

**POLLUTION PREVENTION AND WASTEWATER
RECYCLING
AT
WATKINS-JOHNSON COMPANY
BUILDING 1**

Watkins-Johnson Company eliminated its process discharge to the sewer from its Building 1 metal finishing operations in May 1993. Watkins-Johnson now treats and reuses the wastewater generated from its plating operations. Installation of a wastewater treatment system to reduce cyanide and metals discharge to the sanitary sewer, was required by a compliance agreement with the Palo Alto Regional Water Quality Control Plant (RWQCP) in February 1992. Watkins-Johnson went beyond the requirements of the compliance agreement by implementing pollution prevention measures including consolidating plating operations, improving rinsing, waste handling, and treatment techniques; and recycling treated wastewater for use in its metal finishing process.

Watkins-Johnson's metal finishing operations are conducted by three employees. The shop manager is also responsible for maintenance of the wastewater treatment and recycling system. In the Building 1 metal finishing operation, parts are plated with metals such as copper, nickel, and gold. These specialized parts are then used in semiconductor applications.

Waste-Generating Activities

The metal-containing wastewater generated at the site is from the process rinses. When parts are removed from process baths to rinses, they carry metals out of the concentrated baths into the rinse water.

Figure 1 shows a diagram of the plating processes at Watkins-Johnson's Building 1. Each of these processes uses water to rinse the parts after each step. The rinse water is then treated for reuse.

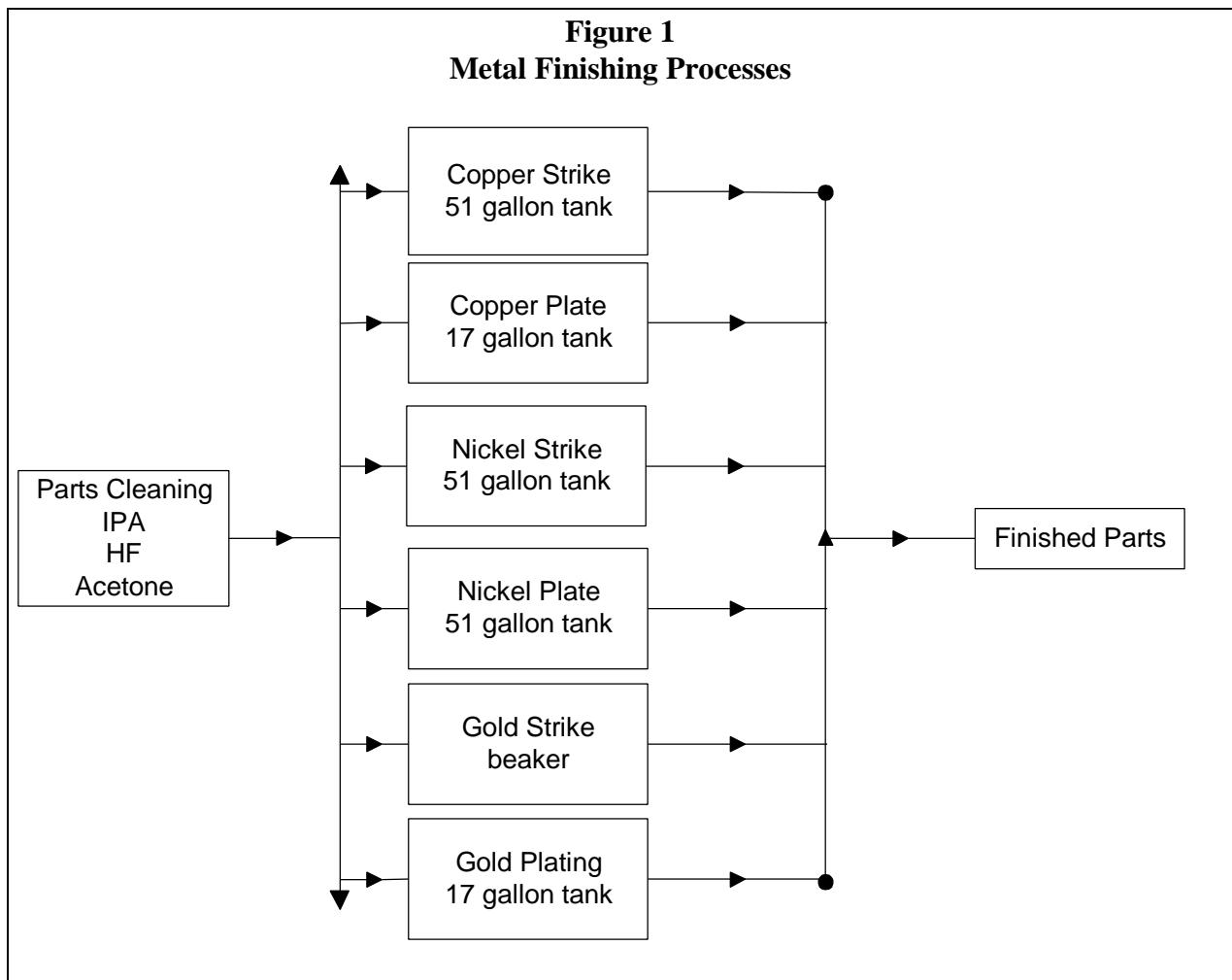
In addition to rinse water, spent process baths are also a source of waste. As contaminants build up in the baths they become less effective and must be replaced. Watkins-Johnson treats most of its spent baths with the distillation treatment system. Concentrated cyanide solutions and the gold plating bath are both sent offsite for treatment.

Rinse Water Use Reduction

Prior to installing the wastewater recycling system, Watkins-Johnson reduced its process water use through a series of rinse water reduction measures. Reducing wastewater generation allowed installation of a significantly smaller wastewater treatment and recycling system, significantly reducing the treatment and recycling system installation and operational costs.

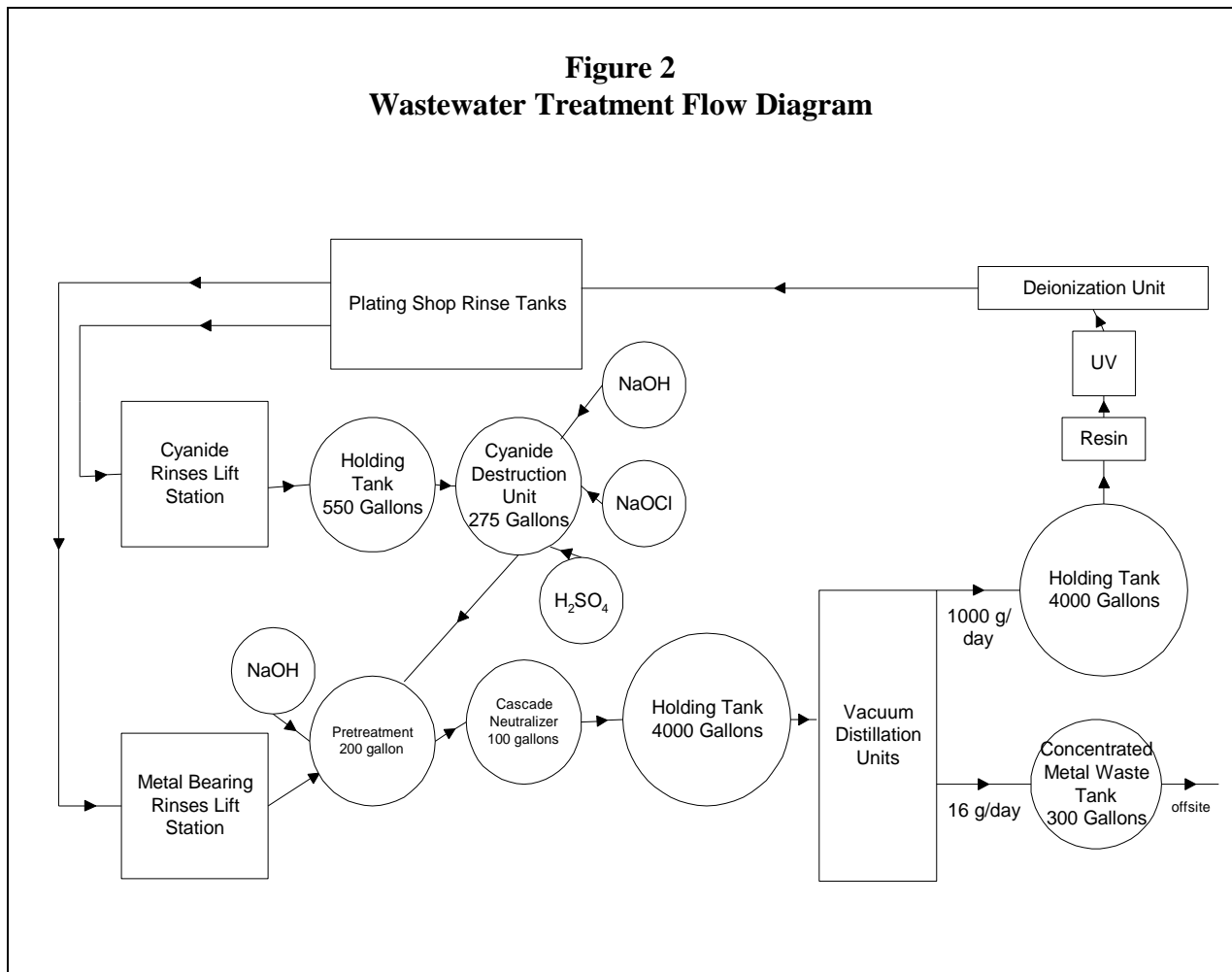
During the plating process, parts are dipped into tanks that contain various solutions. Post-plating rinse procedures now follow the minimal water use steps described below.

After the part is plated it is rinsed with a spray rinse over the heated plating solution. This keeps the metals in the plating solution and reduces drag out. The part is then suspended in a tank where the rinse water is activated by an operator controlled knee switch. Water only flows when a part is present. Parts that need further rinsing, due to their shape, can then be submerged in the rinse tank and a timer can be activated allowing the rinse water to flow for a given period of time. Each rinse is discharged entirely only twice daily, thus reducing the overall volume of discharge rinse water and concentrating the metals. Implementing these special rinse procedures reduced the rinse water used in the plating shop from 5,000 gallons to 1,000 gallons per day.



Wastewater Treatment and Recycling

Watkins-Johnson installed an advanced wastewater treatment system to purify process wastewater prior to re-use of that water in its plating process. The plating line rinse waters are treated on site to remove metals and cyanide. Cyanide is first destroyed in a two stage alkaline chlorination treatment process and then combined with the heavy metal waste streams from the non-cyanide rinses. Under vacuum, the combined wastestreams are vaporized at 21-27 degrees Celsius. The water vapor is then condensed, deionized, and returned to the plating shop to be reused in the rinse tanks. The vacuum distillation unit is also used for on-site treatment of spent baths. The concentrated metal slurry waste resulting from this process is hauled offsite for disposal. The treatment system has the capacity to treat 1,500 gallons per day. The cost to treat one gallon of water is approximately \$0.05. Figure 2 shows a flow diagram of the Watkins-Johnson treatment process.



Challenges

Watkins-Johnson discovered that the distillation system's vacuum pumps were prone to overheating due to installation in a sunny location. Watkins-Johnson then installed a fabric screen around the pumps to reduce the intensity of the heat from the direct sunlight. Watkins-Johnson also replaced its single-stage neutralizer with a cascading neutralizer to gain better control of the system's operation and to lower the pH of the water and metal slurry leaving the distillation unit.

Cost Analysis

These projects involved the installation of equipment and changes in operating procedures. Making these changes resulted in reduced materials and water use, thereby reducing company's operating costs. The treatment system cost approximately \$500,000. Watkins-Johnson believes the installation cost was recovered within 28 months.

Wastewater Metals Discharge

Completion of these projects eliminated process-related sewer discharges from Watkins-Johnson Building 1. Table 2 shows a comparison of Watkins-Johnson's discharge and disposal data before and after completion of its pollution prevention projects. The rinse water use reduction projects together reduced process wastewater generation from 5,000 gpd to 1,000 gpd. These same process changes dramatically reduced wastewater nickel loads, which fell 80% from 10 grams/day before the changes to 2 grams/day upon completion of the rinse water use reduction projects. Installation of the wastewater recycling system eliminated the remaining 1,000 gpd of wastewater discharge, and eliminated nickel discharges to the sewer from Building 1 plating process.

<u>Item</u>	<i>Discharge/Disposal</i>		<u>% Reduction</u>
	<u>Before Projects 1991</u>	<u>After Projects 1993</u>	
Nickel	10 grams/day	0 grams/day	100%
Flow	5,000 gpd	0 gpd	100%
Total Facility Waste Disposal	500,000	250,000	50%

References

Rusty Fayter, Watkins-Johnson, 3333 Hillview Avenue, Palo Alto, CA 94304, (650) 813-2851.