Workshop on Resource Reduction & Recovery in Electroplating Industry

Welcome
to the presentation

B. Datta
ENC Consulting Engineers
www.encconsulting.co.in

1

Environment Protection Rules under E P Act

Background

- The Wastewater Discharge standards for Electroplating Industry in general was introduced in 1986
- CPCB desired to carry out an in-depth study in 2003-4 towards revision of such standard
- Based on the study and detailed deliberations, MoEF notified on 30th March 2012 detailed process specific standards through Gazette notification under EP Rules of 1986

2

Study carried out for CPCB Objectives:

- **Assess Environmental Problems of the Industry**
- **Assess all 3 types of pollution – water, air and noise**
- **Review Existing standards and suggest MINAS for Effluent, Gaseous Emission & noise standards**
- **Suggest cost-effective pollution control measures**
- **Suggest re-use and recovery of resources - chemicals, particularly metals from waste**

3

In-depth Study

♦22 units studied.

♦ results of the in-depth study analyzed with respect to the following :

- Type of units
- Quality of Raw (Untreated) Wastewater
- Quality of Treated wastewater
- Use and Cost of Wastewater Treatment
- Air Emission Status
- Noise Emission Status
- Review of Standards & Practices in other countries

4

Distribution of Units in the Study

Turnover	% of units	Category
> 1 Crore	54	Large
> 50 Lakh but < 1 Crore	14	Medium
Upto 50 lakh	32	Small

5

Water Use – current level & target

- Units do not keep data on plating area
- water requirement varies from 68 to 230 litres per sq.m. of plated surface area
- World Bank recommends a target of 1.3 litres per sq. m. of plated area for rack plating and 10 litres per sq. m of barrel plating

6

Cost of Treatment

- The reported range is as wide as Rs. 30 to Rs. 311 per kl
- Privately run CETP, the charge levied to customers vary from Rs. 0.50 to 1.25 for low TDS and Rs.1.60 to 1.75 for high TDS
- The cost of treatment is always below the generally accepted upper limit of 3% of total cost of production.

7

Air Emission Status

- considerable variation in gaseous emission between large and medium/small units: Ambient acid mist conc. @ 0.5 HCl and 6.3 H_2SO_4 mcg/cum
- fugitive emission levels: many units use TCE for ultrasonic cleaning (with no cover)
- acid fume levels can be reduced substantially
- fume collection and scrubbing with water- rather simple techniques.

8

Regeneration of baths and contents of pre-treatment, rinse and wash tanks.

Metal recovery through ion- exchange presents highest potential and serves the dual purpose of:

- **resource (metal) recovery** (direct recovery by closed loop @ 85-90% for Ni, Sn, Cu; 98% for Zn)
- **waste minimization (by re-use of water of regenerated bath solutions)**

- **Rinsewater reduction** upto 90%
- **Direct recovery by periodic transfer** (50 – 60% recovery - static dragout tank)

9

The methods used are :

- **Filtration & Centrifugation**
- **Evaporation**
- **Advanced Techniques – Tin, Copper, Zinc etc.**
- **Electrolytic Recovery**
- **Nickel Recovery / Recycling by Ion-exchange**
- **Chrome Recovery / Recycling by Ion-exchange**

10

Economic Benefits of Recovery

- Typically, a small plant with 2.5 kg Nickel sulphate per day will save Rs. 1.2 lakh per year ; Similarly, payback period is one year for Chrome recovery

11

Waste minimisation in Electroplating

Minimisation of Wastewater Generation

Minimisation of Gaseous Emission

Minimisation of Solid Waste

Minimisation of Noise Emission (only 8% units record ambient noise @ <70dBA; 42% units @70 – 75 dBA and 50% units @ 75-84 dBA)

12

Waste Minimization Methods

Introduction of rinse water recirculation –
combined benefit of chemical recovery and reuse
Static rinse water recovery

Avoiding and controlling spillage – single largest cause of high wastewater generation in the unorganised sector. By using troughs between tanks and using well defined linear configuration in place of barrels and avoiding haphazard rinsing and washing will ensure very significant reduction in quantum of wastewater generated

- ✓Introduction of cascade and/or counter- current rinsing
- ✓Use of fogging and spraying on objects (rack plating)
- ✓Introduction of metal recovery by electrolytic method (ion-exchange and its advanced application leading to high recovery ratio of water (up to 80%)

13

Best Available Techniques

Key Areas

good housekeeping practices involving working habits and attitudes

technical modification involving modifications on existing machinery,

process modification involving substitution of chemicals and alternative processes

Levels of Sophistication

Immediate application : applying low-tech measure

Intermediate appln. : applying medium-tech measures

Advanced application : applying high tech measures

14

BAT Applications- Low Tech Measures

- Cleaning + maintenance
- Drip guard (polypropylene plastic material) between tank
- Replace leaky tanks and repair leaky pipes
- Sheltered storage for chemical drums with secondary containment but without drainage
- Insulation of hot process tanks and piping
Put air blower in separate enclosure

15

BAT contd…

Medium Tech Measures

Water flow meter and conductivity meter *

Multiple counter flow rinsing / sequence

Barrel rotation * (at top position) *

Spray rinsing *

Centrifuge (pre-treatment)

Introduce / improve vapour collection hoods and scrubber system

16

BAT contd...

High Tech Measures

- Reverse osmosis or ion exchanger
- Ultra filtration / Ultrasonic treatment (pre-treatment)
- Back filling to plating baths
  - Evaporator bath and activated carbon filter
  - Electrolysis cell

17

Treatment of Wastewater

For most heavy metals

precipitation as insoluble hydroxy or sulphite compounds

Reducing Agent	Precipitated Hydroxides as dry matter (Kg)
SO_2	1.98
Sodium bisulphite	1.98
Ferrous Sulphate	8.34

simple reagents followed by pH adjustment and sedimentation. Follow Hazwaste Disposal norms

18

Housekeeping Practices

✓Management accepting its lead role in providing safe working conditions and procedures

✓Participation by the workforce in ensuring safety at work

✓Clear allocation of responsibilities for safety and health services

✓Safety training and instruction, on induction and on-going

✓Reporting, investigation and analysis of accidents and working conditions

✓Dissemination of information on hazards and risks

✓Co-operation with labour and safety instructions and reviews

19

The World Bank Guidelines

- water consumption of no more than 1.3 litres per sq. m. plated for rack plating and 10 litre per sq.m. for drum
- Avoid Cadmium plating or limit maximum cadmium load (in the waste) of 0.3 grams for every kilogram of Cadmium processed
- Recover Solvent emissions by at least 90%
- No CFCs and tri-chloroethanes
- Achieve all of the maximum levels for at least 95% of annual operating hours.

20

Air Quality Standards (indoor)

ought to be in place for :

Chloro-ethylenes and chloro-ethanes (among other toxic organic substances)

Acid vapours

Chromium (including chromic acid vapours), lead and a few other metals.

21

Monitoring Practices

Monitoring to be reasonable, practical & useful

Some selected parameters be monitored more frequently, while other parameters be monitored at longer intervals.

Parameters like Cadmium, Chromium, [Cr(VI) and Cr (T)], Cyanides, Copper, Silver and Nickel need to be monitored *once every week*. That would provide a data of 50 to 52 sets every year.

If 95% compliance is ensured, the performance should be considered satisfactory.

22

Monitoring contd…

Other parameters should be monitored ***at least once a month***, generating 12 sets of values every year. For these parameters also, 95% compliance must be met. This should be applicable to all tiny and small units.

For medium and large units, ***daily*** *monitoring* of selected parameters should be carried out. Other parameters can be monitored ***every fortnight***.

23

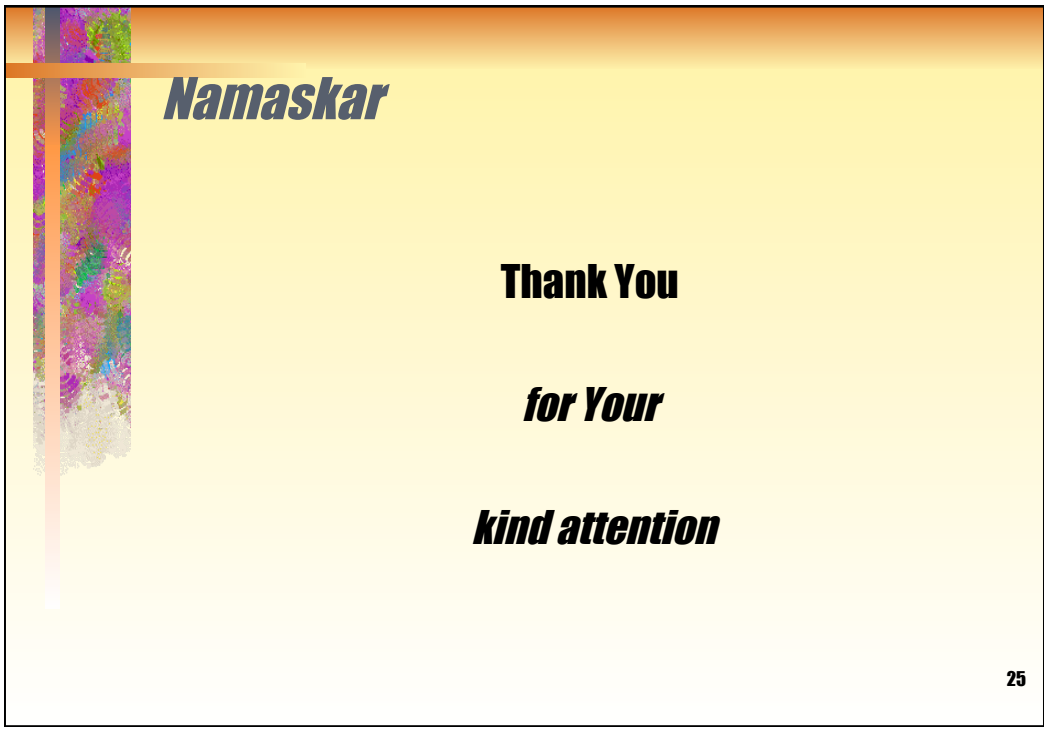
Revised 2012 MoEF Standards

Relate to:

- A – Effluent Standards : Compulsory & Specific parameters for various processes i.e., Ni-Cr, Zn, Cd, Anodizing etc.
- B - Emission Standards : Compulsory & Specific parameters for various processes i.e., Ni-Cr, Zn, Cu and Cd and
- C - Stormwater Disposal

The existing units shall comply with the norms of asterisked pollutants by 1st January 2013. However, new units shall comply with the norms with effect from commissioning of plant.

24


Namaskar
Thank You
for Your
kind attention
25