# Chapter 6

## Conclusions and Recommendations

### 6.1 Conclusions

1. The industry has already implemented a few waste minimization activities such as quality control of intermediate product (polished rims) with in the process, two stage rinsing, dragout recovery.

2. However, the industry lacks technical know-how to carry out the electroplating process efficiently. Quality control of the product is poor.

3. There are possibilities to reduce electricity and water consumption without any quality deterioration of the product; through working longer hours a day, introduction of temperature control units for heaters and removal of unnecessary unit operations. The study showed that a saving of at about Rs.2.40 per rim could be achieved by increasing operating time by 4 hrs (i.e. 12hrs operation per day).

4. Wastewater generated in the surface preparation process is unnecessarily containing nickel and chromium, due to improper preparation of rejects before recycling into the process, which can be eliminated by introduction of stripping for rejects before recycling. The study showed that a saving of at about Rs.0.5 per rim could be achieved by this modification.

5. In the wastewater treatment, neutralization should be carried out only as the final step; neutralization before sedimentation of the precipitated nickel compounds re-dissolves them, which results in higher nickel concentrations in the effluent.

6. Optimum pH for hydroxide precipitation of nickel and chromium in a mixture is pH 8.

## 6.2 Recommendations

1. The following waste minimization activities can be implemented immediately.

    - Introduction of stripping for rejects
    - Introduction of drain boards
    - Introduction of temperature feed back control system for heaters
    - Introduction of improved process control in Ni plating activity
    - Increasing working hours a day.

2. Following waste minimization activities may be implemented, while proper quality control procedures such as corrosion resistant test & Adhesion tests are carried out.

    - Omission of unnecessary unit operations
    - Change over to $Cr^{3+}$ chrome plating solution instead of $Cr^{6+}$ solutions

3. As recommended in the literature unanimously, it is recommended to carryout chromium reduction at pH 3 for minimum of 30 minutes time period after adding the required amounts of $H_2SO_4$ acid and Sodium Meta Bisulphite.

4. It is recommended to test a sample of reduced chromium waste using KI / starch paper or KI/starch solution before releasing that into Heavy Metal Precipitation Tank in order to check whether any $Cr^{6+}$ is remaining in that. If the test is positive for $Cr^{6+}$ recommendation 3 should be repeated.

5. It is recommended to carry out nickel and chromium precipitation using NaOH or $Ca(OH)_2$ at a pH value between 8 – 8.5.



6. Sedimentation should be carried out before neutralization of the wastewater

7. Sedimentation may be improved using $Ca(OH)_2$,or Alum while maintaining the optimum pH for precipitation of the heavy metals present in the wastewater.

8. It is recommended to filter Supernatant of the sedimentation tank since even a small amount of suspended material that passes with the supernatant can lead to exceeded heavy metal concentrations in the treated wastewater beyond the allowed discharge standards.

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CENTRAL ENVIRONMENTAL AUTHORITY

## GENERAL STANDARDS FOR DISCHARGE OF EFFLUENTS INTO INLAND SURFACE WATERS

| No. | Determinant | Tolerance limit |
|---|---|---|
| 1 | Total suspended solids, mg/l max | 50 |
| 2 | Particle size of total suspended solids | Shall pass sieve of aperture size 850 micro m. |
| 3 | pH value at ambient temperature | 6.0 to 8.5 |
| 4 | Biochemical Oxygen Demand — $BOD_5$ in five days at 20°C, mg/l, max | 30 |
| 5 | Temperature of discharge | Shall not exceed 40°C in any section of the Stream within 15 m down stream from the effluent outlet |
| 6 | Oils and grease, mg/l max | 10.0 |
| 7 | Phenolic Compounds (as phenolic OH) mg/l, max | 1.0 |
| 8 | Cyanides as (CN) mg/l, max | 0.2 |
| 9 | Sulfides, mg/l max | 2.0 |
| 10 | Fluorides, mg/l max | 2.0 |
| 11 | Total residual chlorine mg/l max | 1.0 |
| 12 | Arsenic, mg/l, max | 0.2 |
| 13 | Cadimum total mg/l, max | 0.1 |
| 14 | Chromium total, mg/l, max | 0.1 |
| 15 | Copper total, mg/l, max | 3.0 |
| 16 | Lead, total, mg/l, max | 0.1 |
| 17 | Mercury total, mg/l, max | 0.0005 |
| 18 | Nickel total, mg/l, max | 3.0 |
| 19 | Selenium total, mg/l, max | 0.05 |
| 20 | Zinc total, mg/l, max | 5.0 |
| 21 | Ammoniacal nitrogen, mg/l, max | 50.0 |
| 22 | Pesticides | Undetectable |
| 23 | Radio active material | |
| | a Alpha emitters $\mu c$/ml | $10^{-7}$ |
| | b Beta emitters $\mu c$/ml | $10^{-8}$ |
| 24 | Chemical Oxygen Demand (COD), mg/l, max | 250 |



Note 1 All efforts should be made to remove colour and unpleasant odour as far as practicable.

Note 2 These values are based on dilution of effluents by at least eight volumes of clean receiving water. If the dilution is below eight times, the permissible limits are multiplied by one-eighth of the actual dilution.

Note 3 The above mentioned General Standards shall cease to apply with regard to a particular industry when industry specific standards are notified for that industry.