustrated in Figure III-3. A 600- to 800-cubic feet per minute blower provides the suction for the pickup of dust and debris. Large debris falls out in a chip trap which is then transported by an airlock feeder to an exhaust duct. Fine dust that does not gravitate out in the chip trap is pulled through the blower and then exhausted into the exhaust ductwork. This system offers a less expensive alternative to the installation of a central vacuum system.

(3) Reported Exposure Levels

Reported exposure levels are presented in Chapter II.

(4) Future Controls Under Development

Wet mixing immediately after fiber introduction is being used in at least one cement pipe plant. This process modification precludes

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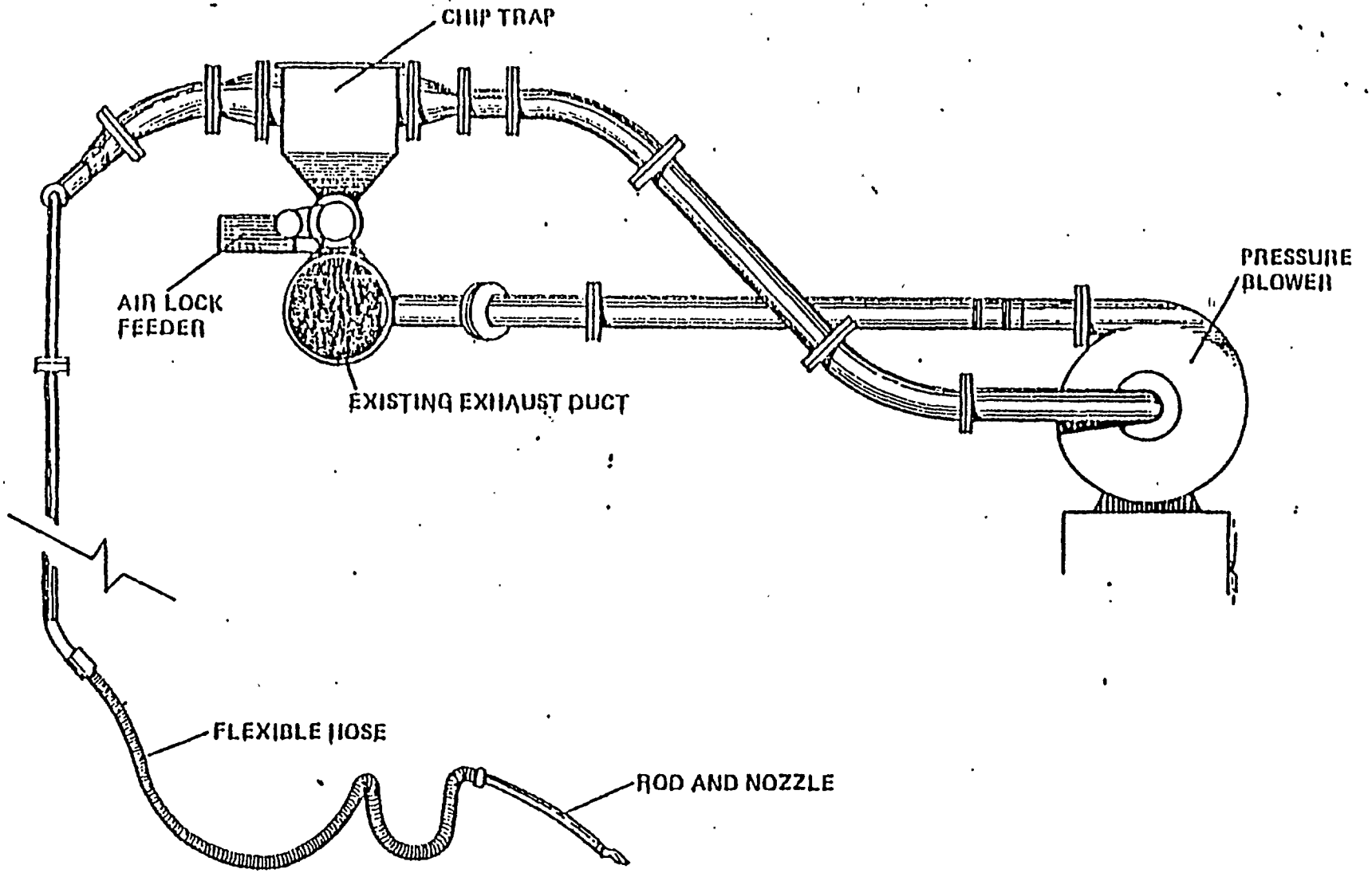

Source: Johns-Manville Corporation

Figure III-3. Typical Arrangement for Vacuum Cleaning System Using Local Exhaust Ventilation System

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any mixing and thus eliminates one potential source of fiber loss to the work environment. Advancing control technology for reducing exposure to asbestos in the finishing operations includes redesigning machinery with integrated local exhaust. Standard milling equipment and machinery with minor modifications have been used in pipe finishing. Significant reduction in worker exposure could be achieved if the machinery were redesigned to improve dust capture.

Wet machining has been used in some areas of the A/C pipe finishing and fitting production, and development work is underway to determine if:

- Wet suppression can be adapted to the pipe lathes; and if
- Wet finishing reduces the fiber release at this processing stage.

Considerable automation could also eventually be incorporated into machinery redesign, thereby reducing employee exposure.