By Larry Lewis and Ken Galardi, P.E.

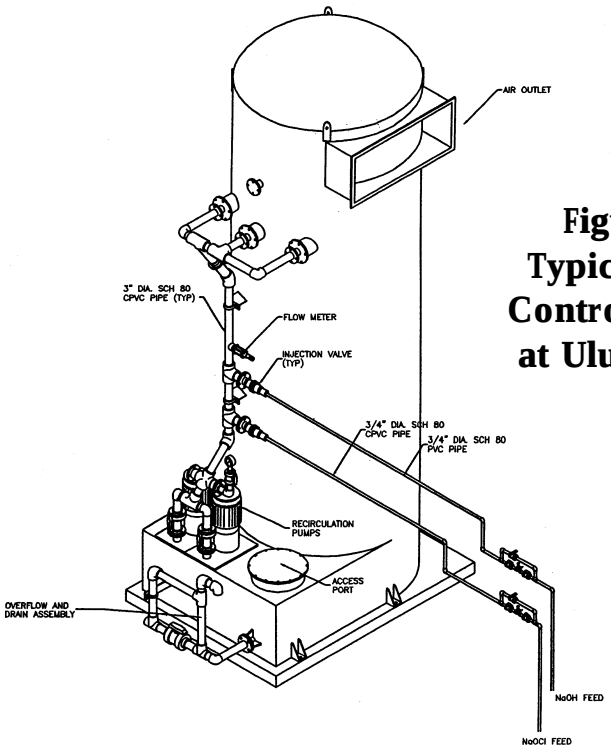
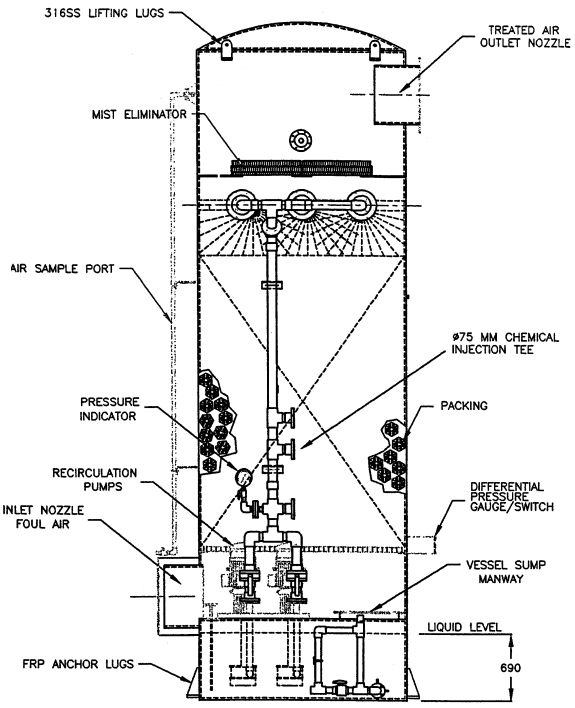


Figure 1: Typical Odor Control System at Ulu Pandan



Neutralizing Noxious Odors

at Singapore's Ulu Pandan Sewage Treatment Works

Three significant reputations for innovative, reliable solutions to environmental problems came together as the Singapore Ministry of the Environment (ENV) planned for expansion and upgrading of its water and wastewater treatment facilities at Ulu Pandan Sewage Treatment Works (STW).

First and foremost was the ENV's Mission Statement that Singaporeans were to have "a clean living environment and enjoy a high standard of environmental public health to protect against the spread of communicable disease." This was to be accomplished through the use of first-rate infrastructure for waste disposal, implementation of pollution control measures and maintenance of high public health standards.

Figure 2: Odor Control System in Service

Figure 3: Odor Control Systems at the Odor Treatment Building

As part of their overall environmental program, ENV turned to the consortium of Mitsubishi International, IHI Industries and Jurong Engineering Limited to upgrade the odor control systems at the Ulu Pandan STW. The consortium selected Camp Dresser & McKee, Inc., as the overall project designer and USFilter/RJ Environmental Products, San Diego, Calif., as the odor control system supplier.

USFilter selected Vanton Pump & Equipment Corp., Hillside, N.J., a manufacturer of thermoplastic fluid handling equipment, to provide the specialized nonmetallic pumps required to handle the aggressive fluids needed to neutralize the noxious emissions.

Hydrogen sulfide, ammonia or other organic compounds typically cause the generation of odors from municipal processing operations. Treatment of these odors at Ulu Pandan STW was accomplished through a large centralized odor control facility incorporating 17 process "trains," each consisting of several packed tower scrubbers in series, followed by a dual bed activated carbon absorber. Each scrubber was equipped with duty and standby liquid recirculation pumps sized to maintain the proper degree of liquid-to-gas contact in the scrubber. A total of 76 recirculation pumps was used. Thermoplastic pumps and fluid handling piping were selected because of their chemical resistance to the acid, caustic and bleach used in the scrubber systems, and their proven reliability in similar applications.

Figure 1 illustrates a typical odor control system installed in the Ulu Pandan STW. These systems were field-assembled and tested to assure the required pH control, reduction of emissions and other performance guarantees. A critical aspect of these systems is their ability to handle the corrosive chemicals required for the neutralization process and the dependable recirculation of these neutralizing chemicals, particularly sodium hypochlorite (NaOCl) and sodium hydroxide (NaOH). Figure 2 is a close-up of one of these systems in operation, and Figure 3 shows a group of five such systems in the Odor Treatment Building of the STW facility.

To provide for the dependable continuous circulation of these neutralizing chemicals, heavy-duty vertical centrifugal pumps with all fluid contact components made of solid, homogeneous polypropylene were specified. This thermoplastic material is inert to the chemicals and the pumps are rated for flows to 250 gpm (95 L/m) against a 45 foot (14 m) head over a broad temperature range. Seventy-six of these pumps were required for the 38 packaged odor control systems at this site. Figure 4 shows a group of these pumps ready for shipment after being tested for performance against the specific conditions of service.

In explaining the reason for the specific pump design, engineers emphasized the following significant specifications.

- The design should limit fluid contact to nonmetallic materials.
- The stainless steel shaft should be completely encased in polypropylene so that no metal would contact the fluid.
- The cover plate over the fluid tank area should be supplied in the same material as the pump.
- The immersed bearings should be nonmetallic and consist of ceramic inner bearings running against Vanite outer bearings.
- The impeller should be solid polypropylene molded around a stainless steel dynamically balanced insert, keyed to press fit into the shaft for increased stability.

Figure 4: Centrifugal Pumps Ready for Shipment

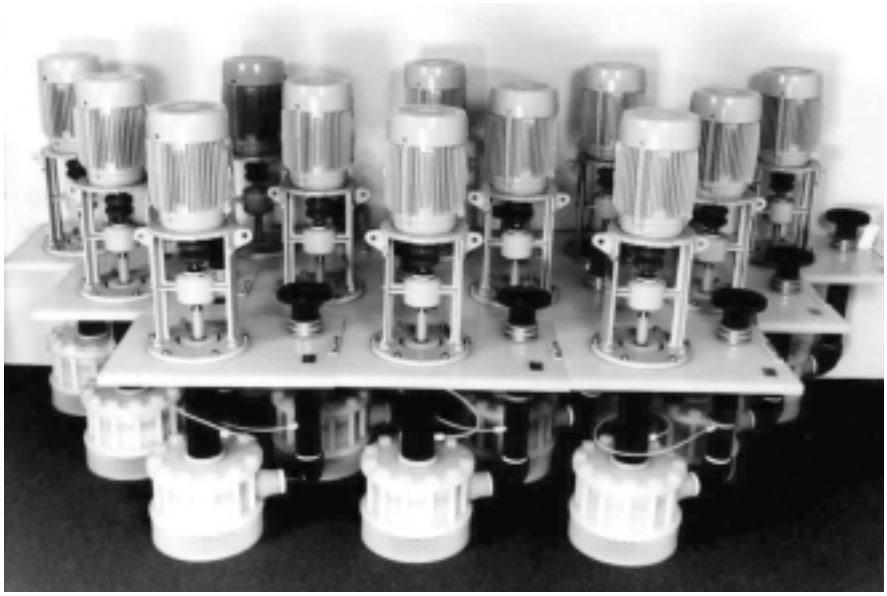
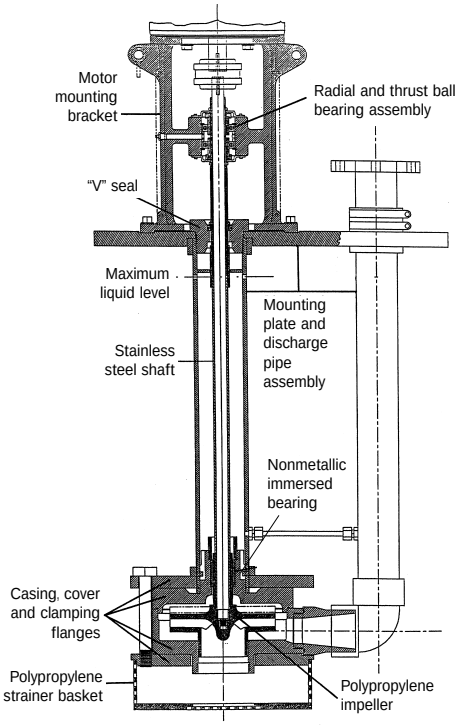


Figure 5: Pump Design Schematic



- The pump casings were to be designed for centerline discharge and configured to accommodate larger sized impellers in order to provide increased flows at lower power input. They were be solid, thermoplastic molded components, not metal components with applied linings.

A schematic view of the pump design is shown in Figure 5.

The Ulu Pandan STW Odor Treatment Building has been fully on line since July 2000, providing efficient and reliable odor control to protect plant personnel, neighbors and the environment.

About the Authors:
Larry Lewis is an applications specialist for Vanton Pump & Equipment Corp., Hillside, N.J.

Ken Galardi, P.E., is a senior project engineer with USFilter/RJ Environmental Products, San Diego, Calif.

For more information on this subject, circle 868 on the reader service card.