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Selecting Components for Waste Treatment Systems

In our present computer age with high technology available to almost every area of manufacturing, platers are faced with seemingly limitless choices of waste treatment systems in order to comply with the Environmental Protection Act. However, since no two manufacturing plants are exactly alike, waste treatment systems must be designed to fit the individual facility. There are many things to consider when selecting the proper components for the system. Many companies design their own systems and purchase components from suppliers.

Naturally, the main objective for a waste treatment system is to meet the Environmental Protection Act requirements. Of secondary concern, but equally important are purchase price, installation cost, operating cost, and having the shortest payback on equipment possible by either tax write-off or return on investment. There are various methods for chemical recovery such as evaporators, ion exchange, electrolytic plate out, filtration, and so on. With due respect to all waste treatment methods available, there are more chemical destruct systems operating today than all others. Chemical destruct systems are the most economical to install due to a lower capital equipment outlay, but there if no payback on equipment because recovery of chemicals is lowest with this type of system. Depending on the size of the particular operation and the type of processing done, sometimes a combination of chemical destruct and recovery methods is the most applicable way to go. The manager in charge of deciding which method to incorporate would be wise to consider all systems available before making a decision.

Selection of SERFILCO waste treatment components

Consideration must be given to hiring outside consultants, which methods to employ, whether to buy a prepackaged system, design and install with in-plant expertise available, or a combination of all! Before any decisions are made, the first thing that will save money is to reduce the flow of water through the plating shop to the absolute lowest rate possible.

The waste treatment system is sized according to the amount of liquid transported through the plating area, rather than the amount of chemicals used, therefore every available method would be employed to reduce the flow of each rinse tank to an absolute minimum. This can be accomplished by spray rinses, counter flow rinsing, and aerators to the incoming rinse water, and rinse tank controllers. For example, by making a single rinse tank a double compartment tank with counter flow rinsing, flow rate of the rinse water can be reduced by 90% and still achieve the same effective rinsing. An aerator would agitate the rinse to provide still more effective rinsing. The rinse tank conductivity controller is an electronic device installed at each running water rinse tank which measures the "resistivity" of the rinse water. A solenoid valve attached to the incoming water line opens and closes automatically, depending on the set point of the controller. This pays for itself in the amount of water it saves.

After the liquid flow is reduced to a minimum in every area, the next step is to group together the rinses for treatment according to their chemical nature. Cyanide-bearing rinses should go to a common line, the chromium-bearing rinses to another. Then it is necessary to decide whether to call in an outside consultant, or call a waste treatment manufacturing company to recommend a system, or whether to proceed with in-house design and installation. If the decision is the latter, then equipment suppliers are contacted to discuss the various components available.

Since pumps are the heart of any waste treatment system, much grief, downtime, and expense is saved in selecting the right pump for the right job. Extreme care should be taken in verifying the chemical capability of the pump against the liquids it will contact, as well as selecting the pump that will deliver the correct flow at the TDH required.

Usually there is a collection sump for each class of solution to be treated (cyanide, chrome or acid / alkaline neutralization). At this point it must be decided to use either a horizontal pump with a priming chamber, a self-priming horizontal, an air operated diaphragm pump, or a horizontal type pump installed with flooded suction outside the tank. In some instances consideration can be given to an in-tank pump, either a cantilever shaft seal-less vertical style, or an extended vertical shaft pump with chemical resistant bearings. These pumps are available to 12 ft. lengths and longer, but shorter lengths should be used whenever possible.

Since all pumps used for waste treatment occupy an extremely important position in the system, it is important to have back-up pumps in these critical areas. It is suggested that duplex pumps be used in sensitive locations and operated by an alternator controller which would alternately cycle the pumps on and off in conjunction with the liquid level controls. If the peak requirement due to a spill demands that both pumps be operated at the same time, the alternator would perform that function too. It is also advisable to have at least one complete spare pump in stock to replace any pump requiring service.

At this point the treatment system would vary, depending on whether it was a batch system or a continuous automatic treatment system. Assuming an automatic system would be employed, the discharge from each of these pumps would be treated. If cyanide, it is reduced in a two step operation to cyanate, and then to CO_2 by either chlorine gas or sodium hypochlorite (bleach). Using bleach, a pH controller is used to raise or lower the pH of the solution in conjunction with chemical metering

pumps wired into the controller, which should automatically pump either NaOH or acid to control the pH for treatment.

An ORP or (Redox) controller would sense the reaction endpoint of the chlorine being added to destroy the cyanide at the proper pH setting. A chromium treatment system would employ similar equipment as the cyanide destruct system. If a destruct system was selected to reduce the hexavalent chromium to trivalent chromium, an ORP controller would energize the meting pump to feed metabisulfite or a similar chemical. Therefore, at this stage several pieces of equipment must be considered such as ORP and pH controllers, sensor probes, pumps, mixers, recirculation pumps and heaters. The acid alkaline neutralization system would be neutralized using a pH controller.

When each of these treatment stages is completed, all of the solutions that were segregated should be integrated into one for final treatment and separation of any remaining metal hydroxides. There are several methods available to accomplish the final task, i.e. dewatering the sludge to attain acceptable dryness of the solids for disposal or recovery.

The first step and most common method of getting treated effluent to a 1-3% solids content is to use a clarifier or settling tank. The overflow from the clarifier could be passed through a polishing filter such as an automatic indexing gravity filter using disposable filter media, or a cartridge type filter. This filtered solution could be run directly to the sewer or consideration be given to recycle the water back into the process area for re-use. The treated effluent may be passed through a carbon bed to remove any organics.

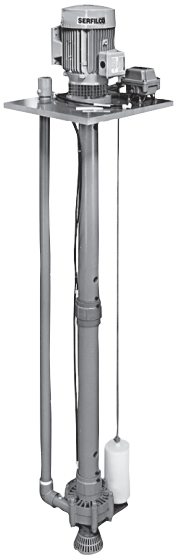
The concentrated solids portion of effluent in the clarifier, or settling tank, would now be mixed with a polyelectrolyte to speed up the settling process by coagulating suspended solids. This slurry could be filtered through an automatic gravity index filter to attain a 12 - 18% solids content. If a 34 - 45% solids content is desired, the slurry should be then pumped into a cone-bottom settling tank and then through a filter press.

The storage tank should have a slant angle of 60% minimum to avoid the sludge sticking to the sides of the tank, and it should have a mechanical, rotating scraper blade inside to deep the sludge off the sides of the tank. Recessed plate filter presses from 1 - 50 ft^3 capacity are available and recommended for maximum solids content of the sludge. Normal plating process waste which has been treated through a chemical destruct system has .05% solids content. Sludge dewatered in a filter press, 35% solids by weight for example is 25 lbs /ft^3. At this point, the decision can be made to the method of disposal for the accumulated sludge. One final and important point, treated discharge should be continuously monitored with a recorder to establish permanent record of compliance and signal when deviation is in excess of agreed limits.

Suppliers and consultants are always ready to help, but demand in the past has not been such that unlimited capacity exists for systems and components or engineering. In fact, many have had the same economic experience as industry in general. Staffing is down, and lead times are longer. System design, approval and delivery all take time. We talk daily to people who are just now beginning to seriously think about waste treatment. And, it is obvious it is a new consideration. Many small shops just don't have the expertise to work out their own system and feel they can't afford a packaged system or consultants.

There are alternatives. All it takes is a commitment — emotional, intellectual, and financial. The job will get done, and many new systems will come on stream. As more and more of these waste systems come on line, there will be a greater demand for sludge disposal services at the same time pressure is building to close disposal sites.

Equipment for basic chemical destruct systems should be considered in detail and be designed for present as well as future needs, and have the capacity for expansion if required. Sump systems, filter presses neutralization, and reaction tanks are examples of equipment which can be sized now for future use at a much lower cost than subsequent modification. Instrumentation generally is not affected by flow rates, but metering pumps and transfer pumps controlled by the instrumentation should have excess capacity. Redundancy in critical areas should be provided in order to assure uninterrupted performance of the system to assure compliance.



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As any reader can recognize after having read this far, the purpose of this article is not to give the exact specification to a complete waste treatment system for each or any individual requirement, but to bring to the average process manager's attention the available assistance at his disposal in planning the right waste treatment system for his conditions, and selecting the right components. Even though there are very highly complicated 'black box' waste treatment systems on the market today, thousands of dollars may be saved in the long run if some time is invested prior to the installation of the waste treatment system to investigate the various methods and components available. The best waste treatment systems are only as good as the individual components used in the system properly specified to obtain the desired results.

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