Plating as traditionally done has a high degree of waste, and decorative chrome has a higher degree of waste than most other plating. The reason for this is that decorative chrome parts are left in the tank for a relatively short period of time, thus, more changes of parts in the same amount of time, and thus, a higher degree of dragout of plating solution.

Chromic acid is a very viscous solution in the concentrations used in decorative chrome plating. The concentration is generally 26 to 44 ounces per gallon. It is one of the main metals that must be treated in a waste treatment system for pollution control. Hexavalent chromium must be converted to trivalent chrome before it can be precipitated out of the waste waters.

A normal plating cycle for hexavalent chrome is to plate for 1 1/2 minutes, transfer to a standing dragout tank, and then into a series of counter current rinse tanks. Because of the difficulty of rinsing hexavalent chrome from parts, the more rinsing you have the better the results.

As a rule of thumb 95% of the average chrome plating bath goes down the drain. In the case of our company this amounted to an average monthly addition of 600 to 800 pounds of chromic acid flake. To reduce hexavalent chrome to trivalent chrome requires 1000 to 2000 pounds of sodium metabisulfate a month. We also consumed 3000 to 5000 pounds of liquid caustic soda a month. This would in turn create 20 yards of filter cake every two months.

The first and most difficult thing for our company to do was to treat the chrome waste. We added sodium bisulfate to a two-station counter current rinse. This converted the hexavalent chrome to trivalent chrome. Trivalent chrome is not viscous and rinses much better. We used this system for many years.
Chromium has always been the hardest metal for us to waste treat. We looked into the idea of evaporating our chrome solution with an atmospheric evaporator and running our rinse water back into the chrome tank. The problem we were confronted with was the low operating temperature of 105 degrees for the chrome solution. Our tank was an 1800 gallon tank, and the five rinse tanks were 1300 gallons each. The efficiency of the evaporation was 15 gallons an hour. We used air lifts to move the rinse water from rinse tank to rinse tank. We had to stop adding sodium bisulfate to the rinse water because this would contaminate the chrome. We ran our system for 16 hours a day. We installed an automatic liquid level sensor on the chrome tank. As the level in the chrome tank went down the water in the cleanest rinse would turn on. This system would change each of our rinse tanks once a week. Because of the concern of contamination of the chrome we took a base line analysis of our chrome solution. We had been using this solution for 10 years. It had 3700 ppm of nickel and 400 lb of iron. This was not considered a very contaminated bath. However we were told that, at our concentration of 28 oz of chrome, if it got up to an ounce of foreign metals in the bath we would start to experience problems. We had less than 1/2 an ounce of contaminates. Other contaminates that are formed in the bath are trivalent chrome and chloride.

We became aware of the need to pay strict attention to what goes into the tank. Rinsing from the nickel tank to the chrome needed to be improved. The water that we added to the tank needed to be demineralized. We needed to dummy the tank for both chlorides and trivalent chrome.

We started our closed loop system in early December, 1986, and ran the system until March, 1989. The results were very good in all respects.

Our first experience was that as the drag out tanks were added to the chrome tank our chrome metal went from 28 oz up to 36 oz. We had to adjust our sulfate ratio on a daily basis. This is the catalyst that makes a chromium bath work. This was as it had been before, but more acute. We did not add any new chromic acid to the tank until March, 1987. At that time we started to have plating problems.

We discovered that the floride catalyst was consumed in plating and we had not been adding enough. Once we got that level where it belonged we plated with few problems.

The advantages of this system are numerous:

a. Chrome consumption went from 600-800 pounds per month to 100 pounds per month.

b. Sodium bisulfate consumption went from 2000 pounds to 300 pounds per month. This was to treat spills.

c. Our caustic consumption went way down.

d. The amount of filter cake we had to haul significantly dropped.

e. Our waste water samples went from 4 ppm to non detectable most of the time.
f. The amount of problems in running our chrome was somewhat outweighed by the better control and more consistent quality.

We felt that the system saved us $2000 to $3000 per month. It created some problems because we had to dummy the bath on a regular basis.

There are several methods that we studied to purify the bath. One was to set an ion exchange system in one of the dilute rinses. This would remove the impurities. Over a long period it would help to keep the bath in very good condition. The cost however was very high.

Another system is to use an electrolytic purification system in the dilute tanks. This would act to clean up the bath but is also very expensive.

The third system is the use of an electrolytic dummy using a porous pot as a barrier on a full strength bath. It also has potential for removing some of the impurities and is relatively inexpensive.

The fourth system for keeping contamination down is to dilute the bath periodically and add new chromic acid to the remaining bath. This would be giving us a waste disposal problem but the problem would be on a very controlled basis.

Our system had 5 rinses flowing counter currently into the chrome tank. After 2 1/2 years of operation they had set up an equilibrium. The chrome tank was 32 ounces/gallon. The final rinse had less than 100 ppm.