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"Large reactor technology" may prove the most feasible way out of the vinyl chloride emission morass. One large reactor for polymerizing VC resin into PVC requires hundreds fewer flanges and valves than do a dozen small ones. This drastically slashes the number of potential VC leak points.

The concept is already working for Japan's Shinetsu Chemical Industry Co., which built Japan's only 35,000-gal. PVC reactor in 1970. And it is now working for Shintech, Inc., a joint venture of Shinetsu and Robintech, Inc., of Fort Worth, Tex. Shintech's Freeport (Tex.) PVC plant is using four 35,000-gal. reactors to produce the same amount of PVC that would be made in some 30 smaller reactors in traditional plants. The giant reactors require manual cleaning no more than once a year. Shintech's experiences since the plant came on stream in October have been more than encouraging. "All our tests indicate we're well below the 1-ppm level without the use of respirators," claims James M. Danial, Shintech vice-president.

Treatment. The key to Shintech's sharply reduced cleaning schedule is a proprietary treatment applied to reactor walls after each batch of PVC is made. The coating is sprayed on under high pressure after the reactor is purged with a hydraulic spray and a vacuum.

"The whole plant is tighter than older PVC plants," claims Joseph L. Brawner, Shintech's plant manager. "We've used welded construction on lines holding vinyl chloride wherever we could, eliminating flanges." The plant is entirely computer-controlled and operates with only 25% of the 163-man work force required at Robintech's older Painesville (Ohio) plant, which has about the same capacity.

Tenneco Chemicals, Inc., has licensed the technology for its new PVC plant in Pasadena, Tex. The plant has five 35,000-gal. reactors and a capacity of 250-million lb. According to Joseph P. Fath, a Tenneco Chemicals vice-president, the plant incorporates some reactor cleaning technology that Tenneco developed on its own which will "obviate reactor opening and entry in the long run." But, Fath admits, there may still be maintenance situations where respirators are needed.

batch of PVC is made, the tanks are hosed down to flush out unreacted vinyl cloride monomers and accumulated PVC resin. "We are down to manual cleaning after only 2% of batches," says Goodrich's Harrington. "With hydraulic spraying, we are at 5 ppm for only five minutes instead of 30 minutes when we clean a reactor," adds Eli Zinn, plant manager at Diamond Shamrock Chemical Corp.'s Deer Park (Tex.) plant.

Both Goodrich and Diamond Shamrock use water hydraulic sprays. Other PVC manufacturers, such as Union Carbide Corp. and Monsanto Co., are trying closed-reactor solvent cleaning systems, and Carbide officials claim that reactors at their Texas City plant now need manual cleaning only once every two months.

Another problem. Even with perfected cleaning methods, however, the vinyl plastics industry will still have another hurdle to overcome: recovering unreacted VC monomer that may be trapped in finished PVC resin. If the monomer is not removed before shipping, it can escape when the resin is heated for fabrication. This then threatens fabrication workers with exposure to unacceptable VC levels.

Recovered VC can be recycled back into the PVC process, so PVC manufacturers are especially interested in developing technology for stripping unreacted monomers from the resins. But so far, they are facing a Catch-22 type of problem. While the goal is to let fabricators heat the resin without releasing vestiges of VC, current stripping methods also require heating. The result can be overheating, which causes hydrochloric acid molecules to break away from the resin. The resin then turns brown and weakens. "Once this degrading starts at the PVC manufacturing level, it continues throughout fabrication, so the goal is to get the vinyl monomer out faster without excess heat," explains Goodrich's Harrington. One new process that looks promising involves use of a vacuum in the reactor to strip much of the unreacted monomer before the resin is dried. A number of PVC manufacturers have programs under way to develop recovery methods. Goodrich, for one, hopes to market a system by yearend.

But OSHA is leaving nothing to chance so far as claims for any system go. Its vinyl industry standard not only specifies exposure limits but mandates that all vinyl producers keep records of worker exposure and monitor vinyl chloride levels wherever they are expected to exceed 0.5 ppm.

The fabrication plants may escape the monitoring problems, because most can establish that they have exposure levels below 0.5 ppm. "In most fabricating plants, there are already ducts and vents above the blenders to meet earlier dust and fume regulations," notes