Why your waste treatment system does not work

John C. Welkie, President J&T Technologies, Incorporated
Pottstown, Pennsylvania United States of America

Regardless of whether your system was installed recently or many years ago it has not performed as expected. In spite of the expense of engineering, installation or the brand name manufacture, there remain inconsistent results. You ask yourself…Why doesn't my waste treatment system work? This is especially critical with today's focus of reducing plant operating costs while improving output and balancing the environmental issues that industry is faced with.
You will see that with the proper consideration of equipment components, selected carefully with the waste constituents in mind, a successful, low cost of ownership operation and efficient waste water treatment system CAN be a reality. The ability to withstand upset conditions while maintaining consistent treatment of the waste water is a critical component to the success of your treatment process.

For More Information Contact:
John C. Welkie, President
J&T Technologies, Incorporated
P.O. Box 622
Pottstown, Pennsylvania 19464
Phone: 610-326-4771
E-Mail: jwelkie@jtequip.com

During the past several years, many electroplaters or surface finishing companies have installed some means by which to treat its waste water. The metal finishing and plating industry utilizes more on site treatment plants per capita than any other similar industrial operation. This may include pre-treatment operations or a complete new waste treatment system. This was done so that the industrial plant effluent to waterways or publicly owned Waste Water Plants meets all federal, state and local clean water discharge permit requirements. Regulations include oxidation of Cyanides, reduction of chrome and other heavy metals as well as pH control. These permits are getting more and more difficult to deal with and current discharge permit limits require a very efficient waste treatment process. Today, because of the high costs and the public and political pressure on industry to reduce toxic chemical emissions, those electroplaters that do respond to the difficulties and challenges by seriously evaluating and implementing efficient treatment systems will save their companies money. Not only by recycling chemicals, reducing chemical addition to waste water and generating less sludge but also by saving or re-using water.

Typical Packaged Waste Treatment System

System Selection and design factors:

1) **Pollutant constituents and characteristics:** System design will depend heavily upon what is in the waste water that needs to be treated. A basic system will only require typical neutralization and chemical precipitation prior to solids separation and filtration. Other systems that use chelating agents would require a more complex system for handling these agents with features such as two or three stage separation treatment, neutralization as well as coagulants and precipitants.
2) **Capacity or Loading:** How much pollutant loading will the system be looking at? These factors will determine such items as chemical usage, clarification and sludge storage capacity, filter press / dewatering machine size, disposal costs.

3) **Flow Rates:** How much waste water can you expect on an instantaneous situation that will require treatment? A major addition to this sudden inrush or increased capacity is rinse water. How you effectively handle this problem can be a key to the successful operation of your treatment plant. Rinse water and facilities cleaning and housekeeping practices can add to this problem. Increases in alkaline cleaners, chelating chemicals can cause problems with a typical conventional system. A proper balance is required to maintain proper coagulation and flocculation characteristics in a waste stream. This is why consistency and conditioning are key elements in a successful waste treatment plant design.

4) **Specific Regulation Requirements:** Discharge permit levels directly impact a system design and this factor alone could easily be the most important yet most difficult to maintain. EPA regulations of water and waste water pollution from electroplating operations have become extremely stringent. Lowering the amount of pollutants that must be discharged is becoming a critical factor in saving companies revenue. This includes efficient usage and reclamation of plating chemicals, chemical addition to waste water for dewatering or thickening sludge and waste filter cake production.

Typical Waste Water Treatment systems include the use of chemicals to react with soluble pollutants which produce insoluble by-products. These by-products are removed from the process using physical separation equipment such as clarification and ultimately filtration.

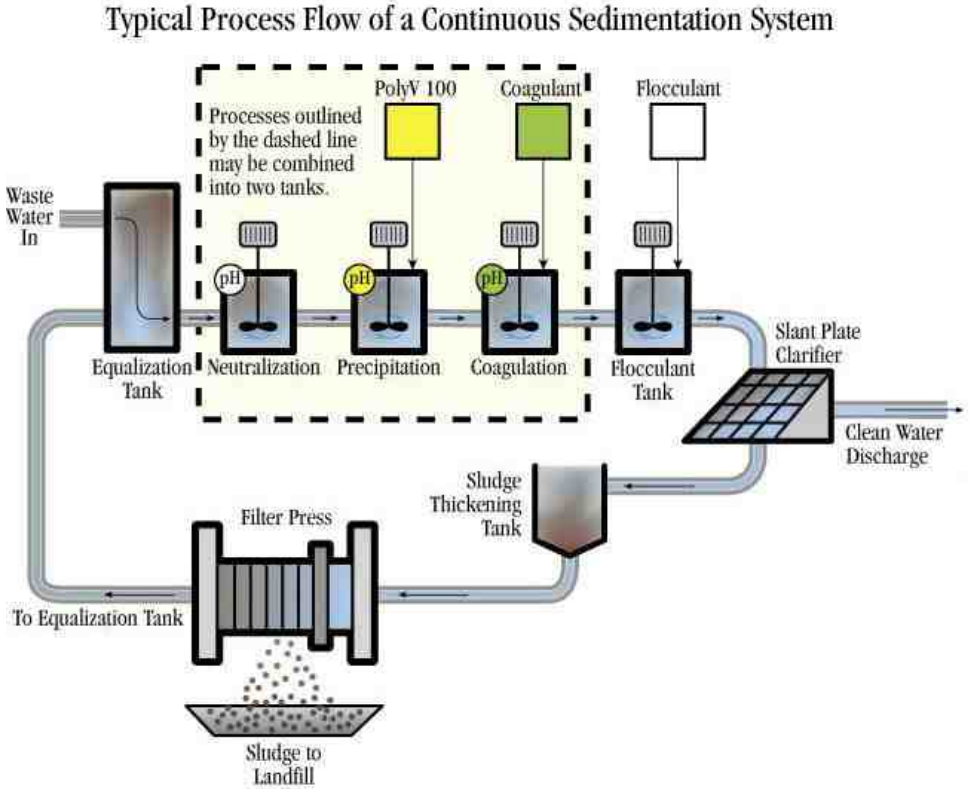
Conventional systems typically include:

- Chrome Reduction
- Cyanide Oxidation
- Chemical Precipitation & flocculation of solids
- Clarification
- Polishing (If required)

The neutralization tank is used to react and hold waste. This helps to establish an efficient retention time to allow pollutants to react to and form insoluble precipitants for eventual physical separation (via a filter press or other device). Hydroxide precipitation is the key ingredient in conventional waste treatment systems. These processes target heavy metals which have varying solubility's based upon their pH. It is required in most cases to add chemical coagulants to the waste water to achieve maximum solubility and superior flocculation/solids separation in the clarifier. This will ultimately work to combine surfactants, wetting agents and phosphates which can interfere with good flocculation. This also improves a greater density allowing for better solids separation in the clarifier.

Various technologies and processes have been tried or utilized for treating waste water and related waste processes in the plating and metal finishing industry. Some with good results

but most with poor or questionable performance. Some of these problems include excessive treatment chemical usage such as lime, reagent chemicals, acids and caustics which result in ph fluctuations and precipitation concerns. This in turn will result in or poor / excessively wet filter cake production.



Critical factors for optimum waste treatment system results are:

- Consistent pH range and residence time: pH is the critical factor and the ability to control higher concentrations with a flow proportional metering pump will compensate for fluctuating spikes.
- Consistent and total destruction of cyanide with little or no residual chlorine in the process filtrate.
- Chrome reduction / Consistent Chrome Removal

Always consider ways to segregate any and all concentrated cleaners, acids, chromates or plating bath solutions. Keep in mind that every ounce per gallon of any chemical process solution is the equivalent to 10,000 ppm. Typical rinse water from an average plating shop has between 500 and

3000 ppm of metal, TSS for the incoming stream. Dropping any concentration bath will upset a system and it must be controlled.

- Maintaining a gravity flow from the time wastewater is introduced to the system until it goes to discharge.

  Pumping to transfer from tank to tank will only aggravate the treatment process. Gravity is less problematic and maintains an even distribution of the solution that makes it easier to control the treatment process.

- Developing a counter flow whenever possible to gain retention time in each stage of the treatment process.

  This will increase chances of maintaining a more consistent pH range and insuring that all metals are precipitated prior to adding polymers and settling in the clarifier.

- Removing settled solids from the bottom of the clarifier.

  Incorporating a timer relay controlling an automated valve and allowing the sludge to evacuate periodically by means of gravity will control the amount of solids removed.

Tapping into the bottom cone of the sludge thickening tank and slowly metering the settled solids to the EQ tank will benefit the user in a multitude of ways.

Transferring the solids to a sludge thickening tank with a built in overflow will condition the sludge and create a more stable concentration for dewatering in a filter press.

Sludge thickening has a few benefits:

1) Storage volume – Allows storage in the event of dewatering machine downtime.
2) Consistent sludge blanket level as noted above. Helps to keep solids from drafting over a clarifier weir and this would be an up-set condition. Sludge blanket level can be controlled via a timer on a pump or valve.
3) Settled solids in a sludge thickening tank along with controlled decanting of recycled supernatants can also increase sludge consistency by as much as 3-4% which allows for better dewatering. This also decreases cycle time of the dewatering filter press and perhaps chemical addition.

Typical Filter Press and clarifier system.
Sludge de-watering equipment typically take a sludge that is any where from 1.0-2.0% (which is watery and very expensive to dispose of) to a high solids percentage "cake". This dry cake will cost much less in disposal fees and will require less frequent hauling.

Polishing:
Clean water overflow from a clarifier may require further removal of suspended solids or polishing to meet additional discharge permits requirements. Sand Filters are typically used for this purpose. These systems typically consist of one or more layers of various sizes and types of granular media. Gravel, sand, coal, garnet or activated carbons are utilized. Most sand filters must be periodically back-flushed to remove any solids build-up. These flush waters are generally returned to the equalization tank and then back into the treatment system. The filters must be checked regularly to ensure quality and that water quality factors are being met.

Operators must do their part for efficient waste treatment plant operation by…

- Keep a daily log listing volumes treated, sludge produced, chemicals consumed, effluent results, Ph data and plant equipment and performance notes.
- Carefully monitor sludge blanket levels
- Get to know your system
- Keep it running smooth by keeping flows thru the system consistent.
- Know the local environmental regulator and communicate with them.

Most industry wide operations personnel will agree that the most important process constituent both in terms of quantity and quality is water. It is possible that a facility can accomplish a near “zero” discharge wastewater system where this re-usable ***CLEAN*** water can be re-introduced back into the process. This can ultimately be envisioned by following these specific yet simple guidelines.

Thru testing and field evaluation, it has been determined that consistency; with the ability to withstand upset conditions are key factors in maintaining proper treatment and performance in a waste treatment system in the plating and metal finishing industry. The chemical waste water components in our industry are hard to control and still maintain a level of consistency. This is where the treatment process demands attention to factors like retention and maintaining a consistent flow through the treatment plant.

