ELECTROPLATING FACILITY INSPECTION MANUAL

With a Special Emphasis on Cyanide Plating Facilities

Prepared By
Rita Hypnarowski
Senior Hazardous Substances Scientist
State Oversight and Enforcement Branch
Enforcement and Emergency Response Program
Department of Toxic Substances Control

Robert Brushia, Ph.D.
Research Scientist III
Office of Pollution Prevention and Green Technology
Toxics in Products Branch
Department of Toxic Substances Control

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ELECTROPLATING FACILITY INSPECTION MANUAL
TABLE OF CONTENTS

CHAPTER 1 – INTRODUCTION

IN THIS CHAPTER, YOU WILL:

- Learn about the nature of the plating industry
- Understand why it is so important to inspect electroplating facilities
- Understand some fundamentals of the electroplating process

1.1 The Plating Industry

Plating is a general term used to refer to various physical, chemical, and/or electrochemical processes (i.e., electroplating, electroless plating, buffing, polishing, anodizing[1], etc.) that are used to "treat" the surface of a product, or ***work piece***, to achieve:

- Enhanced *appearance*
- Improved *durability*
- Improved *functionality*

For example, steel automobile bumpers may be plated with ***chrome*** to improve appearance and provide corrosion resistance; costume jewelry may be ***gold*** or ***silver*** plated to improve appearance; certain airplane parts may be plated to increasestrength and provide corrosion resistance; and plastic circuit boards may be plated with ***copper*** or ***gold*** to provide the means for conducting electrical current.

Plating facilities are typically divided into two main categories: ***captive shops*** and ***job shops***. Plating shops that provide service to one customer, or that conduct metal finishing as part of a larger manufacturing operation, are referred to as *captive shops*. Captive plating shops may also be referred to as ***in-house*** operations, and are generally used to support a ***specific*** manufacturing process. For example, a *circuit board manufacturer* may have a plating process as part of the overall circuit board manufacturing operation.

Circuit board manufacturers often utilize plating in the manufacturing process and include establishments that:

- *Print*
- *Perforate*
- *Plate*
- *Screen*, or
- *Etch*

[see www.bls.gov/bls/naics.htm for information on how industries are classified by the North American Industry Classification System (NAICS)].

[1] "Anodizing" is defined as electrolytic coating of a metal with an oxide.

Job shops are ***independent*** shops that do plating work for a variety of customers. At any given time a job shop may use a *variety of different plating processes* for many different types of work pieces. Generally, job and captive plating shops use the same types of plating processes, and generate ***similar types*** of hazardous wastes.

Job Shops are classified as NAICS code 332813, and include facilities engaged in the following process activities of metal and metal products:

- *Electroplating*
- *Plating*
- *Anodizing*
- *Coloring*
- *Buffing*
- *Polishing*
- *Cleaning and sandblasting*

Anodizing, coloring or dyeing, as well as buffing, polishing, and various other surface finishing operations, are all considered “plating” processes in a generic sense.

While there are many types of businesses that may conduct plating, the industries most likely to have plating operations are:

- Aerospace/defense
- Electronics and circuit board manufacture
- Automotive
- Jewelry
- Decorative chrome

1.2 Why the Emphasis on Plating Facilities?

Why is there such a high priority placed on inspecting electroplating facilities?

Nature of the Waste

- Many electroplaters generate cyanide-bearing wastes, an Extremely Hazardous Waste (EHW) as defined in California Code of Regulations (Cal. Code Regs.), title 22, section 66261.110

Prevalence of the Industry

- There are hundreds of electroplating facilities in California

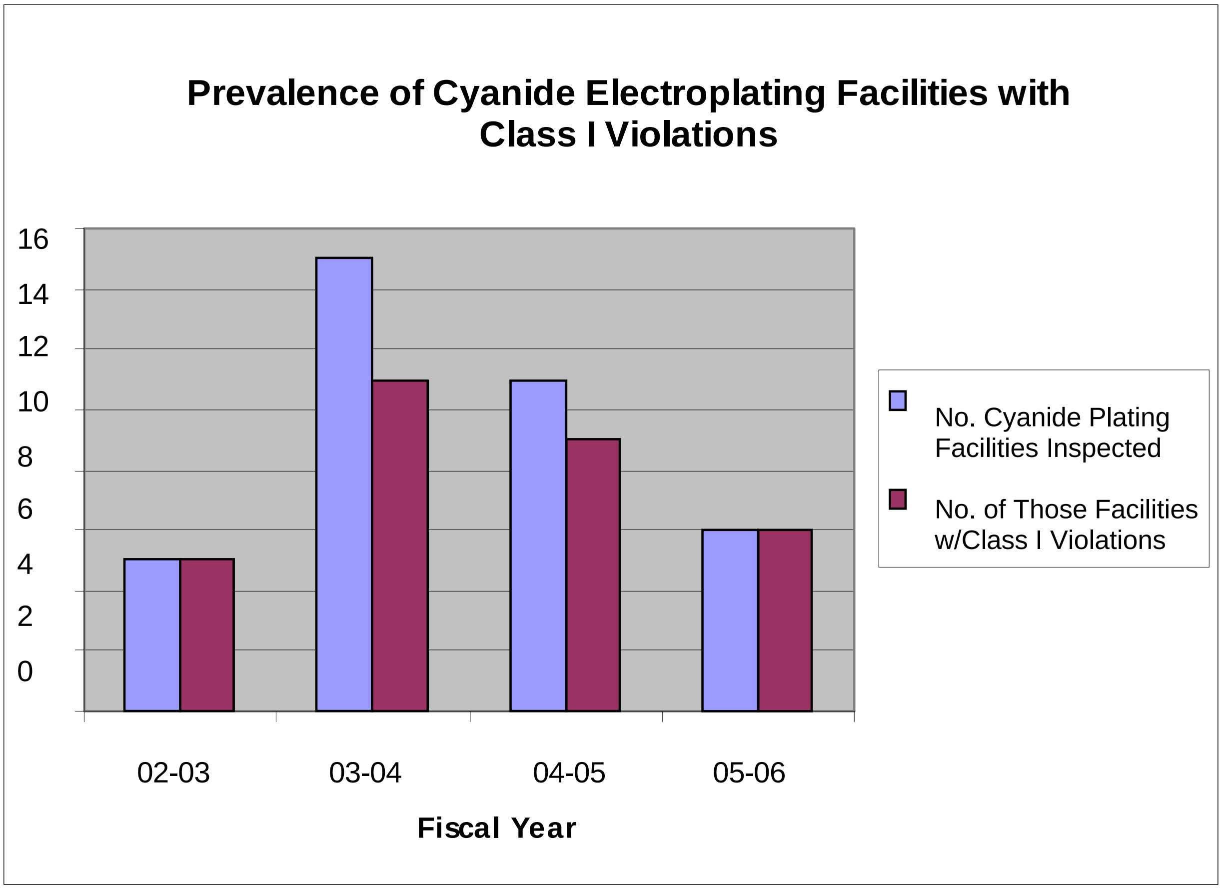
Treatment of Waste

- Many electroplaters treat large volumes of hazardous waste onsite

Last but not least, electroplating facilities have received a high regulatory priority based on the *prevalence of Class I violations* observed at these facilities.

1.2.1 Statistics on Plating Inspections

Based on many inspections conducted by the Department of Toxic Substances Control (DTSC) of plating facilities, almost 80% had Class I violations. Because of the prevalence of Class I violations found, this industry clearly needs a lot of attention in order to achieve compliance and correct operations that may pose a high threat to human health and the environment.



(See next page.)

1.2.2 Prevalence of Class I Violations

Why are so many Class I violations observed at electroplating facilities? There are several reasons:

- Most electroplating facilities utilize a ***wet-floor operation*** which increases the chance of spills and of incompatible wastes mixing
- Many plating operations are ***decades old*** and may not be equipped with sophisticated *leak detection systems* or other technology that make waste management easier; in addition, they may not be equipped with adequate *secondary containment*
- Since many facilities are decades old, operators may be out of touch with ***current laws and regulations*** regarding handling and treatment of plating waste, especially those applying to tank systems
- Especially in wet-floor operations, employees and operators may become ***desensitized*** to seeing spilled plating chemicals and not understand or address the seriousness of chemical crystals forming, corroded tanks or pipes, accumulated waste in sumps, etc.

Class I violations are discussed in more detail in section 6.3.

What can you as a regulator do to bring an electroplating facility with serious violations back into compliance?

- Understand violations prevalent among electroplating facilities, and document and explain these to the owner/operator;
- Ensure timely return to compliance of the facility by monitoring its progress in addressing violations;
- Penalize violators to provide a disincentive and eliminate economic benefit gained from noncompliance;
- Encourage facilities to use drip pans (also known as drain boards) or implement a spray-rinse process to minimize the spillage of plating chemicals to the floor;
- Identify and promote opportunities for pollution prevention.

Each of these topics is covered in detail in this manual.

(See next page)

Our job as environmental professionals is to reduce and eventually eliminate conditions like this at electroplating facilities

1.3 Plating Chemistry

This manual focuses on plating facilities that use ***cyanide***. Cyanide has many properties that make it especially well suited for use in metal plating. Although less toxic alternatives to cyanide have been available for some time, cyanide *continues to be used* extensively in the plating industry because:

- Cyanide-based plating solutions tend to be much less affected by ***impurities*** than other plating solutions
- Cyanide can remove tarnish or other undesirable films from surfaces to be plated
- Cyanide has properties that facilitate the plating process, and make it ***easier*** and ***cheaper*** to maintain plating solutions
- Certain job specifications (e.g., military contracts) continue to require the use of cyanide plating processes

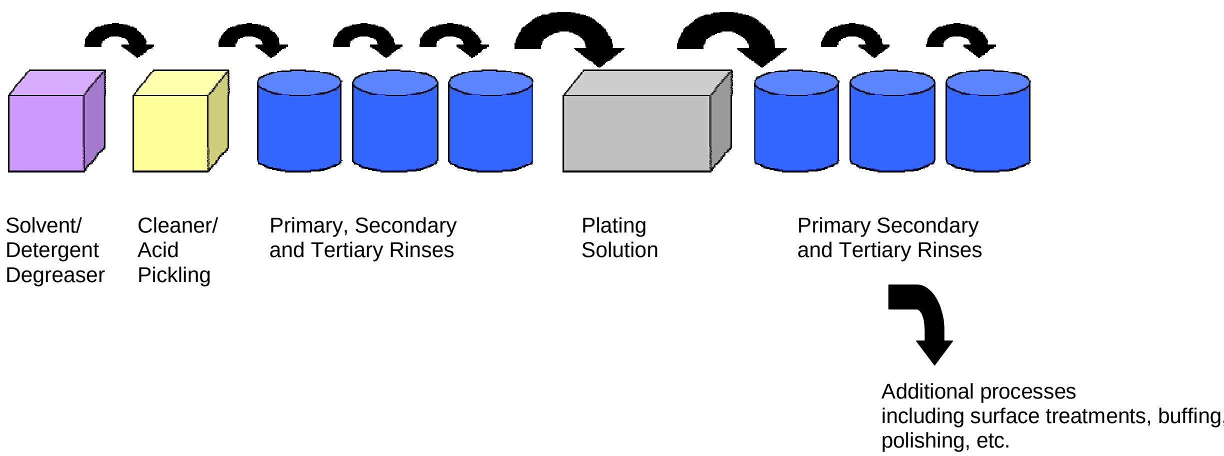
Besides understanding why cyanide is used, it is helpful to understand the basic science behind plating. Both electroplating and electroless plating involve ***oxidation-reduction*** chemical reactions. You may recall that oxidation-reduction, or *redox* reactions involve the transfer of an electron from a *donor* group to an *acceptor* group. The donor loses an electron, and is said to become *oxidized*; the acceptor gains an electron, and is said to become *reduced*. The oxidized and reduced form of a redox component are said to form a redox couple. For a more comprehensive discussion of plating chemistry, see Appendix C.

1.4 The Plating Line

Plating is typically performed in a series of tanks and/or containers in close proximity to one another, to *minimize t*he distance that work pieces must be moved and to *maximize* efficiency. The tanks and/or containers comprising a plating process are commonly referred to as the ***plating line***.

> Work pieces are moved from one tank or container to the next in the plating line in order to achieve the desired finish.

The following schematic illustrates the layout of a generic plating process line:



The arrows indicate the direction in which the work pieces move through a plating line.

A combination of the following chemicals may be used to clean and prepare the surface of the work piece:

- Solvent degreasers,
- Alkaline cleaners,
- Acid pickling solution*, or*
- Other process solutions

Surface preparation and cleaning typically removes

- Dirt
- Oxidation, *and*
- Various contaminants

from the work piece. This eventually leads to ***contamination*** of the cleaning solution with dissolved metal and various other, potentially hazardous, contaminants.

After the surface of the work piece is cleaned and prepared, it is immersed in the plating solution where an ***applied electrical current*** or a ***chemical reaction*** causes dissolved metal in the plating solution to be plated onto the surface of the work piece. After being rinsed, the work piece may receive ***additional treatments*** with various chemicals, or may be buffed or polished. The resulting product is a metal piece ready for use in any one of many applied industries.

Now that we've taken a look at the "who, what, and why" of electroplating facilities, it's time to understand the hazardous wastes ***generated and treated*** in plating processes.

CHAPTER 2 – HAZARDOUS WASTES GENERATED AND TREATED IN PLATING PROCESSES

IN THIS CHAPTER, YOU WILL:

- Learn the types of wastes generated in plating facilities
- Understand the different hazards of plating wastestreams
- Learn how to evaluate a tank treatment unit and review an engineer-certified tank assessment

2.1. Sources of Plating Waste

2.1.1 Drag-out

Plating solution typically contains a high concentration of dissolved metals and various other chemicals including cyanide. Plating solution containing dissolved metals is usually very ***expensive*** to replace due to the cost of the metal in the solution. Therefore, most plating facilities take considerable care to ***maintain*** their plating solutions, and only dispose of them if there is no other option.

Although most plating shops will dispose of plating solution from time to time, it rarely comprises a large percentage of the hazardous wastes generated from most plating operations. However, most hazardous waste generated in plating operations *indirectly* arises from ***drag-out.*** Drag-out is the plating bath solution that is carried over to the rinse tanks, along with the work piece that is being plated. The primary rinse tank is initially filled with clean water. As the plating line is operated, the drag-out rinse tank remains stagnant and its chemical concentration ***increases*** as more work is processed.

The amount of solution that adheres to the work piece will depend on many factors, including:

- The surface tension of the solution
- The surface area of the work piece
- Irregularities and cavities in the surface of the work piece

In general, the ***higher*** the surface tension of the plating process solution, or the more surface area on the work piece, the ***greater*** the volume of the solution that will adhere to the work piece, and the more drag-out.

> Plating process solution that adheres to the surface of the work piece is called "drag-out," because it is literally dragged out of the plating tank or container on the surface of the part.

If a plating process tank or container holds a solution with specific hazardous characteristics, the drag-out will have those same hazardous characteristics.

2.1.2 Rinsewater

As discussed in section 1.4, **rinsing** is done between various plating process steps to remove residual solution (the drag-out) and to prepare the part for the next step in the plating process. Since most plating process solutions are aqueous, or water-based, ***water*** is the most common solvent for rinsing. A work piece will typically be rinsed sequentially in ***primary, secondary***, and even ***tertiary*** rinses.

Drag-out from the surface of the work piece will ***contaminate*** each of these rinses. As the work piece is moved through the sequential rinses, successively less drag-out will adhere to the surface of the work piece. Thus, the ***primary*** rinse will become contaminated with drag-out more rapidly, and to a greater extent, than either the secondary or tertiary rinses.

> Eventually the rinses may become so contaminated with drag-out that they will no longer function as required.

Left indefinitely, the concentration of hazardous plating chemicals in the primary rinse tank would approach their concentrations in the plating solution. Therefore, rinse water tends to be changed frequently. Waste rinse water is referred to as being ***spent***. If the spent rinse waters exhibit any hazardous characteristics (and typically they do) they must be managed as hazardous waste in accordance with the Hazardous Waste Control Law (HWCL) and applicable regulations.

Spent rinse waters typically account for between **50%** and **70%** of the hazardous waste generated by a given plating operation. Larger plating shops that process a lot of work pieces may change their rinse waters ***weekly*** or ***daily,*** or may even have “counter-flow” systems that continuously exchange fresh water for spent rinse water.

> Spent rinse water is typically the largest hazardous waste stream generated by a plating operation.
> As an inspector, you must determine the hazardous characteristics of rinse waters and evaluate how a facility manages them.

Spent rinse waters also need to be considered when evaluating pollution prevention opportunities. (See Appendix D for more information.)

Aqueous vs. Solvent Solutions: Certain plating process ***solutions*** (e.g., solvents, cleaners, acid pickles, plating solutions, etc.) may also become “spent”. Whereas spent organic-based ***solvents*** and plating solutions may be very expensive to dispose of and replace, ***aqueous*** cleaning solutions and acid pickles are relatively ***inexpensive to replace***. Therefore, along with spent rinse waters, ***spent acid pickles*** and ***aqueous cleaning solutions*** are often discarded when they become heavily contaminated. Spent cleaners and acid pickles typically contain hazardous concentrations of dissolved metals, and may be corrosive.

Most shops ***treat*** their hazardous spent rinse waters, spent cleaning solutions, and spent acid pickle solutions onsite because they are typically generated in large quantities. For most facilities, the cost of sending these wastes to a treatment, storage, or disposal facility (TSDF) would present a huge financial burden.

Stripping also contributes to the generation of spent rinsewater. It involves the use of an aqueous solution containing concentrated cyanide, or some other agent, to facilitate the removal (***dissolution***) of the metal surface from a work piece.

Stripping is used to

- Recover valuable precious metals from the surface of a discarded work piece
- Prepare the work piece for resurfacing
- Chemically polish newly finished work pieces

The work piece will be rinsed after the stripping process is complete, and the concentration of chemicals from the stripping solution will gradually ***increase*** in the rinse water until the rinse water becomes spent.

Even though plating and stripping are used in the plating process for ***opposite*** purposes, waste from these two processes tends to have very ***similar*** hazard characteristics. They will almost always contain dissolved metals.

> Dissolved metals, including silver, copper, zinc, cadmium, chrome, nickel, and others, are toxic at or above certain concentrations, and some are suspected carcinogens.

The next section, 2.2, will discuss specific hazardous characteristics of rinsewaters.

2.1.3 Filter Cake

In general, hazardous spent rinse waters, spent cleaning and stripping solutions, and spent acid pickle solutions are all ***aqueous*** hazardous wastes (i.e., mostly water, and less than 1% suspended solids), and are often collectively referred to as plating “waste waters”. The typical treatment process for plating waste waters generates another hazardous waste referred to as filter cake.

Filter cake is nothing more than the solid, metal-bearing residue that is removed from waste water during treatment. This material is called filter cake because it is typically dried in an apparatus called a ***filter press*** to decrease its aqueous content and thus its weight (to reduce shipping and disposal costs).

Filter cake may account for between **30%** and **50%** of the hazardous waste generated by a plating operation. Thus, spent rinse waters and filter cake (which is generated from the treatment of the spent rinse waters) can together account for **80%** to **100%** of the hazardous wastes generated by an electroplater.

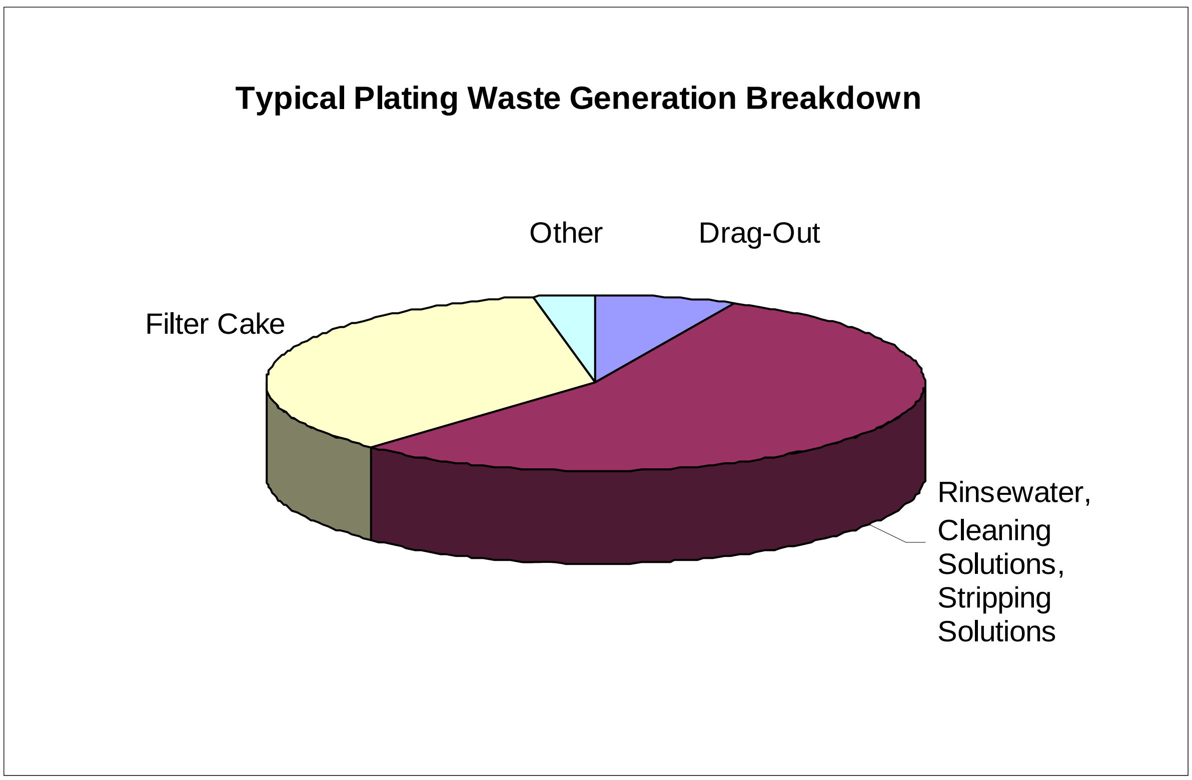
Since the amount of rinsewater generated correlates to drag-out practices, ***drag-out,*** as discussed earlier, gives rise to most of the hazardous waste generated in plating operations. Changes to a plating process that lead to a ***reduction in drag-out*** may also lead to a reduction in the amount of hazardous waste generated.

2.1.4 Other Hazardous Wastes Generated

Other hazardous wastes generated in plating operations may include:

- Spent solvents
- Spent filters (discussed in section 2.3.7)
- Buffing dusts from polishing operations
- Others specific to a plating technique

These typically account for a very small proportion (i.e., between **<1%** and **5%**) of the hazardous waste generated in a plating operation.



2.2 General Characteristics of Hazardous Wastes From Plating Operations

The criteria for identifying hazardous wastes are found in Article 2 of chapter 11 of Cal. Code Regs., title 22, commencing with section 66261.10. You can also access DTSC's online tutorial on waste classification by going to http://ccelearn.csus.edu/wasteclass/intro/intro_01.html.

Many hazardous wastes generated from electroplating operations have been listed as Resource Conservation and Recovery Act ***(RCRA)*** wastes pursuant to 40 Code of Federal Regulations, section 261.30 (also see Cal. Code Regs., title 22, section 66261.30).

The following chart shows the U.S. Environmental Protection Agency (EPA) hazardous waste number for several listed wastes pertinent to plating operations:

EPA Hazardous Waste Number	Hazardous Waste	Basis for Listing
F005	Certain spent non-halogenated solvents	Ignitability and Toxicity
F006	Waste water treatment sludge from electroplating operations	Toxicity
F007	Spent cyanide plating bathSolutions	Toxicity and Reactivity
F008	Plating bath residues (from the bottom of plating operation tanks) where cyanides are used in the process	Toxicity and Reactivity
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process	Toxicity and Reactivity
F011	Spent cyanide solutions from salt bath pot cleaning from metal heat-treating operations	Toxicity and Reactivity
F012	Quenching waste water treatment sludges from metal heat-treating operations where cyanides are used in the process	Toxicity
F019	Waste water treatment sludge's from the chemical conversion coating of aluminum	Toxicity

Most of the hazardous wastes generated in electroplating operations will exhibit the characteristic of ***toxicity*** due to a high concentration of dissolved metals (for reference see Cal. Code Regs., title 22, section 66261.10 *et seq*.). Wastes from ***electroless*** plating operations contain chelated ***metals*** and ***formaldehyde gas***, and are toxic (formaldehyde gas is "reasonably anticipated to be a human carcinogen" by the National Institute of Environmental Health Sciences (NIEHS, http://ntp.niehs.nih.gov/ntp/roc/eleventh/profiles/s089form.pdf).

Many hazardous wastes generated in electroplating operations, especially alkaline cleaners and acid pickling solutions, may also exhibit the hazardous characteristic of ***corrosivity***. Finally, wastes from plating operations where cyanides are used may exhibit the hazardous characteristics of ***reactivity***[2] and/or ***acute toxicity***[3] from cyanide.

Various other constituents of plating process solutions, such as ***surfactants*** and various organic ***brightening agents***, contribute slightly to the overall hazardous characteristics of the waste.

In summary, the wastes generated in plating operations may have any one, or a combination, of the hazardous characteristics of ignitability, corrosivity (i.e., pH ≤ 2 or ≥ 12.5), toxicity, or reactivity, but most will typically exhibit the characteristics of corrosivity and/or toxicity. The wastes generated by facilities that use *cyanide* in their plating process may also exhibit the characteristics of ***acute*** toxicity and reactivity.

2.3 Treating the Hazardous Waste Generated in Electroplating Operations

Plating facilities typically treat a ***significant proportion*** of the metal-bearing and/or corrosive aqueous hazardous wastes they generate. Most plating facilities utilize ***similar methods*** and treatment systems for treating their hazardous wastes. Treatment is typically done in tanks and/or containers. Although tank systems are not unique to electroplating facilities, it is critical to understand treatment unit requirements given the large amount of plating waste treated onsite every year.

Electroplating produces relatively large volumes of wastewater (in some cases hundreds of thousands of gallons per month) with a relatively low cyanide concentration (i.e., less than 1500 parts per million). Cyanide in any form (e.g., ferro- cyanide, zinc cyanide, etc.) is presumed to be hazardous by DTSC.

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[2] Cyanide-bearing waste is classified as "reactive" if, when exposed to a pH between 2 and 12.5, it can generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment (see Cal. Code Regs., title 22, section 66261.23). U.S. EPA has withdrawn its reactivity/test method.

[3] A waste is extremely or acutely hazardous if it has an oral LD_{50} ≤ 50 mg / kg; an acute dermal LD_{50} ≤ 43 mg / kg; an acute inhalation LC_{50} ≤ 100 ppm as a gas or vapor; if it contains any substance listed in Cal. Code Regs. title 22, section 66261.24(a)(7) at a single or combined concentration equal to exceeding 0.1% by weight; or is water-reactive; or if it has been shown through testing or experience that human exposure to the material may likely result in death or disabling injury.

There is not necessarily a correlation between the **size** of a facility and the **amount** of wastewater it will generate on a monthly basis. The volume of wastewater will depend on the throughput and technical aspects of the manufacturing process.

2.3.1 Authorization

As mentioned in the last section, cyanide-bearing waste is generally presumed to be reactive and extremely hazardous. Until August 6, 2008, extremely hazardous or reactive waste was normally ***not eligible*** for onsite treatment authorization under a Permit by Rule (PBR), or any lower tier of the Tiered Permitting system. Therefore, a grant of authorization from DTSC was required to treat any hazardous waste containing cyanide, *even if it was generated onsite.* DTSC provided this “other authorization” in the form of a cyanide treatment authorization Consent Order from 1997 through 2008.

Even though most hazardous waste generated in electroplating is regulated under RCRA, the treatment of this waste is exempt from **federal permit requirements** so long as it is either:

a) Treated in waste water treatment units (tanks) as defined in 40 Code of Federal Regulations, part 260.10, and discharged to a publicly owned treatment works (POTW) operating under a National Pollutant Discharge Elimination System (NPDES) permit, or

b) Treated in an accumulation tank or container within 90 days of the date it is first generated, for large quantity generators (or 180 or 270 days for facilities that generate between 100 kg and 1000 kg of hazardous waste per month), or

c) A listed waste discharged directly to the POTW where it is mixed with domestic sewage, as described in Cal. Code Regs., title 22, section 66261.4(b)(2) (this is the Domestic Sewage Exclusion; see Section 2.3.2.1 for more information).

DTSC issued Consent Orders to electroplating facilities authorizing onsite treatment of dilute aqueous waste streams containing cyanide. Consent Orders were issued to facilities on a case-by-case basis, and only ***under the condition*** that the cyanide waste treatment be conducted in accordance with all standards applicable to PBR. In addition, DTSC inspected each facility prior to issuing a Consent Order to ensure that the facility was operating in compliance with the Hazardous Waste Control Law and all applicable regulations. Consent Orders were only issued to facilities in compliance.

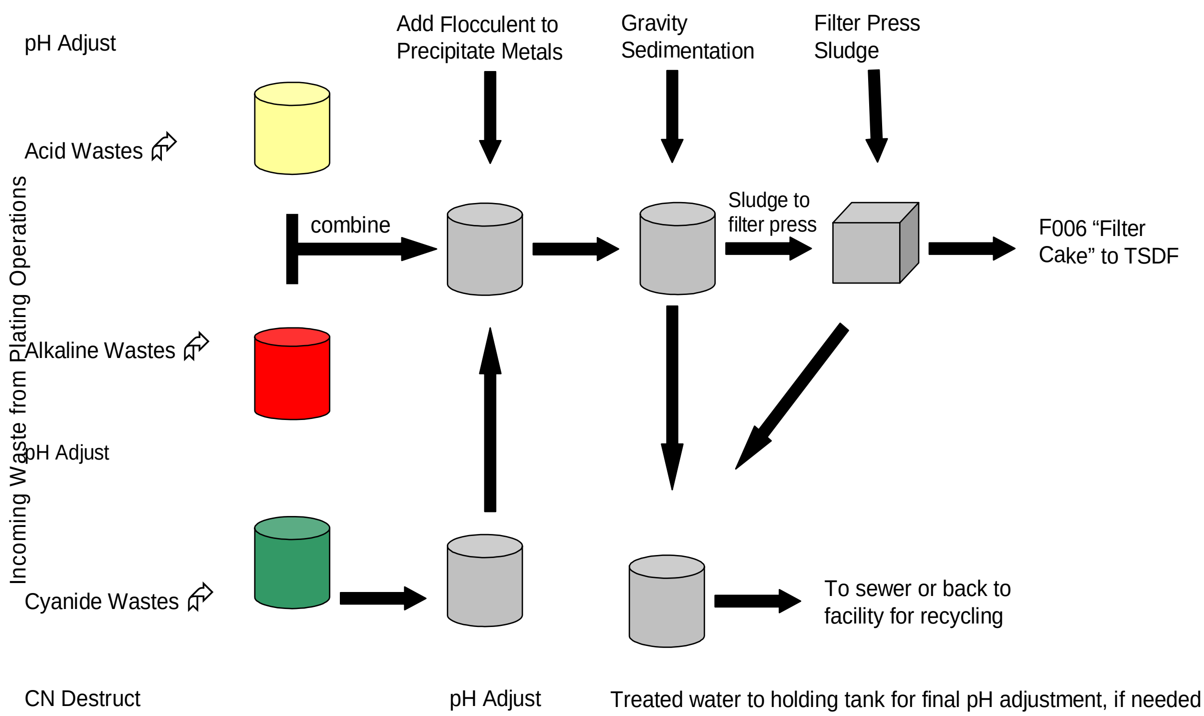
DTSC determined that onsite treatment of wastewaters containing relatively low levels of cyanide does not present an increased risk to public health and safety, or the environment, so long as the treatment is conducted in accordance with certain standards. DTSC developed regulations to allow the treatment of such waste. “The PBR for the

Treatment of Aqueous Wastes Containing Cyanides" regulations became effective on August 6, 2008. Details of these regulations are provided in Appendix E.

2.3.2 Evaluation of Treatment Units

At least 25% of your total inspection time, on average, should be devoted to evaluating an electroplating facility's treatment unit(s). It is equally important to ***review paperwork*** related to the tank treatment unit (mainly the engineer's unit assessment) as it is to ***visually inspect*** the unit. Although inspections of electroplating facilities are covered in great detail in Chapter 3, the rest of this chapter is specifically dedicated to evaluation of tank systems.

A typical treatment process is depicted in the following schematic diagram:



This figure illustrates how incompatible wastes, accumulated in separate collection tanks, are treated to facilitate compatibility (pH adjustment and cyanide destruction) before being combined. A flocculent is added to the waste to facilitate precipitation, generating a sludge as a metal precipitate. Next, gravity sedimentation is utilized to collect the precipitate, which is pumped to a filter press to be dried. Treated water from this process may be discharged to the sewer, held in a tank for one final pH adjustment and then discharged to the sewer, or redirected back to the plating operation if the facility is recycling.

As shown in Figure 2.1, plating waste is *typically* treated in a series of tanks and/or containers by:

- Cyanide destruction;
- pH neutralization;
- Precipitation of dissolved metals;
- Gravity sedimentation or filtering to collect the precipitated metals; and
- Use of a filter press to dry, or dewater, the precipitated metals

(Many other treatment processes and variables are possible.) Treated water may be ***discharged*** to the sewer, or ***reused*** in the facility (i.e., recycled). The dried, precipitated metal sludge, or "filter cake," is listed as RCRA waste code **F006** or **F008,** hazardous for toxicity. Filter cake is usually transferred to a permitted offsite facility for treatment, storage, or disposal.

Compatible wastes from throughout the facility are typically collected in one or more accumulation tanks or containers. ***Incompatible*** waste streams will be collected in ***separate*** accumulation tanks or containers, ***until*** they have been treated to the extent that they become compatible, and then they may be commingled for further treatment.

While inspecting an electroplating facility, you may observe treatment units that are ***many years overdue*** for an assessment or reassessment. A typical electroplating facility tank unit can treat an average of 300,000 gallons per month of wastewater contaminated with cyanide, cadmium, chromium, and other heavy metals. Tank reassessments are required for a reason – tank units are subject to daily wear and tear from treating such large volumes of hazardous wastes, and even the most durable systems may periodically ***need repairs*** and part(s) replaced due to extensive use.

An operator may make contact with a consultant to have a unit reassessed, but will delay having the reassessment once he or she finds out the cost of any repairs and/or replacements of essential units or ancillary equipment. Assessments and reassessments are discussed in more detail in section 2.3.3.

Aging and neglected treatment units can present a serious threat since they may be in dire need of repair.

Now that we've gone over some background information on electroplating facility tank treatment, here are several key elements of your ***visual inspection*** of the tank:

1. Look for ***corrosion*** of the unit platform. Platform corrosion may be so severe in several areas as to cause possible collapse. Take many photographs of units that appear to be in poor condition, especially if the unit looks to be overburdened (volumes at or near capacity levels, hoses shaking loose, etc.).

2. Does the facility prevent ***leakage*** from tanks and containers? Look for evidence of leakage around supply tanks (leakage from a hazardous materials supply tank constitutes hazardous waste, since it can no longer be used). Leakage may be dried at the time of inspection, but this does not necessarily make it less hazardous. Finally, do not assume that any wet spots on the ground are "just water."

3. For uncovered tanks, make sure there is adequate ***freeboard space.*** Remember that the freeboard requirement does not apply if the tank is equipped with a containment structure, drainage control system, or diversion structure (i.e., standby tank) with a capacity equal to or greater than the volume of the top two feet of the tank under cover.

4. ***Spill prevention*** – A tank system or secondary containment system from which there has been a leak or spill, or which is unfit for use, should be removed from service immediately. (This will be discussed in more detail in section 3.3.3.)

5. Check to make sure that leak detection ***sensors and probes*** are functioning properly (and not dangling unused down the outside wall of the tank).

6. Since all of California is considered a ***seismic zone***, you should check for evidence that the tank system is ***anchored*** to prevent flotation or dislodgement, and that units are ***bolted*** and ***strapped***. Although an inspector cannot evaluate the appropriateness of strapping and/or bolting, you can note that it exists and then review the certified tank assessment (discussed in Section 2.3.3) for consistency of any engineer diagrams with what you observed.

(See next page.)


Back-wash holding tank with proper seismic anchoring

Even though the basic idea of many treatment units is similar, each tank setup at a facility will be unique according to the specific equipment the operator has purchased. Therefore, keep in mind the following when evaluating individual units:

- Almost all units have filter presses to produce filter cake, as described earlier in this chapter. ***Filter presses are tanks*** if they are hard-plumbed to the unit
- You cannot place ***ignitable*** wastes in a treatment tank system
- When the tank system is placed in a ***saturated zone***, make sure the tank system is anchored to prevent flotation or dislodgement
- When inspecting ***fiberglass*** tank walls, observe the tank's wire mesh. If the wire is exposed, it can rust and compromise structural integrity
- ***Corrosive*** wastes cannot be placed in metal or concrete tanks
- ***Sediment build-up*** in a tank is an indication that a tank is holding a waste with a higher specific gravity than it was designed for
- ***Bubbles*** on the surface of a poly tank indicate sun damage

2.3.2.1 Domestic Sewage Exclusion for Certain Wastewaters

During your evaluation of the electroplating facility's treatment unit, be aware that a special exemption, the Domestic Sewage Exclusion (DSE), allows a facility to discharge ***listed*** waste to the publicly owned treatment works (POTW) if it is ***mixed*** with ***domestic*** sewage. To apply, the electroplating facility can only discharge listed hazardous waste (e.g., not *characteristic* hazardous waste) ***directly*** to the POTW, as long as it is mixed with *domestic* sewage (i.e., from residential sources prior to treatment or storage at the POTW).

The regulatory basis for the DSE is contained in Cal. Code Regs., title 22, section 66261.4(b)(2), which in turn cites a RCRA regulatory exemption of certain wastes that do not exhibit the characteristic of toxicity. The applicable excerpt from Title 40 of the Code of Federal Regulations is as follows:

> § 261.4 Exclusions.
>
> (a) *Materials which are not solid wastes.* The following materials are not solid wastes for the purpose of this part:
>
> (1)(i) Domestic sewage; and
>
> (ii) Any mixture of domestic sewage and other wastes that passes through a sewer system to a publicly-owned treatment works for treatment. “Domestic sewage” means untreated sanitary wastes that pass through a sewer system.
>
> (2) Industrial wastewater discharges that are point source discharges subject to regulation under section 402 of the Clean Water Act, as amended.

This exclusion applies only to the actual ***point source*** discharge. It does not exclude ***industrial wastewaters*** while they are being collected, stored or treated before discharge, nor does it exclude sludges that are generated by industrial wastewater treatment.

The rationale for the DSE is that hazardous wastes often lose their “hazardous” qualities when they are mixed with domestic sewage, and that without the exclusion, POTWs may frequently receive wastes that could be classified as hazardous wastes under RCRA. Once a listed waste is mixed with domestic sewage, it meets the criteria of an ***exempt solid waste***.

In order to verify that a plating facility qualifies for this exemption, you should:

- Review the waste analysis plan to ensure that the listed waste is mixed with domestic sewage
- Review POTW records in order to verify that domestic sewage, not industrial sewage, is mixed with the listed waste

Again, if the listed waste is not mixed with domestic sewage, the exclusion cannot apply. Listed hazardous waste retains its listing, even after it is treated to meet the pretreatment standards of the local sanitation district or POTW.

2.3.2.2 Treatment Unit Clarifiers

Many tank treatment units at electroplating facilities include an ancillary equipment component known as a ***clarifier***. Clarifiers function as a first step in wastewater treatment by allowing wastewater to dwell and change flow direction in distinct compartments (known as chambers), which causes sediments to separate from water and settle at the surface. (Solids are then trapped in the compartments for later removal.) Clarifiers can also function to contain an ***accidental release***. Although there are different types of clarifiers, you will find that electroplating facilities frequently use a *three-stage* clarifier, installed and operated either aboveground or underground. The clarifier is usually a requirement of the facility's wastewater discharge permit through the local sanitation district.

You should first determine if the clarifier is ***hard-plumbed*** to the tank unit. If it is, then it clearly qualifies as ancillary equipment. A clarifier may not appear to be hard- plumbed to a tank unit because of the way water drains into it, but may have underground piping to the unit which technically qualifies it as part of the unit. Always examine a unit's specific set-up closely to make sure it falls under hazardous waste regulatory requirements.

Since a clarifier is frequently in contact with soil, specifications for ***soil sampling*** around the clarifier should be included in the facility's *waste analysis plan*. Since it is part of the tank unit, an analysis of the clarifier should also be included in the unit's *tank assessment* (discussed more in the next section).

Many clarifiers are classified as tanks, although some are characterized as ancillary equipment. Even if a clarifier is considered to be ancillary equipment, it and its associated piping is subject to the ***secondary containment requirements*** described in Cal. Code Regs., title 22, section 66265.193. As will be discussed in more detail in section 2.3.6, tank(s) and ancillary equipment operating without secondary containment and a leak detection system must be ***inspected daily*** for signs of leakage or corrosion. As you might expect, it is easier to visually inspect ***aboveground*** clarifiers than underground clarifiers. Electroplating facilities that operate ***underground*** clarifiers are frequently found in violation for failing to inspect their clarifiers for leaks, either visually or via a leak detection system with secondary containment.

To address an underground clarifier in violation, an electroplating facility can:

- Close the underground portions of the clarifier unit, ***reinstall*** the unit aboveground, provide the required secondary containment for the clarifier, and conduct daily inspections of the clarifier and piping; or,
- Bring the underground clarifier unit into compliance with the extensive requirements applicable to underground hazardous waste tanks.

Since more requirements apply to underground than aboveground clarifiers, electroplating facilities may opt for the first option.

If a facility simply chooses to stop using the clarifier, and close it, this decision ***must be acceptable*** to the ***local sanitation district.*** As the inspector, you should ensure that the electroplating facility consults with the sanitation district on this matter.

Now that we have gone over the physical inspection of the tank unit and its components, we can review the required elements of a tank treatment unit's *assessment* document. An up-to-date written, certified assessment is required for all hazardous waste tanks and associated ancillary equipment (e.g., piping, pumps, etc.) and is one of the most frequent deficiencies found at electroplating facilities.

2.3.3 Assessments and Certification

An electroplating facility's tank assessment document must include the specific ***written statements*** listed in Cal. Code Regs., title 22, section 66265.192. An independent, qualified, professional engineer, registered in California, must certify the assessment attesting that all ***written statements*** in the assessment are accurate, and that the tank system is ***suitably designed*** to safely hold or store hazardous wastes.

The tank assessment document must include all of the following, as listed in Cal. Code Regs., title 22, section 66265.192(k):

1. Tank configuration (horizontal, vertical), material of construction, and gross capacity (in gallons);
2. Design standards, including:
   a) Material of construction
   b) Material thickness **and** the method used to determined the thickness
   c) Description of tank system **piping** (material, diameter)
   d) Description of internal and external **pumps**
   e) Sketch or **drawing** of tank, including dimensions
3. Documented ***age*** of the tank system (if known)
4. Description and evaluation of any **leak detection** equipment
5. Description and evaluation of any **corrosion protection** equipment, devices, or material
6. Description and evaluation of any **spill prevention** or overfill equipment;
7. Description and evaluation of **secondary containment**
8. Hazardous **characteristics** of the waste(s) that have been or will be handled
9. Results of inspection for weld cracks or breaks, scrapes of protective coatings, corrosion, or other structural damage (including damaged fittings)
10. Tightness testing of all new tanks and **ancillary equipment**
11. Estimated remaining **service life** of the tank system

Also included must be ***volume calculations*** showing that the tank's secondary containment is capable of containing **100%** of the contents of the largest tank [Cal. Code Regs., title 22, section 66265.193 (a)], and a description of how the tank will be ***anchored*** to prevent flotation or dislodgment [Cal. Code Regs., title 22, section 66265.192 (a)(5)].

All discrepancies noted during the tank assessment should be ***documented*** and ***remedied***. (Be aware that the owner/operator of a facility can prepare the tank assessment, but cannot sign off on it. Only an appropriate engineer can sign off/certify the unit.) Frequently deficient elements of a tank assessment are:

- One or more of the above elements were overlooked
- No engineer, or an *unqualified* engineer signed/stamped the assessment (see "Certifications" section below)
- The engineer's assessment *certification* is missing or incomplete (see below)
- The estimated remaining service life is stated to be ***"unknown"***
- The engineer or owner/operator forgot to attach tank drawings and diagrams to the assessment

Be aware that assessments may contain ***conditions*** that are applied to the tank unit's operation. These operating "conditions" may be written into the assessment by engineers who may be pressured to sign off on units to meet timeframes and regulatory requirements, even though some aspect of the unit does not meet every required element to its full standard. The owner/operator should be aware of this and adjust accordingly, i.e., not overburden a treatment tank that an engineer notes is passable, but not in optimal condition.

Engineer Certifications: No tank unit assessment is ***complete*** without being certified by an appropriate engineer. DTSC previously requested that the California Board of Professional Engineers and Land Surveyors make a determination regarding what type of engineer is ***qualified*** to assess hazardous waste tank systems. ***Civil, Structural,*** and ***Geotechnical Engineers*** are qualified to sign for entire tank unit assessments. However, they may need to rely on other professionals for specific areas of competence.

In cases where a Civil, Structural, or Geotechnical engineer is not signing off for the assessment, then all engineers contributing to the assessment must sign. These other registered engineers can sign off only for parts of a tank certification within their specific discipline.

Certifications must include the name and license number for each engineer who approves a section or sections of an assessment. The ***text*** of the required statement is listed in Cal. Code Regs., title 22, ***section 66270.11(d).*** By signing and including this statement in the tank assessment, the engineer attests that the tank system has sufficient structural integrity, and is acceptable for the transferring, storing and treating of hazardous waste.

To summarize, the requirements for engineer certifications are ***very stringent*** due to the importance of ensuring that a facility's tank unit can operate safely.

2.3.4 Reassessment of Units

Tank systems must be reassessed at least every ***five*** years from the date of the initial assessment, or anytime a new component is added to, or removed from, the tank system (such as replacement of a leaking cyanide destruct tank), or the service life expires prior to five years from the last assessment. Reassessment is not required for ***routine maintenance*** or replacement of defective pumps or plumbing with ***identical*** or ***functionally equivalent*** parts. (A new tank system holding RCRA waste not covered by Tiered Permitting, that was designed and certified as a new tank, does not require re-assessment; however, such a case will rarely apply to electroplating facilities since most plating operations require a Tiered Permit.)

Failure to reassess a tank unit is one of the most ***frequently noted*** violations at electroplating facilities. After an initial assessment, an operator may simply forget five years later to have the reassessment. Encourage the facility to maintain a long-term ***reassessment schedule*** to keep them on track, especially if they have a high employee turnover rate.

For the rare plating shop (such as a small jewelry shop) that is not a Large Quantity Generator (LQG) **and** not operating under PBR, hazardous waste tanks will not require assessment (see Cal. Code Regs., title 22, section 66262.34(d)]. Remember that rinsewater treated onsite counts toward the total waste quantify for consideration of ***generator*** status (Small Quantity Generator vs. LQG).

2.3.5 Other Tank Documents to Review

Besides reviewing the tank assessment and certification, there are several other tank-related documents you must review to ensure compliance:

1. Records of completed ***training*** of employees on tank inspection/operation
2. The facility's ***contingency plan***, which should include information on how to deal with emergencies involving tanks and their contents
3. Daily ***inspection records***
4. ***Treatment notification forms*** to determine the volume of waste treated, and the hazardous characteristics of the wastes (RCRA or non-RCRA)
5. ***Waste analysis records*** of wastes treated in tanks
6. ***POTW*** logs

Items 1 through 5 will be covered in more detail in section 3.3.10; a discussion of POTW log review for wastewater treatment unit discharge is as follows.

2.3.5.1 Publicly Owned Treatment Works (POTW) Logs

In order to conduct a *comprehensive* of a facility's operations, you should review their POTW records to ensure that they are in compliance with the local ***sanitation district***. While DTSC and CUPAs are the sole authority for authorizing hazardous waste treatment systems, the POTW regulates the concentrations of various pollutants in the industrial water that is discharged. As you might expect, sanitation districts establish *numerical limits* for maximum concentrations of ***heavy metals*** and other ***discharges permissible*** in an industrial discharge to public sewers. Wastewater is "discharged" by the plating facility as soon as it enters the sewer, and it must meet the discharge concentration requirements to be safely managed in the POTW's sewer system.

POTW logs will usually contain the following information:

- Concentrations of constituents, or ***Critical Parameter Values (CPVs)***
- Daily or weekly facility water use
- Daily or weekly facility wastewater discharge
- Yearly cumulative flow of wastewater
- Information on frequency of water sample analyses

A review of the POTW logs will provide the following information:

- Whether elevated levels of metals or other Constituents of Concern (COCs), included among the CPVs, have been noted on an industrial wastewater report checklist [violation of POTW limits is a violation of California Code of Regulations, title 22, section 67450.3(c)(5) and Health and Safety Code, chapter 6.5, section 25200.3(c)(7)].
- Whether analyses submitted by the facility indicate that they are in violation of the Sanitation District's effluent limits, and therefore their *industrial wastewater discharge permit*

A violation of the sanitation district's discharge limits can be an indicator that the electroplating facility's treatment unit is ***not functioning*** as it should. Finally, ongoing discharge to the sewer in excess of allowed chemical waste concentrations may constitute ***illegal disposal*** of hazardous waste.

2.3.6 Secondary Containment

Virtually all tank systems require secondary containment. Historically there have been certain exemptions based on the date the tank system was installed and the type of waste managed in the tanks, but these exemptions expired as of July 2006.

Some cases where secondary containment is still not required:

- A variance is obtained from DTSC (local agencies do not have authority to grant these variances or exemptions)
- The tank system is inside a building with an impermeable floor and the waste has no free liquids

The chances of either of these two exemptions applying to electroplating facilities are remote.

The purpose of secondary containment, simply put, is to ***detect*** and ***collect*** any releases – to put an extra barrier between hazardous waste, and humans and the environment. Keep in mind that secondary containment should be kept ***dry*** (a particular challenge at a wet-floor operation). If waste is allowed to accumulate in the designated secondary containment, then it is no longer functioning as true "secondary containment" and becomes regulated as a ***tank unit***.

Examples of secondary containment are:

- Liners
- Vaults
- Double-walled tanks
- Others, as appropriate for the type of waste

Cal. Code Regs., title 22, section 66265.193 covers requirements for secondary containment in detail.

If the facility's tank system requires secondary containment, then the written certified tank system assessment (as discussed in Section 2.3.3) must include the following as pertains to secondary containment:

- A ***description*** of the secondary containment system
- Written statements, engineer-certified as described previously, indicating that the secondary containment is in compliance with applicable regulatory requirements (including capability to ***contain 100% of the contents*** of the largest tank

Secondary containment is not required for ***aboveground pipes*** connected to the tanks if the tank system, including the piping, is inspected ***daily*** for signs of corrosion or leaks. Inspection records documenting these daily inspections must be maintained and available for review onsite.

If the tank system ***isn't inspected daily***, and has no leak detection system, secondary containment must be provided for all piping connected to the tanks.

A *very important* point to remember is:

Incompatible and reactive wastes cannot be placed in the same tank or tank system (Cal. Code Regs., title 22, sections 66265.198 and 66265.199).

Therefore, since secondary containment is defined as part of the tank system (pursuant to Cal. Code Regs., title 22, sections 66260.10), separate secondary containment must be provided for any tanks holding incompatible wastes, such as acid and cyanide-bearing wastes.

Secondary containment must also be provided for any ***containers*** that are used to treat hazardous waste under PBR. However, the secondary containment requirements for containers are slightly ***different*** than are those for tanks:

The owner/operator must obtain a written statement signed by an independent, qualified, professional engineer, registered in California, indicating that the containment system for any **containers** used to treat hazardous waste under PBR is suitable to achieve the requirements of Cal. Code Regs., title 22, section 66265.175.

Ancillary Equipment: Do not overlook ancillary equipment when evaluating a tank unit. Ancillary equipment must have full secondary containment except for:

- Aboveground piping that is inspected on a daily basis;
- Welded **flanges**, welded **joints**, and welded **connections** that are visually inspected on a daily basis;
- Sealless or magnetic **coupling pumps** and **sealless valves**, that are visually inspected on a daily basis;
- Pressurized **aboveground piping systems** with automatic shut-off devices (including excess flow check valves, flow metering shutdown devices, and
- loss of pressure-actuated shut-off devices)

Being able to identify different types of ancillary equipment takes time and practice.

Until you next get out in the field, take a look at the following inspection photographs of tank treatment units:

Photo 1

You are about to enter a typical electroplating facility treatment unit area

Photo 2

Tanks and containers used to hold and treat hazardous wastes

Photo 3

Tanks and containers used to hold and treat hazardous wastes

Photo 4

Floc Tank

Ferrous Sulfate Process Tank

Photo 5

Illegally treated cyanide filters in leaking container next to sulfuric acid tank that does not meet containment standards

Evidence of Leakage

Photo 6

Sludge
Holding Tank

Photo 7

The bowels of a corroded, structurally compromised tank platform

Photo 8

Bowels of the tank unit, part 2: note all the ancillary equipment. Make sure you understand which pipes feed where.

Note also that for exceedingly complex systems, labeling may be required for piping. See Cal. Code Regs., title 22, section 66265.31

Photo 9

Filter press used to dry F006 filter cake waste

Photo 10

Another example of a filter press used to dry F006 waste

2.3.7 Other Treatment Activities You May See

We have gone over in detail the treatment of electroplating waste in tanks. However, other activities at electroplating facilities can qualify as treatment. One popular but illegal practice is ***bleaching*** of ***cyanide filters*** from filtration units in the plating area.

Ask the owner/operator if the facility filters its plating solutions, and find out how they manage the filters.

Testing has shown that spent filters from cyanide plating operations contain very high, potentially reactive, and extremely hazardous concentrations of cyanide. Therefore, spent filters from cyanide plating operation are **not eligible** for treatment under California's onsite treatment tiers (i.e., Permit by Rule, Conditional Authorization, or Conditionally Exempt). Moreover, spent filters do not ***meet the definition*** of aqueous waste, and if they are contaminated with RCRA waste, their treatment would not be exempt from federal permit requirements and a ***full permit*** is required.

If the owner/operator claims the facility does not filter its plating solutions, then you should ***inquire*** how the facility keeps its plating solutions from accumulating residues (e.g., carbonates, dirt, and debris, as discussed in Section 2.1) that may adversely impact the plating operations. You may recall that such ***residues*** from plating operations where cyanides are used in the process are listed RCRA wastes, waste code **F008**.

Spent filters contaminated with F008 waste do not meet the definition of "aqueous waste," so their treatment is not exempted from federal permit requirements (i.e., require a full permit).

It is almost always unfeasible for an electroplating facility to obtain such a permit, so the facility should simply stop treating their filters and send them offsite to an appropriate permitted facility.

Photo 11

This photograph shows open and unlabeled containers holding spent filters from a cadmium cyanide plating operation. The filters are contaminated with F008 RCRA waste, with concentrations of 68,000 mg/kg cyanide according to sample results.

Photo 12

This photograph shows an open and unlabeled container holding spent filters from a copper cyanide plating operation.

Photo 13

This photograph also shows an open and unlabeled container holding hazardous spent cyanide plating filters, and sludge that has drained from the filters.

In California, the treatment of F008 wastes, or spent filters contaminated with F008 wastes, without a full permit is a ***violation*** of section 25201 of the Health and Safety Code.

Besides bleaching of plating bath filters, you may also see:

- Evaporation of liquid wastes by addition of heat or chemicals
- Other activities designed to change the hazardous characteristics or properties of the waste

You should investigate such treatment activities immediately during the inspection and determine what type of authorization is necessary for each activity.

Now that we have discussed generation and treatment of hazardous waste at electroplating facilities, we will cover in detail how to ***inspect*** a plating facility.

CHAPTER 3 - INSPECTING PLATING OPERATIONS

IN THIS CHAPTER, YOU WILL:

- Learn who to contact and what to review to prepare for an electroplating facility inspection
- Understand what violations to look for while conducting a walkthrough of an electroplating facility and reviewing the facility's records
- Learn how to respond to serious threat situations at electroplating facilities
- Understand when a follow-up inspection at an electroplating facility is necessary

3.1 Introduction

Now that we have gone over generation and treatment of hazardous wastes at electroplating facilities, we can discuss the details of the actual inspection.

The purpose of inspecting the electroplating operation is to:

- Verify compliance
- Collect evidence to support enforcement cases, if serious violations are found at the facility
- For ***CUPAs***, to ***review PBR standards*** if the facility has submitted a PBR application to treat cyanide wastes onsite;
- For **CUPAs**, to ***authorize treatment*** of cyanide waste under PBR, if the electroplating facility has submitted an application to do so

You should allow at least a ***full day*** for an inspection, especially when you have no idea what situations you may encounter at the site.

Since electroplating facilities are some of the most ***complex*** and ***dangerous*** sites inspected by regulatory agencies, only experienced inspectors who have received adequate on-the-job training should attempt to inspect electroplating facilities independently. Local agencies in particular should be aware of the complexity of electroplating inspections, and establish guidelines to ensure that new inspectors are properly backed up with experienced individuals in the field.

Finally, part of your site inspection may include ***collecting samples***. Sampling is discussed in detail in Chapter 4.

3.2 Preparing for the Inspection

3.2.1 Interagency Coordination

After you identify a facility to inspect, coordinate with other agencies to gain more information about the site, and to keep other regulators aware of your intentions.

Open lines of communication should exist between:

- DTSC;
- The CUPA, and
- The sanitation district with local jurisdiction over the facility.

General CUPA contact information is available at:
http://www.dtsc.ca.gov/HazardousWaste/CertifiedUnifiedProgramAgencies.cfm.

Finally, it may be appropriate to notify other agencies, such as:

- State Water Resources Control Board (SWRCB)
- Air Resources Board (ARB), Air Pollution Control District (APCD), or Air Quality Management District (AQMD)
- U.S. Environmental Protection Agency (U.S. EPA)

regarding your plans to conduct the inspection. Your supervisor should be consulted on whether or not to contact these other regulatory agencies prior to conducting an inspection, especially if you suspect ***multimedia issues*** will arise.

CUPA Role and Perspective
The CUPA is responsible for inspecting all hazardous waste generators in its jurisdiction, and for authorizing certain onsite hazardous waste treatment activities under the three lower tiers of the tiered permitting program.

DTSC Role and Perspective
A DTSC electroplating facility inspector should coordinate with all branches within EERP, as well as the Tiered Permitting and Corrective Action Unit in the Brownfields and Restoration Program, to determine if DTSC is ***already involved*** with the facility you intend to inspect, and to find out if the facility has a ***permit*** from DTSC.

Enforcement Records
A regulatory agency inspector will want to confer with DTSC to identify any DTSC enforcement cases against a facility, past or current. Ongoing enforcement may:

- Impact the ***scope*** of your inspection
- Place certain ***limits*** on your jurisdiction and authority in the face of an existing order imposed by another agency or division
- Give you important ***background information*** on current problems at the site

Permits
Permits set forth operating requirements, and may impose more stringent operating requirements than the regulations; therefore, you should determine whether the facility has a permit from DTSC or the CUPA. If the facility file includes a permit, you should obtain a copy and ***review it in advance*** to become familiar with the facility's operating requirements.

Sanitation District
Most counties and/or cities have local sanitation districts that can be identified by contacting the local CUPA. Ask to speak to the sanitation district inspector responsible for the facility you intend to inspect.

The local sanitation district:

- Is responsible for issuing ***sewer discharge permits*** and for citing discharge violations
- May provide ***daily water use and discharge rates*** of the facility you intend to inspect. Water usage information can help you evaluate ***alleged recycling activities*** (discussed in more detail in section 3.3.9)
- Can provide other useful information on the facility you intend to inspect.

Pollution Prevention Networking
You should also coordinate with your regional DTSC pollution prevention (P2) liaison regarding SB14 requirements (see Chapter 7) and how they may apply to the facility. More information, including P2 liaison contact information, is available at: http://www.dtsc.ca.gov/PollutionPrevention/index.cfm#Pollution_Prevention_Overview.

3.2.2 Searching DTSC's Hazardous Waste Tracking System

Another useful source of inspection planning information is DTSC's Hazardous Waste Tracking System (HWTS). HWTS allows users to retrieve and analyze facility-specific records regarding ***shipments*** of hazardous waste, and provides a ***profile*** of the types and amounts of hazardous wastes generated by a facility each year. Keep in mind that waste treated onsite, if still hazardous after treated, is included in the total for overall hazardous waste generated by a facility (some operators hold the erroneous belief that treated hazardous waste should not be included in generation totals).

Specifically, HWTS is useful for:

- Identifying ***what types*** of hazardous wastes you may find when you inspect
- Determining the ***regulatory status*** of the facility (e.g., does the facility generate
RCRA waste, and is the facility a RCRA LQG or SQG?)
- Preparing a ***health and safety*** appraisal form (known to DTSC inspectors as the HARP)

DTSC offers HWTS training for DTSC, CUPA, and U.S. EPA staff.

3.2.3 Searching the Internet

Take a few minutes to search the internet for the facility you may inspect.

You may find:

- That the facility has ***its own website*** providing insight into its operations
- A ***reference*** to an administrative or criminal action brought against the facility by another regulatory agency.

The more information you can gather before entering the facility, the better prepared you will be.

3.2.4 Identifying Hazards and Preparing for Your Safety

Health and Safety preparation is the next step in readying for your inspection. All environmental agencies have some protocol on preparing to safely enter a site to inspect. You should refer to your agency's guidelines as appropriate.

If you are a DTSC inspector, coordinate with a DTSC industrial hygienist (IH) to prepare a ***Hazard Appraisal and Recognition Form (HARP)*** prior to the inspection. The HARP needs to be completed and submitted to an IH for review prior to the date you plan to conduct the inspection. The IH needs time to review the HARP and prepare any monitoring equipment, Self-Contained Breathing Apparatuses (SCBAs), etc., that you may need to bring to the inspection.

Other agencies are encouraged to follow a similar procedure for preparation of health and safety appraisal documents, including consultation with an IH.

Appendix A contains a model health and safety appraisal form prepared for the inspection of a plating facility.

Generally speaking, all electroplating facilities present ***similar hazards*** since most generate similar types of hazardous waste:

- Metal- and cyanide-bearing, corrosive and toxic wastes
- Hazardous buffing or polishing dusts
- Solvents
- Others specific to an operation
- Wet floors

which should all be listed on a health and safety appraisal form.

Hazards that are more difficult to anticipate are:

- Site-specific hazards, such as high noise levels;
- Overhead and trip hazards;
- Possible confined space areas (note that a room in a building could be considered a confined space)

Past inspection records may provide some insight into site-specific hazards. Always ***err on the side of caution*** when estimating hazards, and plan and prepare accordingly.

Other hazards associated with metal manufacturing and finishing operations may include:

- ***Fumes*** and ***vapors*** from plating process tanks, including corrosive vapors from acid “pickling” tanks, and carcinogenic chromium vapors;
- Metal casting, which involves very hot ovens, open flames, molten metals, and may generate hazardous ***slag*** and ***metal fumes***;
- Metal polishing and grinding which can generate potentially hazardous ***particulates*** (i.e., polishing dust);
- Soldering, which can generate potentially hazardous metal fumes, especially when cadmium solder is used;
- ***Overhead equipment*** and hoists;
- Heavy moving equipment (e.g., forklifts, etc.)

In the absence of any records, the inspector will err on the side of caution and regard all plating and stripping process bath formulations as ***Extremely Hazardous Waste (EHW)***. Plating or stripping solutions should never be allowed to come into contact with bare skin. Absorption of plating bath constituents, especially cyanide, may lead to serious health complications. In addition, vapors emitted by some plating process solutions may be toxic and/or may irritate mucous membranes.

Summary of Common Hazards – Electroplating Facilities

Hazard	Characteristic	Safety Precautions and Concerns
Corrosive process bath (e.g., acid pickle)	Corrosive; emits corrosive vapors, contains dissolved metal.	Follow ‡General safety precautions, and avoid breathing corrosive vapors. Avoid skin contact. If vapors are encountered, either wear air-purifying respirator or exit area.
Plating bath	Corrosive, toxic, extremely toxic and reactive if cyanide present; carcinogenic if chrome or cadmium present.	Follow ‡General safety precautions. May be marine pollutant. If cyanide present, keep separated from incompatible acids. Avoid skin contact. Avoid breathing vapors.
Stripping solution	Corrosive, toxic; extremely toxic and reactive if cyanide present.	Follow ‡General safety precautions. May be marine pollutant. Must be separated from incompatible acids. Avoid breathing associated vapors. Avoid skin contact.
Aqueous cleaning solutions	May contain toxic organic compounds; corrosive, may contain dissolved metals.	Follow ‡General safety precautions. May be marine pollutant. Must be separated from incompatible acids. Avoid breathing associated vapors. Avoid skin contact.
Organic degreaser	May contain volatile organic compounds; may be flammable, may contain metals. May be carcinogenic.	Follow ‡General safety precautions. Must be separated from incompatible acids. Avoid breathing associated vapors. Avoid skin contact.

Wastewater	May be corrosive, may be toxic; extremely toxic and reactive if cyanide present. May contain carcinogenic metals.	Follow ‡General safety precautions. May be marine pollutant. Must be separated from incompatible acids if cyanide present. Avoid skin contact.
Metal polishing/grinding	May generate particulates that pose respiratory hazard.	Follow ‡General safety precautions. Maintain safe distance from area, or wear air purifying respirator. Wear hearing protection if grinding equipment is in operation.
Wastewater treatment sludge (filter press sludge)	May be toxic, may release toxic particulates if dry; may contain cyanide.	Follow ‡General safety precautions. May be marine pollutant. Must be separated from incompatible acids if cyanide present. Avoid skin contact.
Used oil	Toxic, may contain metals	Follow ‡General safety precautions. Avoid skin contact.
Overhead and heavy equipment hazards	General Safety	Follow ‡General safety precautions. Wear hard-hat, wear orange safety vest.

‡General Safety Precautions = Wear chemical-resistant safety boots, long pants, and eye protection. Use good hygiene practices (e.g., wash hands; shower and change clothes as soon as practicably possible; rinse boots at facility, if possible; contain boots in bag for transport). Carry drinking water to facility, but do not eat or drink in or near hazardous waste or process areas. Remain upwind of all process and hazardous waste areas, and maintain as much distance from waste and processes as possible. Do not touch, lean, or brush up against anything in the processing area. Have the facility contact point out open cabinets or pull up duckboards, if necessary. Always carry hard-hat, safety vest, and air purifying respirator to inspection.

3.2.5 Preparation of Inspection Equipment and Documents

3.2.5.1 Gathering Equipment

You should develop a general equipment checklist for conducting inspections. (Sampling equipment will be discussed in more detail in Chapter 4.)

It is strongly advised that you ***bring a camera*** to use during the inspection. You could observe serious violations during a plating facility inspection, and photographs will go a long way in proving violations.

Common inspection equipment or personal protective equipment used in a *non-sampling* inspection includes:

- Gloves (neoprene, nitrile, silver shield, or other)
- Cyanide gas monitors (e.g., PAC III monitors)
- Ear plugs or muffs
- Boots
- Eye protection

3.2.5.2 Documents/Templates

Some typical documents and/or templates you may bring to the inspection include:

- The facility file
- Copy of the facility's cyanide treatment Consent Order application, if applicable
- Copies of HWTS reports, EPA ID Profiles, etc., so you can compare and account for wastestreams, generation quantities, etc.
- Cal. Code Regs., title 22 and Health and Safety Code

Some additional documents ***DTSC*** inspectors should bring include:

- Summary of Violations forms
- Summary of Observations forms

Some additional documents ***CUPA*** inspectors may bring include:

- Checklists
- Inspection forms
- Facility-to-CUPA reporting forms (including treatment notification forms and recycling notification forms)

3.3 The Inspection

3.3.1 Get Consent to Conduct the Inspection

It cannot be emphasized enough that when you arrive at the site, you should:

- Enter through a public entrance
- Make contact with the owner or operator
- Inform the owner/operator that you are requesting consent to conduct an inspection and take photos

You should specifically ask the owner/operator for permission to ***enter*** the facility, and emphasize that you are there to inspect *hazardous waste management* activities. You should also ask permission to take ***photographs*** and ***review and copy pertinent records***. (Also ask for consent to collect samples, if you will be taking any.)

You should document, exactly:

- Whatever the owner/operator says in ***response*** to your request for consent to conduct the inspection
- The ***date and time*** the response was given
- Who was present when you asked for consent and the owner/operator gave his or her response

If the owner/operator *denies consent* to conduct the inspection, you might explain that regulatory agencies take steps to ensure that all ***trade secrets*** are protected. (Specifically, trade secrets are protected as described in Health and Safety Code, chapter 6.5, section 25173.)

If the owner/operator still refuses to give consent, inform him/her that refusing consent to conduct the inspection is a violation of Health and Safety Code, chapter 6.5, section 25185; if the owner/operator still refuses, leave the facility and prepare appropriate documents to enter the facility with an ***inspection warrant.***

Your agency may require you to document the refusal by completing a “refused consent” form and having the owner/operator sign it.

3.3.2 The Walkthrough

Most inspections occur in three phases:

- The facility walkthrough
- Records review
- The closing conference

You should always begin the inspection, if possible, with the *facility walkthrough*. This gives you an opportunity to evaluate the facility without giving the operator a chance to clean up “behind the scenes.”

Ask the operator to point out all areas where hazardous wastes are generated, treated, or stored. Also ask the operator to narrate the facility’s ***industrial process***, step by step. Make sure you understand the facility’s basic operation to the extent that you can determine ***how*** and ***where*** wastestreams become hazardous.

Take a ***progressive approach*** to conducting the inspection: the more violations you find, the more time you should spend investigating the facility’s hazardous waste management activities. Adverse conditions at the facility warrant ***more inspection time*** and you should allow yourself extra hours to observe violations and gather evidence of mishandling.

If you find violations that pose a substantial threat to human health or safety, and are unsure of how to respond, contact your supervisor for direction. Potential quarantine and imminent threat situations are discussed more in Section 3.3.8.

As you begin your walkthrough, you will see containers and tanks comprising the plating lines as described in Section 1.4. There will typically be a ***boardwalk*** (i.e., an elevated platform) in and around the plating line. The following photographs show some of the plating shops that have been inspected by DTSC. These photographs show “typical” plating operations, and examples of the boardwalk surrounding various plating tanks.

~*Virtual Tour*~

As you look through these photographs, see if you can identify potential hazardous waste violations.

Photo 1

Plating containers

Photo 2

Plating tanks

Plating Tanks

Photo 3

Wet floors,
Unlabeled
tanks…

Photo 4

Parts
racking area

Plating
tank

Plating Tanks

Photo 5

Photo 6

The boardwalk

Grates where spilled cyanide crystals can accumulate

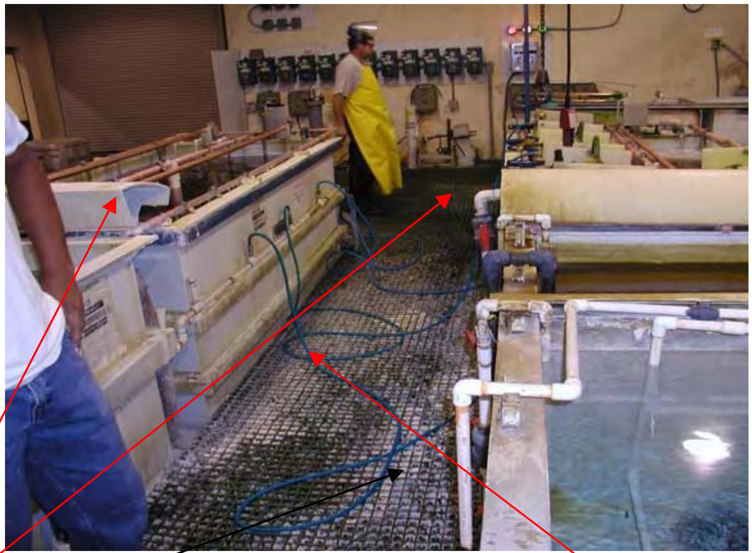
Plating Tanks and Containers

Boardwalk

Photo 7

Plating Tanks and Containers

Photo 8



Worker safety?

Plating tanks and containers

The Boardwalk

Photo 9

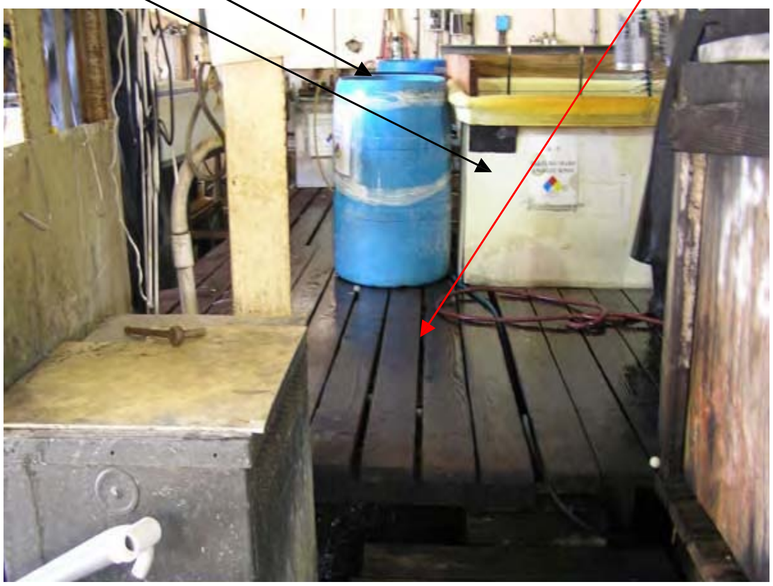


Photo 10

Photo 11

The *next set* of photographs will give you an idea of what other types of things to look for during the facility walk-through, such as:

- Spilled plating chemicals
- Open and unlabeled containers
- Sumps filled with hazardous waste

In some photographs you will see spilled plating chemicals on the floor. As discussed in Chapter 2, ***wet floor*** plating operations are common and describe facilities where open baths of plating solutions can result in continuous chemical spillage and splashing onto the floor during the plating process.

Pay close attention to the floor under and around the plating tanks and containers for ***accumulated*** spilled plating chemicals. Accumulated chemicals ***crystallize*** and pose a greater threat than spilled liquids since they are more ***concentrated***. Such crystals may have accumulated for months or years, and may be caked several inches deep. Forming crystals often look like sludges.

You should investigate any potential spilled chemicals, and collect samples for analysis when possible.

Photo 12

In this photograph green nickel sulfate crystals accumulate on the sides of nickel plating tanks, and on the boardwalk. These crystals were sampled and analyzed by DTSC, and determined to have 150,000 mg/kg nickel. Waste containing nickel at or above 2,000 mg/kg is considered hazardous, and nickel is "reasonably anticipated to be a human carcinogen," according to the National Institute of Environmental Health Sciences (NIEHS, http://ntp.niehs.nih.gov/ntp/roc/eleventh/profiles/s118nick.pdf)

Photo 13

In this photograph spilled plating chemicals accumulate on the floor where a plating tank once stood. The accumulated chemicals were sampled and analyzed by DTSC, and determined to contain hazardous concentrations of lead, zinc, copper, and chromium.

Photo 14

In this photograph spilled plating chemicals accumulate under the boardwalk near a copper cyanide plating tank. The accumulated chemicals were up to **six inches** deep, and contained 30,000 mg/kg cyanide, and hazardous concentrations of lead, nickel, zinc, chromium, and copper.

Photo 15

This photograph shows spilled chromium plating solution on the floor under a chrome plating tank.

Photo 16

This photograph shows blue copper (cupric sulfate) crystals accumulated on the floor around copper plating tanks

Photo 17

This photo shows berms significantly filled with plating waste chemicals.

Photo 18

A typical “alley” in a plating facility. Would you trust the operator’s statement of conducting visual pipe and tank inspections?

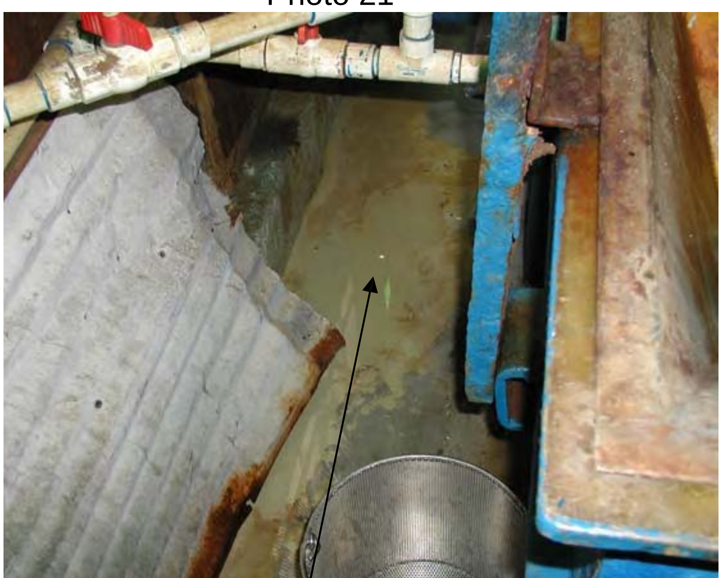
Photo 19

Cadmium-cyanide crystals “growing” on a cadmium filtration unit apparatus – high risk of dermal exposure

Photo 20

A plating facility operator hosed his grates down of cyanide-cadmium crystals, only to have them recrystallize under and around grates (a more dangerous situation since workers can no longer see them?)

Photo 21



This photograph shows liquid accumulated on the floor under and around acid-zinc plating tanks. DTSC sampled and analyzed this liquid and determined that it was corrosive (pH < 1.0), and contained a hazardous concentration of zinc.

Photo 22

This photograph shows spilled liquid and staining of the concrete floor under plating tanks.

Photo 23

This photograph shows staining and corrosion of the concrete under and around plating process tanks.

Photo 24

This photograph shows leaked liquids and chemical stains in the concrete containment structure surrounding a hazardous waste accumulation tank. Is the tank's integrity compromised?

Photo 25

Here we see a buffing machine and buffing dust accumulated all over the floor of the facility. The buffing dust was analyzed and found to contain hazardous concentrations of lead, nickel, chrome, and zinc.

Photo 26

This photograph shows an open and unlabeled container holding hazardous buffing dust waste.

Photo 27

This photograph shows a number of open and unlabeled drums holding unknown and potentially hazardous wastes.

Photo 28

This photograph shows drums holding hazardous wastes. The drums are not labeled adequately, as can be seen in the next photograph.

Photo 29

This is a close-up view of the label on one of the drums shown in the previous photograph. Rain rendered the label illegible.

Photo 30

This photograph shows an inadequately labeled, and bulging, drum of waste acetone sitting next to the property line.

Now that we've taken a virtual tour of a plating facility, it's time to discuss what technical elements in particular must be reviewed.

3.3.3 Analyzing Secondary Containment

Secondary containment for tank systems was already covered in section 2.3.6. Secondary containment of waste ***sumps*** and ***pipes*** within the actual plating area is just as important to understand.

Facilities may (intentionally or unintentionally) use secondary containment as a ***permanent storage mechanism*** for considerable amounts of waste. This clearly defeats the purpose of having secondary containment, and is ***in violation*** of requirements to address leaks and spills into secondary containment, as described in Cal. Code Regs., title 22, section 66265.196.

> The main point to remember is that *secondary containment* should not be functioning as *primary containment*.

Regulations state that removal of spilled or leaked waste from secondary containment is required ***within 24 hours***, or in as timely a manner as possible to prevent harm to human health and the environment (Cal. Code Regs., title 22, section 66265.193).

A facility must have secondary containment for concrete ***waste collection sumps*** under the floorboards in the plating area. Since sumps can be difficult to physically inspect, request a ***diagram*** of the plating area from the operator before you go through the plating facility.

The diagram should include locations of:

- Sumps
- Berms
- Pipes
- Plating bath tanks
- Any other structure(s) relevant to plating area hazardous waste operations

Not only will such a diagram help you determine if all relevant areas have appropriate secondary containment, it will indicate whether incompatible areas are sharing the ***same*** secondary containment system (more in section 3.3.5). An ***example*** of such a plating diagram is provided in Appendix B. Inspectors who only have jurisdiction over hazardous *waste* areas should be aware of their jurisdictional limits to regulate certain aspects of the plating area, since chemicals properly maintained in actual plating baths (e.g., not spilled or otherwise ready for disposal or piping to the treatment unit) are *not wastes.*

3.3.4 Analyzing Leak Detection Systems

Sophisticated hazardous waste tank and pipe leak detection systems have become very common in today's electroplating facility. They can save time since hazardous waste tank systems that do not have a leak detection system must be ***visually inspected daily*** for signs of leaks or corrosion, pursuant to Cal. Code Regs., title 22, section 66265.195.

Leak detection systems may consist of alarms, sensors, and probes. Others may consist of cameras, mirrors, and access ports under and around floorboards. However, some plating shops are either too old or not set up to be ***retrofitted*** with modern leak detection systems, and must rely on doing daily inspections of tanks and pipes. For example, many times plating bath ***floorboards are bolted down*** so as to make removing them for daily inspection of underlying pipes impractical. Plating facilities can get around this, literally, by using a simple lighted-mirror device to check under and around pipes and tanks for any leaks.

During the inspection, have the operator ***demonstrate*** the facility's leak detection system, or otherwise show how pipes and tanks are visually inspected.

Photo 31

Mirrored device used to assist in conducting daily inspections of pipes and tanks in plating area

Once again, if there is no leak detection system, it is absolutely essential that the facility have the means to practically inspect pipes and tanks running under the floorboards of the plating facility. Failure to have either a leak detection system, or a means to visually inspect every day, is considered a serious violation.

Finally, keep in mind that all ***underground*** hazardous waste pipes and tanks require secondary containment and an automated leak detection system.

3.3.5 Segregation of Incompatible Wastes

Unfortunately, some facilities are designed so that incompatibles in tanks and/or sumps are inadequately segregated. "Adequate segregation" means that a dike, berm, wall, or some other means is used to physically separate chemicals.

Often, there are two concrete sumps underneath the plating bath area, one designated for acid wastes and the other for cyanide wastes, which may only be segregated by a concrete partition between them. ***Acids*** (low pH) and ***cyanides*** (high pH) are the key plating wastestreams that must be segregated.

Remember that inadequate secondary containment frequently correlates with inadequate segregation of incompatible wastes

– if there is no secondary containment of berms and sumps, chances are there is inadequate segregation of incompatibles.

Inadequate segregation of incompatibles can have serious consequences. In the event of ***seismic activity***, incompatible acids and cyanides could spill over an existing inadequate partition and generate lethal hydrogen cyanide gas.

3.3.6 Facility Layout

Tying into the concepts of secondary containment and segregation of incompatible wastes is your assessment of the facility layout as relates to everyday practices. Assessing the facility's layout is essential since regulations state that the facility must be maintained to ***minimize the possibility of a fire, explosion or unplanned release*** (Cal. Code Regs., title 22, section 66265.31). "Facility layout" covers management practices of both tanks and containers. While the facility at some point had to put some thought into organizing and structuring tanks in a safe manner, container accumulation is usually given less thought and may present hazards. For example, you should determine:

- Is adequate aisle space maintained?
- Are floorboards cracked, uneven, or otherwise arranged so that an employee accident or chemical spill is inevitable?

Apply concepts of facility layout to how the facility's sump ***pipes*** are operated as well. For example, ask:

- Are the pipes ***flushed out*** between running high-pH and low-pH waste streams through?
- Can those pipes be ***turned off*** to prevent a potential for back-mixing?

Finally, you should inquire about the facility's everyday practices. For example, if the facility routinely washes down floors of spilled plating chemicals containing cyanide, and that wastewater accumulates inches from a nitric acid tank, suggest they practice another washdown method.

Careful accumulation and operation practices, while always important, are especially critical at electroplating facilities given the type and volume of wastes handled.

3.3.7 Interviewing Staff

While you are analyzing all of the above technical elements, also use the facility walkthrough to question the facility personnel who routinely handle hazardous wastes.

You should:

- Get the full names of any staff you interview
- Make observations of what ***activities*** they are performing and later compare your observations to their ***documented training***
- Note any ***contradictory statements*** personnel make, especially if they *conflict with what the owner/operator tells you*

- Note if staff are following the ***safety protocols*** of the facility. If it is apparent (based on your observations and interview(s) with employees) that there are safety issues at the site, you may consider making a Cal/OSHA referral.

Information you obtain from interviewing facility staff should be carefully documented, since it may be used as important evidence later in an ***enforcement case.***

3.3.8 Potential Quarantine Situations; Imminent and Substantial Endangerment Orders

During your electroplating facility inspections you may see violations that present a ***serious threat*** unless they are addressed ***immediately***. Such violations might be:

- ***Spilled plating chemicals***
- Clearly ***leaking*** tanks, pipes, or containers of electroplating wastes, especially in areas of inadequate secondary containment
- Treatment tank(s) or platform(s) in such disrepair that ***collapse*** of the unit is possible

These types of violations require urgent attention at ***electroplating facilities,*** especially those that use cyanide, because of the nature of the waste and the potential for incompatibles to mix and produce hydrogen cyanide gas.

What would you do if you observed one or more of these critical situations at an electroplating facility? You have ***two main options***: you may exercise quarantine authority or issue an Imminent and Substantial Endangerment (ISE) Order to the facility.

You may exercise quarantine authority when you have reason to believe that:

1. The material in question is a hazardous waste
2. It may be transported, stored, or disposed of illegally
3. It may be a threat to human health and/or the environment

Be aware of the ***implications*** of exercising quarantine authority. These include:

1. Responsibility for the waste: do not exercise quarantine authority unless your agency is in a position to ***assume responsibility*** for the waste
2. Considerable ***legal support*** is required to obtain quarantine authority, including designations of a ***hearing officer*** and ***authorized agent***
3. Having to justify a request for quarantine, based on the three elements listed above

If quarantine authority is exercised, the authorized agent must issue and complete items including:

- Preparing and affixing ***quarantine labels*** to identified tanks/containers
- Preparing a ***quarantine log***
- Preparing and issuing the ***Notice of Quarantine***

Authority to proceed with a quarantine is provided to DTSC in Health and Safety Code section 25187. As statute is currently written, only the DTSC Director can appoint a hearing officer to hear an appeal to a quarantine order. Therefore, if you work for a local or other non-DTSC regulatory agency, you may wish to contact DTSC's Office of Legal Affairs for more information on your ***authority to proceed***.

If you do exercise quarantine authority, be aware that:

- The quarantine can be removed by the hearing officer, authorized agent, or the court, or is automatically removed after 30 days
- The authorized agent must accompany the waste to the location where it is to be stored or held, or shall take other actions to ensure that it arrives at its scheduled location.

An ***alternative*** to exercising quarantine authority is to make an ***Imminent and Substantial Endangerment (ISE***) ***Determination.*** Authority to make an ISE determination is also provided in Health and Safety Code section 25187, and authorizes DTSC or the Unified Program Agency to require an owner/operator to take corrective action ***immediately*** if DTSC or the Unified Program Agency determines that violations may pose an imminent and substantial endangerment to the public health or safety or the environment.

An ISE Order is effective immediately upon the date of issuance.

Typically, all corrective actions identified in an ISE order must be completed within five days of the date of service of the Order.

Within **30** days of the date of the issuance of this Order, the owner/operator must submit documentation to show that all items have been complied with. If corrective action is not taken on or before the date specified in the ISE Order, DTSC may take (or contract someone else to take) that corrective action and recover the ***cost*** from the owner/operator under the terms provided for in Health and Safety Code section 25187.5.

After comparing quarantine authority to ISE Order issuance, which option should you choose?

- If the violating facility is ***incapable*** of handling its own affairs, you may want to exercise quarantine authority
- If the facility has the ***resources*** to address the high-threat violations, you may want to issue the ISE Order

Of course, many factors apply, including your regulatory agency's authority and resources to take either or both of the above actions. As is the case with quarantine authority, check with DTSC's Office of Legal Affairs on your options for proceeding with an ISE Order, or seeking assistance to do so, if you work for a local or other non-DTSC regulatory agency.

More enforcement responses will be discussed in Chapter 6.

3.3.9 Onsite Recycling

You may encounter a facility that claims that its hazardous waste treatment activities are ***exempt*** or ***excluded*** from permitting requirements because they "recycle" the hazardous wastes that they treat. For example, plating shops sometimes reuse the spent rinse waters that they treat onsite. You should thoroughly investigate such claims to ensure that:

1. The treatment activity is ***eligible*** for a recycling exemption or exclusion pursuant to section 25143.2 of the Health and Safety Code, and
2. The facility has adequate ***records*** and ***documentation*** to support its claim that it is exempt or excluded from permit requirements.

A good place to begin investigating a recycling exemption claim is with ***the local sanitation district*** that has jurisdiction over the facility. The sanitation district may be able to provide information on the daily rate of water usage and discharge at the facility. If a facility recycles significant portions of its rinse waters, then you would expect that its daily ***rate of water usage*** and discharge would be ***low*** compared to the volume of waste rinse water treated on a daily basis.

If the water usage and discharge rates are ***similar***, and if the daily water usage and discharge volumes are not significantly below the daily volume of rinse waters treated by the facility, it would suggest that the facility is ***not*** *r*ecycling its rinse waters. U.S. EPA presents the following input on recycling:

"The Agency (EPA) consequently views with skepticism situations where secondary materials are ostensibly used and reused by the generator, or (where a) recycler is unable to document how, where, and in what volumes the materials are being used and reused. The absence of such records in these situations consequently is evidence of sham recycling. We note also that persons claiming that they are recycling hazardous wastes in a manner excluded by regulation have the burden of proof that are within the terms of the exclusion." (Federal Register, Vol. 50, No. 3, United States Environmental Protection Agency, January 4, 1985.)

In conclusion, in order to adequately evaluate claims of recycling, you will need to:

- Have an understanding of ***allowable recycling activities*** pursuant to section 25143.2 of the Health and Safety Code;

- Develop an ***understanding*** of the wastes the facility claims it is recycling (listed or unlisted wastes, federally regulated or non-RCRA, etc.);

- Evaluate the facility's recycling activities ***documents***, and make sure the facility has documented how, where, and in what volumes the materials are being used and reused;

- Examine historical ***water usage and discharge*** rates at the facility to ensure water usage and discharge rates correspond to volumes of waste the facility claims to recycle;

- Determine if the facility has filed the required recycling ***notification*** with the local CUPA pursuant to Health and Safety Code section 25143.10.

If a facility treats a federally regulated, ***but not listed***, RCRA aqueous waste, or a non-RCRA aqueous hazardous waste, the water that remains after treatment may no longer be regulated as a hazardous waste if it does not have any remaining hazardous characteristics. In that case, the facility could:

- Reuse a majority of that water onsite;
- Discharge the rest to the local POTW; and
- Still claim to be exempt from permit requirements for the treatment process, provided that the facility maintains documentation that it is in compliance with the local ***POTW's*** discharge requirements, and makes the required notifications pursuant to Health and Safety Code section 25143.10.

Keep in mind that if wastewater is held in tanks prior to recycling activities, the tanks and ancillary equipment may still be subject to hazardous waste tank standards.

3.3.10 Records to Review

The following list describes some of the records that must be maintained by facilities that treat hazardous waste under Permit by Rule (PBR) [see California Code of Regulations, title 22, section 67450.3, subsection (c)(9)]. These requirements apply to electroplating facilities since the vast majority of them treat cyanide or other plating waste under PBR.

You should allow at least ***two to three hours*** to review these records onsite. (If the facility simply lacks the record(s) altogether, you can spend that time explaining the requirements to the facility.)

- Written employee ***training plan*** and records (Cal. Code Regs., title 22, section 66265.16)

- ***Waste analysis plan*** and analytical records for all hazardous wastes treated onsite (Cal. Code Regs., title 22, section 66265.13)

- ***Contingency plan*** (Cal. Code Regs., title 22, sections 66265.51 & .52)

- ***Biennial report*** [Cal. Code Regs., title 22, sections 66262.41 & .40(b)]

- Annual ***waste minimization certification*** and copy of ***source reduction evaluation*** review and plan (Health and Safety Code, sections 25244.19 & .21)

- Records of ***secondary containment*** for all applicable hazardous waste tank units (Cal. Code Regs., title 22, section 66265.193)

- A written and certified hazardous waste ***tank system assessment*** containing all required written statements (Cal. Code Regs., title 22, section 66265.193)

- Written ***inspection schedules*** and inspection logs (Cal. Code Regs., title 22, sections 66264.175 & 66265.195)

- Written ***operating instructions***, and a record of dates, volumes, residuals management, and types of waste treated [Cal. Code Regs., title 22, sections 67450.3(c)(9)(D) & 66265.73(b)(2, 6, 7, & 10)]

- Records documenting compliance with ***POTW pretreatment standards*** and industrial waste discharge requirements [Cal. Code Regs., title 22, section 67450.3(c)(5)]

- ***Hazardous waste manifests*** and Land Disposal Restriction records from the past three years (Cal. Code Regs., title 22, sections 66262.20,66262.40, 66268.7)

- ***Phase I Environmental Assessment*** (Health and Safety Code section 25200.14 and Cal. Code Regs., title 22, section 67450.7)

- Written ***closure plan***, closure cost estimate, ***financial assurance*** mechanism and certification that was submitted to the CUPA [Cal. Code Regs., title 22, sections 67450.3(c)(11)(B), and 67450.13(a)(1)]

- Onsite hazardous waste ***treatment notification forms*** that the facility submits annually to the CUPA to treat hazardous wastes under Permit by Rule (Cal. Code Regs., title 22, section 67450.3 (c)(1))

- ***Recycling records*** (if the facility claims to be exempt from permit requirements pursuant to a recycling exemption or exclusion; see Section 25143.2 of the Health and Safety Code)

You may request that the facility ***provide you copies*** of any documents. If you observe any violations or potential violations related to specific documents or records, you should obtain copies of those documents or records, *at the time of the inspection.*

Two recordkeeping requirements that electroplating facilities frequently have problems with are the first two listed above, the *training plan* and the *waste analysis plan.* Both of these plans have many detailed elements to them.

Refer to the boxes below for the elements required for each plan.

A training plan must include:

- A written description of the ***type*** and ***amount*** of both ***introductory*** and ***ongoing*** training (formal or informal) that will be given to facility personnel
- ***Job titles*** for each position related to hazardous waste management
- ***Name(s)*** of employee(s) filling each position
- Written ***job description(s)*** for each position, including requisite skills and education, and duties of facility personnel assigned to each position
- ***Records*** documenting that personnel have received and completed the required training or job experience

A waste analysis plan must include:

- A list of ***all*** wastestreams treated onsite
- ***Specific*** test methods that will be used to determine hazardous characteristics
- ***Sampling methods*** that will be used to obtain representative samples
- A description of sampling ***equipment***
- Sample ***processing procedures***
- Instructions on how to ***document*** samples collected
- ***Chain of custody*** procedures
- Specified ***locations*** to take samples (each waste must be collected for analysis ***before*** it is commingled with any other wastestream, and ***before*** it is treated in any way)
- A statement that only a ***lab certified by the State of California*** will be used to analyze samples, pursuant to Health and Safety Code section 25198

Also remember that for the waste analysis plan, only ***recognized*** hazardous waste test methods documented in U.S. EPA publication SW-846, or title 22 of the California Code of Regulations, shall be used to analyze waste for hazardous characteristics.

Keep in mind that a generator operating under PBR cannot Use generator knowledge to determine hazardous waste characteristics of waste treated onsite; he or she must use a state-certified lab to conduct waste analyses.

Waste analyses will be covered in more detail in section 4.8.

3.3.11 Documenting Violations

Inspectors should refer to their respective agency for ***protocols*** on properly documenting violations. State law requires that inspectors leave a list of violations observed during the inspection with the facility owner/operator. DTSC documents all violations, and required corrective actions, in a *Summary of Violations* (SOV), and issues it to the facility owner/operator at the conclusion of the inspection.

DTSC inspectors should document issues that *may* lead to violations but require *more investigation* in a Summary of Observations (SOO), which is also issued to the facility at the conclusion of the inspection.

As mentioned previously in this manual, regulatory agencies that use inspection checklists are strongly encouraged to either expand on such checklists with ***inspection narratives*** or develop a customized electroplating facility inspection checklist in order to cover ***all possible violations*** that may be observed at an electroplating operation.

See Chapter 6 for a comprehensive analysis of violations observed at plating facilities.

3.3.12 Managing Inspection Photographs

Every regulatory agency has its own policy on taking photographs during inspections. As an electroplating facility inspector, it is highly recommended that you take photos of observed violations (or potential violations) since they may be very ***important evidence*** for enforcement actions.

Some key points to remember about inspection photographs are:

- Photos ***should not be altered*** in any way
- ***Archive*** inspection photographs on a CD that is maintained with the facility file
- Photographs should be included in the body of, or as attachments to, any inspection report
- Under no circumstances should you ***withhold*** a photograph from inclusion in an inspection report

Chapter 4 will cover taking photographs during sampling activities (for photographic evidence logs, etc.).

3.3.13 The Closing Conference

The facility inspection should conclude with a closing conference. Begin this conference by discussing ***positive*** observations regarding the facility's operations. You should then discuss ***each*** violation with the facility owner/operator, describing the observations that led you to determine that a violation was occurring, or had occurred (before your site visit). Finally, explain the required ***corrective actions***, and answer any questions the owner or operator may have.

Before leaving, make sure that:

- The owner/operator of the facility has your contact information
- The owner/operator knows what to expect from you (an inspection report, other follow-up report, and/or follow-up inspection if that is your agency's protocol)
- The owner/operator signs the Summary of Violations, inspection checklist, or Summary of Observations

3.4 When a Follow-up Inspection Is Necessary

3.4.1 Confirming Return to Compliance

In many cases it is necessary to revisit an electroplating facility to ensure that it has returned to compliance. When is a follow-up inspection appropriate?

- When submitted photographs and documents are ***insufficient*** to prove return to compliance
- When you have reason to believe that the operator is ***covering up*** violations
- When a facility is ***inconsistent or vague*** in their reports of returning to compliance
- When a ***facility requests*** your re-inspection in order to verify that they are taking the appropriate steps toward compliance

For electroplating facilities, returning to compliance can be a major undertaking requiring many hours and thousands of dollars. Addressing typical violations can require repair and replacement of equipment; altered day-to-day operations (for example, taking the time each day to conduct pipe and tank inspections, if necessary); and new, correct procedures which can be unfamiliar to facility personnel. For these reasons, a re-inspection of electroplating facilities, often ***several months*** after the initial inspection(s), is frequently needed.

Return to Compliance strategies are discussed more in section 6.2.

3.4.2 What if New Violations are Observed?

If ***new*** violations are observed during a follow-up inspection (i.e., not observed before), you will generally issue another Summary of Violations or inspection checklist. "New violations" would be those you have not observed before, and that do not directly relate to those already cited.

If you observe violations documented before which have ***still not been addressed***, do not list these as "new" violations; indicate on a Summary of Observations, or equivalent designation on a local agency report, that the violation(s) observed on a previous date are ***continuing***.

Be very ***specific*** as to how the violations have not been corrected on the follow-up visit, as this documentation can impact an enforcement action against the facility.

Failure to cooperate with compliance directives will be discussed more in Chapter 6. The next topic we will cover is ***sampling*** at electroplating facilities.

CHAPTER 4 - SAMPLING

IN THIS CHAPTER, YOU WILL:

- Learn how to create a sampling plan for an electroplating facility
- Understand specific sampling situations at electroplating facilities and how to prepare sampling equipment and documents
- Learn what EPA test methods to use to analyze samples taken from electroplating facilities

If you observe serious violations at an electroplating facility, chances are you will ***return*** to the site as soon as practicably possible to collect samples.

4.1 When Sampling is Recommended

- When you need ***evidence***
- When you need to determine ***concentrations*** of wastes
- To determine if a waste is ***hazardous***
- When a facility has relied on "generator knowledge" of a particular wastestream's characteristics, and/or inadequate waste analyses exist

(Recall that a generator operating under PBR cannot use generator knowledge to determine hazardous waste characteristics and concentrations; he or she must use a State-certified lab to conduct waste analyses, as specified in their waste analysis plan)

4.2 Creating a Sampling Plan

If you are the sampling team ***leader***, you will rarely be unfamiliar with the site you must sample at. It is the responsibility of the team leader to familiarize those sampling team members who have never been to the site with a *sampling plan*, to ensure an organized approach to the site visit.

When preparing a sampling plan, take into account:

- The ***goals*** of your sampling investigation, based on the criteria in section 4.1
- The ***feasibility*** of collecting certain samples (from difficult to access areas, etc.)
- ***Time*** constraints (is a waste so sparse or spread so thin that it will take you thirty minutes to fill one jar?)
- Last but not least, think about your ***safety*** (refrain from climbing a ladder on an unstable platform, etc., to obtain a sample)

You should coordinate with an industrial hygienist before collecting samples, especially if you will collect samples of cyanide-bearing wastes. Therefore, it is essential that you plan your sampling activities ***well in advance*** of the inspection.

Pre-Sampling Coordination: Inspectors should familiarize themselves with the following topics before engaging in sampling activities:

- Sampling techniques and equipment
- Sample preservation
- Chain of custody procedures
- Others

If you are a DTSC inspector, coordinate with DTSC's Environmental Chemistry Laboratory ***(ECL)*** before the inspection so that the lab can prepare to receive the samples for analysis. Certain forms must be completed prior to collecting samples, including the SAR *(Sample Analysis Request*) and ARF *(Authorization Request Form*). Other regulatory agency inspectors should review internal guidance on sampling procedures before proceeding to the field.

In preparing a sampling team, you will typically need to secure the resources of at least two coworkers. Sampling requires a minimum of three staff just to conduct the following sampling activities:

- Collect the actual samples
- Take photographs
- Document the sampling activities

As the sampling team leader, you should be aware of the following:

- At electroplating facilities, 90-100% of samples may be taken ***inside***, as opposed to other operations you might sample at

- Since most sampling takes place inside, ***vapors*** are a bigger problem than ***heat***, especially if there is poor ventilation

- The majority of your samples will likely come from hazardous waste rinse waters; fewer samples will be taken from drums

Sample Teams: You may need more than one sampling team depending on how many samples you collect. If you plan to take any more than about twenty samples, designate two sampling teams, unless you are able to come back to the site the next day.

Your regulatory agency may have specific protocols on how many inspectors are required to enter a site together in order to conduct sampling. For example, DTSC policy requires that at least four DTSC staff be present if there is a chance that inspectors may don ***SCBAs*** (Self-Contained Breathing Apparatuses).

Always carry SCBAs with you when:

- Sampling cyanide-bearing wastes or wastes with unknown hazardous characteristics;
- Under certain circumstances when a Pac III HCN sensor or similar measuring device reads cyanide gas levels above 2.5 ppm.

It is usually best to assign different teams to distinct areas of the plating facility. Keep in mind that samples to be collected ***first*** should be those most critical to your investigation. If you are concerned that all samples may not arrive to the lab in an expeditious manner, collect samples with a short holding time ***last***.

Where and What to Sample: Your sampling plan should include specifics on:

- Location to take each sample
- Device to use to take each sample
- Quantity of samples to take at each location

Be sure to focus on tanks that contain ***wastes***. Chemical ***supply*** tanks will be outside the focus of the inspection, unless:

- They are leaking
- You would like to verify the ***characteristics*** of a particular supply chemical (e.g., the pH of nitric acid in a supply tank close to a buildup of cyanide crystals)

You are most likely to encounter cyanide in:

- Dead rinse tanks
- Cadmium, zinc, silver, gold, copper, and palladium rinse tanks
- On floor grates, in crystal form, near and around the above such tanks

This manual focuses on plating facilities that use cyanide in their operations. However, many of the same principles apply to other operations such as ***copper*** and ***nickel*** plating. If you encounter a facility that conducts ***gold*** or ***silver*** plating, be aware that these types of plating operations use cyanide; however, there is typically ***less cyanide*** in gold or silver plating solutions than in cadmium plating or most other heavy metal plating solutions. Because cyanide is held in ***suspension*** within a gold or silver plating solution, it is typically less of a threat, and samples taken from gold or silver plating lines should contain less cyanide than from, say, a cadmium plating line.

Finally, because of its lower concentration and suspension within a gold or silver plating solution, there is less chance of cyanide gas forming. However, this is no excuse not to use appropriate health and safety measures when sampling from a gold or silver plating line.

Sampling of Cyanide-Containing Filters: You may not have the equipment or appropriate lab planning needed to sample bleach-treated cyanide filters, especially if you were not expecting to find them. Sampling of such a solid and fibrous waste requires special sampling equipment; therefore, you may have to ask the facility to collect the sample for you. Make sure that any samples taken by the facility are analyzed using appropriate methods. Keep in mind that you cannot demand the facility to take sample(s) for you.

4.3 Sampling Equipment

If you are unfamiliar with certain sampling equipment that you may use at plating operations, refer to the following:

A ***Coliwasa*** (which is an acronym for Composite Liquid Waste Sampler) is a long glass or plastic tube which, when immersed in liquid, allows representative sampling of ***stratified*** liquid wastes. It is an ideal device for taking samples from many electroplating baths.

A ***trowel*** is a plastic or metal hand shovel for handling solid materials. It is often used to collect samples of ***crystallized*** plating bath solutions (on the floor, adhered to tanks, filtration units, etc.).

The following list will give you a general idea of the ***type*** and ***quantity*** of equipment to bring to a typical sampling investigation of a plating facility:

1. Sampling Jars
- 8 oz. jars are usually sufficient for taking ***solid*** samples; 12 or 16 oz. jars are usually necessary for taking ***liquid*** samples (however, check with the lab to determine how much sample they need for the requested analyses as this is dependent on suspected *concentration*)

(Note: before sampling, you may want to ***pre-label*** jars because it is very difficult to handle labels in the field.)

2. Coliwasas and/or Drum Thieves
- It is best to pack one Coliwasa or drum thief per planned sample, to avoid cross-contamination in the field. Take 5-10 extra in case of breakage or other mishap

3. Trowels
- Pack one trowel per solid sample you plan to collect, plus five extra

4. Sampling/Evidence Tape
- For preserving the integrity of samples taken
- Take two rolls

5. *Plastic bags*
    - Bags will be needed for containing used/contaminated equipment and PPE
    - Take *large bags* (preferably 38” x 64”) for containing used Coliwasas and/or drum thieves
    - Take *smaller bags* for containing used PPE (Personal Protective Equipment) and boots worn during sampling

(Note: sample *jars* may or may not be bagged, and are usually put in *ice chests* for safer transport)

6. *Ice Chest(s)*
    - Depending on how many samples you collect, you will need at least one ice chest for preserving temperature-sensitive samples (such as cyanide); see section 4.8 for more details
    - Plan ahead to make sure you have access to ***ice*** after you take samples

7. *Bubble wrap*
    - For cushioning of samples within ice chest(s)
    - Pack at least one large roll

8. *Sampling Truck or Van*
    - Reserve a utility or multi-compartment truck, if available. *Do not use a sedan* for field sampling activities
    - Depending on the extent of your involvement with the shipment of samples, you may need to review *Dangerous Goods Packaging* rules for sample transport, including whether or not you must have been trained in these rules. Also, keep in mind that shipping samples via *air* requires specific training

4.4 Health and Safety Equipment While Sampling

Personal Protective Equipment (PPE) is not unique to sampling at electroplating facilities, but cannot be emphasized enough when dealing with such hazardous chemicals.

While collecting samples, chemical-resistant safety boots, gloves, Tyvek suit, and eye protection should generally be worn. In addition, extra layers of gloves, hearing protection, a hard hat, and an SCBA should all be available in case they are needed.

Monitoring equipment is equally important for your health and safety during the sampling investigation. Some health and safety monitoring equipment that is frequently used at electroplating facilities are:

- MSA Sirius Multi-gas Detector
- Combustible Gas/Oxygen Meter
- Draeger Meter
- Photoionization Detector
- PAC III w/HCN Sensor

Your IH will be well-trained on how to use this equipment and interpret readings.

The most commonly used monitoring equipment is the HCN monitor. Your IH may set the monitor at a particular HCN gas *action level* (typically between 2-5 parts per million) and advise you to immediately leave an area as soon as the sensor goes off. Make sure your IH zeroes out your monitor before use.

Other health and safety tips:

- Remain aware of incompatible waste hazards (e.g., acids and cyanide solutions stored without adequate separation)
- As with any sampling investigation, you should always carry the telephone number, address, and map showing the location of the nearest local ***hospital***

4.5 Collecting and Documenting Samples

Tips on Sampling at Electroplating Facilities:

- Even in plating shops with severe compliance problems, plating bath tanks generally have some labeling information. Therefore, you may not encounter quite as many "unknowns" during your visit. It is the ***concentrations*** of wastes that are most often in question

- There is an even higher chance of ***cross-contamination*** when taking samples at electroplating facilities. Therefore, it is critical to use ***new*** sampling equipment (Coliwasas, trowels, etc.) to collect each sample

- During your sampling activities, you will frequently lean over tanks, so be aware of a higher chance of ***splashing*** and ***spillage***

A special note on collecting cyanide:

- You may need a scoop to collect cyanide ***crystals***, if they exist
- Sample from the ***bottom*** of rinse tanks in order to get representative cyanide samples, because of ***chemical settling***

Efficient Sampling

Plating facilities usually work ***sequentially*** from tank to tank down a "plating line," as discussed in Section 1.4; you should keep this in mind when you are taking samples during a busy operations period. Use common sense to ***avoid disrupting*** a facility's operations; for example, plan your sampling activities to take samples from heavily used plating baths during employee breaks, etc. if possible.

Handling Sampling Equipment:

- Maneuvering Coliwasas: if you are inexperienced in handling a Coliwasa to take liquid examples, have someone assist you. After use, place Coliwasas used to sample acid wastes and cyanide wastes **in separate bags**.
- You may put on an extra layer of tight gloves over silver-shield gloves in order to get a better grip on equipment

Evidence Tape & Labeling
Management of samples requires the utmost care. After collecting an appropriate sample quantity (at least 4-8 oz. for solid samples and 12-16 oz. for liquid samples), sampling jars must be ***immediately closed*** and ***sealed*** with evidence tape. If the jars have not been labeled before the start of the sampling, they should be immediately labeled. Have a person not directly involved in extracting the samples seal evidence tape and ensure proper labeling. The label should list the name of the person taking the sample, the sample number, the date, the facility name, and the facility's EPA Identification Number. It may also list the time at which the sample was collected.

Photographs
Finally, take a ***photo*** of each sample jar (or *jars* if taking duplicate samples) by the area where each sample was taken. A member of the sampling team should maintain the sample ***photo log***.

Photograph your sample jars close to where samples are taken
(you can always zoom in to read labels)

Duplicate Samples
You should issue a ***duplicate sample receipt*** to the facility operator, if he or she requests duplicate samples. DTSC has a standard such receipt for listing up to ten

duplicate samples per page; each receipt should be signed by both the facility representative and the inspector. CUPAs and other agencies should develop a similar such form, if one is not already available, to document a duplicate sample request. Duplicate sample requirements are described in title 22, California Code of Regulations, section 66272.1.

Issued duplicate samples must be properly submitted to a lab for analysis or else properly disposed of; make sure the facility is aware of this before they agree to accept the samples.

If the facility does not request duplicate samples, you should issue a sample receipt anyway to document that you have taken property (wastes) from the facility.

After sampling activities are completed, follow your agency's policy for decontamination methods of PPE, monitoring equipment, and vehicle(s) as necessary.

4.6 Chain of Custody

In order to preserve the integrity of samples taken, a chain of custody form should be initiated by the person taking the samples and should be signed by ***each person*** the samples are transferred to, until they arrive at their destination lab. Make a ***photocopy*** of each chain of custody as the samples transfer from person to person.

4.7 Coordination with Laboratory

Cyanide samples have a ***14-day holding time***; if they are analyzed past this holding time, their analyte concentrations may have decreased and the samples are no longer representative. Equally important as the cyanide samples' holding time is that they must be maintained at 4 degrees Celsius, or ***approximately 40 degrees*** Fahrenheit – the average temperature of a refrigerator. Since refrigerators are hard to come by in the field, an ice chest filled with blue ice or ice cubes is essential.

If you expect certain delays in getting all samples to the laboratory on time, make sure that 24-hour holding time samples (e.g., for pH) arrive at the lab first.

4.8 Analyses Needed to Characterize Samples

The following EPA analytical methods, as described in EPA publication SW-846 (*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd Edition)* are typically used for analyzing samples from electroplating facilities:

- EPA method 9010C for ***cyanide*** analysis
- EPA methods 3050B and 6010B for most ***metals***
- EPA methods 9040B and 9045C for ***pH***

Document SW-846 sets forth acceptable methods for the regulated and regulatory communities to use in responding to RCRA-related sampling and analysis requirements. Depending on what type of plating a given electroplating facility conducts, you may need to run different or additional analyses.

Different Cyanide Analyses
It is highly recommended that EPA SW-846 Method ***9010C*** (*Total and Amenable Cyanide: Distillation*) be used to analyze cyanide samples. Another frequently used method is EPA Method ***335*** (Cyanide Amenable to Chlorination). EPA Method 335 is for the analysis of waste water effluent that will be discharged to the POTW or discharged under an NPDES permit.

- Results for both tests should be close when there are no *suspended solids*, but won't be when there are
- Because of the different nature of the test (chlorination), Method 335 will yield much lower concentrations of cyanide than Method 9010C

TCLP: Finally, although it is not always required, it is helpful to run the TCLP Analysis when analyzing samples to establish RCRA characteristic waste concentrations. (Keep in mind, however, that there is no TCLP analysis for copper or zinc.)

Below is a model table of analytical results from an electroplating facility (the facility is fictional, but the results are typical of what may be found):

(See next page.)

Example Table of Analytical Results – Electroplating Facility Samples

Immaculate Plating Inc.*
Analytical Results from Samples Collected 1/1/06

Analytical Results

	Sample ID	IP1	IP2	IP3	IP4	IP5	IP6	IP7	IP8	IP9	IP10
	Physical State	Liquid	Liquid	Liquid	Solid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid
	Sample Location	Tank #13 Dead Rinse Tank	Tank #16 Cadmium Rinse Tank	Tank #19 Water Rinse	Plating Floor	Tank #10 Chrome Plating Rinse	Tank #37 Chrome Rinse Water	Tank #2 Soap Tank	Tank #4 Etch Tank	Tank #8 Zinc Tank	Tank #6 Nitric Desmut Tank
	Sample pH	12.7	10.9	8.09	11.2	7.83	3.87	9.61	13.3	13.5	1.26
Metals	Regulatory Level, mg/L										
Barium	100	5.0	8.1	8.5		0.16	ND	ND	ND	ND	9.6
Cadmium	1	5900	230	39		4.7	450	6.6	ND	0.52	540
Chromium	5	10	1.5	0.50		26	330	6.6	0.21	0.94	28
Copper	25	200	12	0.38		0.026	0.15	18	ND	0.64	1100
Nickel	20	48	3.2	0.46		ND	ND	4.7	ND	3.2	830
Lead	5	2	ND	ND		ND	ND	11	ND	ND	19
Zinc	250	2.8	0.24	0.18		0.37	72	9.9	ND	13000	24
Metals	TTLC Reg. Levels (mg/kg)										
Barium	10,000				ND						
Cadmium	100				16000						
Chromium	2,500				28						
Copper	2,500				460						
Nickel	2,000				53						
Lead	1,000				ND						
Zinc	5,000				54						
Total Cyanide		27450 mg/L	1270 mg/L	16 mg/L	28460 mg/kg	ND	ND	ND	ND	31 mg/L	NA

NA=Not Analyzed; ND = Not Detected
Red highlighting denotes samples detected at or above hazardous waste levels.
*Fictional facility and results

When analyzing sample results, remember that:

- The “Regulatory Level (mg/L)” values correspond to the Soluble Threshold Limit Concentrations ***(STLC)***, Cal. Code Regs., title 22, section 66261.24(a)(2).

- The “TTLC Reg. Levels (mg/kg)” values correspond to the Total Threshold Limit Concentrations ***(TTLC),*** listed Cal. Code Regs., title 22, section 66261.24(a)(2). Any ***liquid*** sample containing a metal concentration above the corresponding STLC Reg. Level (mg/L), or any ***solid*** sample containing a metal concentration above the corresponding TTLC Reg. Level (mg/kg), is a hazardous waste pursuant to Cal. Code Regs., title 22, section 66261.24.

- Per Cal. Code Regs., title 22,, section 66261.22(a), a waste is hazardous due to ***corrosivity*** if the pH is less than or equal to 2, or greater than or equal to 12.5, or corrodes steel at a rate greater than 6.35 mm (0.250 inch) per year at a test temperature of 55° C (130° F).

Finally, note that several samples showed very high concentrations of ***cyanide***, specifically the solid sample of cadmium-cyanide crystals taken from the floor and the liquid sample taken from Tank #13 (Dead Rinse Tank).

For a more comprehensive explanation of waste analysis tests, see DTSC’s online tutorial at http://ccelearn.csus.edu/wasteclass/mod9/mod9_01.html .

Now that we have gone over both sampling procedures and inspection activities at electroplating facilities, we will go over incorporating this information into the facility’s ***inspection report***.

CHAPTER 5 – PREPARING THE INSPECTION REPORT

5.1 Writing the Report

Since electroplating facilities frequently have complex operations, requirements, and violations, it is highly recommended that an inspector ***memorialize*** all inspection observations in an inspection report.

DTSC inspectors are required to prepare a ***formal*** inspection report; other regulatory agency inspectors may not. The DTSC inspection report ***template*** is available in the Policy and Procedure for Conducting Inspections: http://www.dtsc.ca.gov/LawsRegsPolicies/Policies/HazardousWaste/HazardousWaste_policies.cfm

A *generic inspection checklist* will almost certainly not contain all the specialized items that must be evaluated during a plating facility inspection. If checklists must be used, the development of a ***specialized*** local agency "electroplating facility" inspection checklist would greatly benefit the local agency's effort, especially if *enforcement* must be pursued.

If your regulatory agency does not have a standard inspection report template, the following information can help you record all important observations at an electroplating facility:

- All violations, and any others identified ***following*** the site visit, should be discussed in detail
- Record the ***circumstances*** that led to each violation
- Include all supporting documentation, including ***photographs*** and ***analytical data*** for any samples collected
- State if each violation is considered Class I, Class II, or minor, and the ***basis*** for your determination (discussed in more detail in Section 6.3)
- For document or recordkeeping violations, attach a ***copy*** of those document(s)
- to the inspection report
- Any discussions with the owner/operator or facility employees related to
- potential violations should be recorded ***word for word***; use exact quotes in the inspection report if possible

Preparation of the inspection report is perhaps the ***most subjective*** aspect of the inspection, because each individual has his or her unique writing style. To promote uniformity, you may review available ***sample inspection reports*** which serve as useful models for the types of information to include in the report.

Start writing the inspection report as soon as possible following the site visit, while the details of the inspection are fresh in your mind.

Familiarize yourself with your agency's policy on disposal or retention of ***field notes.*** (DTSC's policy is to destroy field notes as soon as they are no longer needed for preparation of the inspection report – usually once the draft inspection report is prepared.)

5.2 Issuing the Report

You should issue the inspection report to the facility in as ***timely*** a manner as possible. Health and Safety Code, chapter 6.5, section 25185, subsection (c)(2)(A) requires the inspector to issue the report within 65 days of the date of the site visit.

DTSC Inspection Policy and Procedure mandates that a DTSC inspection report ***cover letter*** include a reference to Health and Safety Code, chapter 6.5, section 25185.3, subsection (c)(3). This subsection requires the owner/operator to submit a ***written response*** to DTSC or the local officer or authorized agency within 60 days describing the corrective actions taken, or proposed to be taken, to bring the facility back into compliance.

CHAPTER 6 -VIOLATIONS AND ENFORCEMENT

IN THIS CHAPTER, YOU WILL:

- Learn about the most typical violations found at electroplating facilities
- Understand how these violations are classified
- Learn how to apply qualitative factors such as potential for harm and extent of deviation to electroplating violations
- Understand how to prepare specialized evidence of mishandling at electroplating facilities
- Understand some examples of injunctive relief in the case of a civil enforcement case against an electroplating facility

Chapter 1 provided some alarming statistics on violations at plating facilities – Based on many inspections conducted by DTSC of plating facilities, almost 80% had Class I violations. As an electroplating facility inspector, you are therefore likely to encounter a Class I violation during your site visit(s). This chapter will cover how to address those violations by taking appropriate enforcement and ensuring return to compliance.

As you may know, there are two types of enforcement responses: ***formal*** and ***informal***. Because of the seriousness of the violations observed at electroplating facilities, and types of waste generated and treated, most enforcement actions taken against plating facilities are *formal.* It is DTSC policy to take formal enforcement against facilities with Class I violations and against Significant Non-Compliers, or SNCs (discussed in more detail later in this chapter). Other agencies should be aware that a Class I violation warrants a formal enforcement action.

6.1 Common Violations

Regulatory agencies are encouraged to balance ***education and outreach*** with the regulated community with ***enforcement***. In 2002, DTSC identified eight of the most common violations at electroplating facilities, and provided detailed steps to the plating industry on how the violations can be corrected and/or addressed. Since DTSC made a concerted effort to ***provide this information*** to the electroplating industry, a plating facility should have little excuse for not being informed of essential compliance requirements.

The list of eight violations is available on the internet at:
http://www.dtsc.ca.gov/HazardousWaste/CertifiedUnifiedProgramAgencies.cfm
A summary of the eight most common violations is as follows. Most of these were discussed in more detail throughout Chapter 3.

1. Failure to provide adequate ***secondary containment*** for tanks and containers used to manage hazardous wastes pursuant to Cal. Code Regs., title 22, section 66265.193;

2. Failure to ***segregate incompatible wastes***, including separate secondary containment for tanks and containers used to hold or treat acidic and cyanide-bearing wastes pursuant to Cal. Code Regs., title 22, sections 66265.198 and/or 66265.199;

3. Failure to maintain the facility to prevent any planned or unplanned, sudden or nonsudden, ***releases*** of hazardous waste to the environment (e.g., failure to clean up spilled plating chemicals from the floor or ground) pursuant to Cal. Code Regs., title 22, section 66265.31;

4. Failure to adequately ***label*** tanks and containers used to hold and treat hazardous wastes pursuant to Cal. Code Regs., title 22, section 66262.34;

5. Failure to obtain the required ***permit*** or ***grant of authorization*** needed to treat specific types of wastes, especially cyanide-bearing wastes, pursuant to Health and Safety Code section 25201;

6. Failure to prepare a written ***waste analysis plan***, and to obtain waste analysis records for all hazardous wastes treated onsite pursuant to Cal. Code Regs., title 22, section 66265.13;

7. Failure to adequately ***train*** employees that manage hazardous wastes pursuant to Cal. Code Regs., title 22, section 66265.16;

8. Failure to prepare a written and certified hazardous waste ***tank system assessment*** pursuant to Cal. Code Regs., title 22, section 66265.192.

These violations will be discussed from several different perspectives throughout the rest of this chapter.

6.2 Return to Compliance Strategies

To give you a better outlook on getting a facility back into compliance, the ***goals*** of enforcement are worth a brief discussion. These goals, in general, are:

- To protect the ***environment*** and public ***health and safety***
- To promote ***compliance***
- To treat facilities ***equally and consistently*** with regard to the same types of violations
- To return violators to compliance in a ***timely manner***
- To penalize violators and deprive them of any ***economic benefit*** gained from non-compliance

Looking back at the list of eight most common violations, notice that the first three typical violations are more “hands-on” and could require ***physical restructuring*** of the facility; the last four are primarily ***recordkeeping*** violations. It may be helpful for you to think of violations as falling into one of these two categories.

Almost all the violations on this "List of Eight" may require ***significant time, money,*** and ***effort*** on behalf of the facility to return to compliance; only #4 could be addressed fairly quickly. Because most violations at electroplating facilities are not "quick fixes," then, it is vital to have a *return to compliance strategy*.

Actions the facility can take to speed them along the path to compliance are:

- Maintaining open lines of communication with you, the inspector
- Making use of available ***guidance documents***, including those that you provide
- Designating a facility ***environmental coordinator****,* full-time if possible, to understand and internally communicate all applicable laws and regulations
- Hiring a *consultant* to help return to (and stay in) compliance. *Note: although you may recommend this, make sure the facility understands that this is not* ***required****, and that you cannot endorse any kind of consulting services.*

Paperwork items that an environmental coordinator or consultant can assist with are:

- The Waste Analysis Plan
- The Contingency Plan
- The Training Plan

Locating a consultant to correctly identify ***structural changes*** that need to be made at the facility (e.g., lengthening of berms, installation of leak detection systems, etc.) can be more difficult, since they often involve more ***liability*** and require more technical knowledge (usually that of an *engineer*).

To correct violations that require structural modifications, the facility can take such measures as installing *different* or *additional* equipment that meets requirements, and/or *ceasing operation* of a certain component.

Making such changes can require weeks, even months. This time may include:

- Time to interview and hire consultant(s)/engineer(s) for a job
- The time for an engineer or consultant to prepare reports, summaries, assessments, etc.
- The time it actually takes for the engineer and/or consultant to implement the change, new element, etc.

Whatever the violations are and however much money must go into returning to compliance, remember that a ***prompt return to compliance*** is the main goal. Every day that the facility is out of compliance is another day that its employees work in compromised conditions, and the surrounding environment is at risk.

6.3 Classifying Violations

Although not specific to electroplating facilities, the ***definitions*** (as listed in California Code of Regulations, title 22, section 66260.10) of Class I, Class II, and minor violations bear repeating in our discussions of violations and enforcement. Class I and minor violations are also referenced in Health and Safety Code sections, 25110.8.5 and 25117.6, respectively.

Class I Violation means:

a) A deviation from the requirements specified in Chapter 6.5 of Division 20 of the Health and Safety Code, or regulations, permit or interim status document conditions, standards, or requirements adopted pursuant to that chapter, that represents a ***significant threat*** to human health or safety or the environment, because of
   1) The ***volume*** of the waste,
   2) The relative ***hazardousness*** of the waste, or
   3) The proximity of the ***population at risk***, or that is significant enough that it could result in a ***failure*** to accomplish the following:
      (A) Ensure that hazardous wastes are destined for and delivered to an ***authorized*** hazardous waste facility;
      (B) ***Prevent releases*** of hazardous waste or constituents to the environment during the active or post-closure period of facility operation;
      (C) Ensure ***early detection*** of such releases;
      (D) Ensure adequate ***financial resources*** in the case of releases;
      (E) Ensure adequate financial resources to pay for facility closure;
      (F) Perform emergency clean-up operation or other ***corrective action*** for release; or

b) The deviation is a Class II violation which is a chronic violation or committed by a ***recalcitrant*** violator.

A Class II Violation is:
A deviation from the requirements specified in Chapter 6.5 of Division 20 of the Health and Safety Code, or regulations, permit or interim status document conditions standards, that is ***not a Class I violation***.

> Keep in mind that minor violations are a subset of Class II violations.

While Minor Violations are a subset of Class II violations, they are distinguished from Class II violations since they ***cannot*** include any of the following:

- Any knowing, willful, or ***intentional*** violation
- Any violation that enables the violator to ***economically benefit***, either by reduced costs or competitive advantage
- Any Class II violation that is ***chronic*** or committed by a recalcitrant violator

Because of the nature of the electroplating facility and its wastes, many observed violations are determined to be Class I violations, especially since many wastes include cyanide, an Extremely Hazardous Waste (EHW).

Finally, an additional classification exists to characterize a flagrant violator: SNC, which stands for ***Significant Non-Complier***. SNCs are characterized as:

- Having caused ***actual exposure***
- A chronic or ***recalcitrant*** violator
- ***Substantially deviating*** from the terms of a permit
- ***Substantially deviating*** from statutory or regulatory requirements
- ***Systematically failing*** to follow statutory or regulatory requirements

Of course, since "substantial deviation" and "systematic failure" are not quantified terms, SNCs must be proven and evaluated based on the seriousness and extent of violations (as well as the ***intent*** of the violator) on an ***individual basis***.

6.4 Potential for Harm and Extent of Deviation: Examples

We've established that a handful of Class I violations ***typically recur*** at plating facilities. Therefore, this section is devoted to looking at ***examples*** of these Class I violations and assessing their potential for harm and extent of deviation using the ***qualitative standards – major, moderate, and minimal –*** as defined in Cal. Code Regs., title 22, chapter 22, section 66272.62.

Potential for harm can be described as:
Major: The characteristics and/or amount of the substance involved present a major threat to human health or safety or the environment, and the circumstances of the violation indicate a high potential for harm.

Moderate: The characteristics and/or amount of the substance involved ***do not*** present a ***major*** threat to human health or safety or the environment.

Minimal: The threat presented by the characteristics and the amount of the substance or by the circumstances of the violation ***is low***.

Extent of deviation can be described as:
Major: The act deviates from the requirement to ***such an extent*** that the requirement is ***completely*** ignored and none of its provisions are complied with, or the function of the requirement is rendered ***ineffective*** because some of its provisions are not complied with.

Moderate: The act deviates from the requirement, but it functions to ***some extent*** although not all of its important provisions are complied with.

Minimal: The act deviates somewhat from the requirement. The requirement functions ***nearly*** as intended, but not as well as if ***all*** provisions had been met.

Because of the nature of the electroplating industry and its wastes, most violations are determined to have a ***major*** or ***moderate*** potential for harm. Very few, if any, violations at electroplating facilities will have a minimal potential for harm.

While you are reviewing the examples below, compare your understanding of a Class I violation, and degrees of harm and deviation, to the determinations made in each example.

VIOLATION EXAMPLE 1

An electroplating facility conducted unauthorized treatment of cyanide-bearing filters contaminated from cyanide plating operations, by dipping them in bleach and leaving them in the open to dry. This treatment activity requires a full RCRA permit.

Other Details:

- Cyanide filter lab analyses revealed that the filters contained up to ***10,000 ppm*** cyanide
- The facility has practiced this unauthorized treatment for ***years***
- The facility treated ***100%*** of their filters this way

Potential for Harm: Major, based on:

- The high concentrations of cyanide
- The waste involved, cyanide, is an ***extremely hazardous*** (reactive) waste
- The cyanide filters were treated onsite with bleach, posing a major ***threat to workers,*** and left in the open to dry

Extent of Deviation: Major, based on:

- Statute states that the operator shall not conduct onsite treatment without the proper permit. Bleaching filters contaminated with RCRA waste would require a ***full RCRA permit***. The facility had no authorization whatsoever to conduct this activity.
- Approximately ***one dozen*** such treated filters were observed at the time of inspection (not one filter, or two, or six)
- Routine practice for several years

VIOLATION EXAMPLE 2

An electroplating facility accumulated a dozen cyanide-bearing filters in an unlabeled and open container next to a sulfuric acid tank.

Other Details:

- HCN gas emission readings in the area around the filters tested greater than 5 ppm
- There was ***leakage*** on the floor around the container of unlabeled filters

Potential for Harm: Major, based on:

- Acids and cyanides, two highly ***incompatible*** wastestreams, were stored next to each other in open containers
- The practice could lead to generation of ***lethal cyanide gas*** if the container of filters tipped over onto the sulfuric acid tank, or the leakage from the container came into contact with sulfuric acid
- Workers frequent the area and could ***inhale fumes*** or otherwise come into contact with the filters

Extent of Deviation: Major, based on:

- The facility made ***no effort*** to accumulate the filters in a safe area, segregated from the acid
- Regulations specify that containers of hazardous waste must be labeled and covered
- The number of filters (twelve)
- The act deviated from the requirement to such an extent that ***none*** of the provisions were complied with

VIOLATION EXAMPLE 3

An electroplating facility failed to have their Permit by Rule treatment tank unit reassessed and certified in the required timeframe. The tank unit was last assessed in 1995; since a reassessment is required every five years, reassessments should have been conducted in 2000, 2005, and every five years thereafter.

Other Details:

- The tank treats an average of 250,000 gallons per month of wastewater contaminated with cyanide, cadmium, chromium, and other heavy metals
- In 2002, the operator phoned several consultants to obtain estimates on repairs and replacements; based on his description of the unit, consultants told him the job would cost about $50,000. After hearing this, the operator did not pursue any type of reassessment.
- There was evidence of leakage on the floor surrounding several portions of the ancillary equipment
- The tanks were not inspected daily

Potential for Harm: Major, based on:

- The ***amount*** and ***type*** of wastewater treated (an average of ***250,000 gallons*** per month of wastewater contaminated with cyanide, cadmium, chromium, and other heavy metals)
- The operator admitted that he frequently worried that the unit would be ***overburdened*** by the high volumes of waste coming in
- Evidence of ***leakage*** on the floor surrounding several portions of the ancillary equipment
- Adding to the potential for harm was that the tanks were not ***inspected daily***
- Finally, the original tank assessment (from 1995) *lacked several technical elements*, as noted by the current engineer conducting certification.

Extent of Deviation: Major, based on:

- The ***length of time*** that the tank reassessments were overdue
- ***No attempt*** to have a tank reassessment (making some phone calls to obtain rough cost estimates on needed repairs does not qualify as an attempt to have a reassessment conducted; in fact, this information works *agains*t the facility since the owner/operator knew it should have been done but made a business decision not to based on cost)
- The facility missed the reassessment cycle ***twice***, not once (although you could factor this into the *number of times* the violations occurred, which could effectively double the penalty for this violation).

You may ask: when would this violation have a ***lesser*** extent of deviation?
A reasonable example would be (all other factors the same):

Moderate or Minor: tank system reassessment one year overdue, did not require repair

Extent of deviation may still be ***major*** if, for example, the tank system reassessment was two years overdue but still required repair. (After all, in this scenario the unit treated approximately three million gallons of wastewater each overdue year in a compromised tank system.) Individual situations will dictate the final choice of extent of deviation.

VIOLATION EXAMPLE 4

An electroplating facility failed to inspect pipes and tanks daily, and document inspections, for the pipes and tanks running under the floorboards of the plating facility.

Other Details:

- There was no leak detection system in place
- There was no record of any tank and pipe inspections conducted
- The facility admitted that some of the contamination under the floorboards had been there for ten years

Potential for Harm: Major, based on:

- The ***types of chemicals*** (acids and cyanide) in the pipes and tanks
- In the event of an accident, the floorboards could not be removed in a timely manner, and a spill or leak ***cleaned up***, since all the boards were bolted down
- Failure to inspect for leaks or spills presented a substantial threat to the dozen or so ***employees*** who work in the plating area all day
- Adding to the potential for harm was that there was ***no leak detection system*** in place

Extent of Deviation: Major, based on:

- Regulations specify that areas subject to spills must be inspected daily
- There was no record of ***any*** inspections conducted
- Some of the contamination under the floorboards had been there for ***ten years***
- The act deviated from the requirement to such an extent that ***none*** of the provisions were complied with

VIOLATION EXAMPLE 5

An electroplating facility allowed spilled plating chemicals to accumulate on the floor, including crystallized chemicals from cadmium-cyanide plating, and chrome plating chemicals.

Other Details:

- By the operator's admission, the facility has practiced the same plating and spillage methods for the past ten years
- The crystals had a concentration of 27,450 ppm cyanide, 5,900 ppm cadmium, and pH at almost hazardous waste levels (pH 11.2)
- The crystals are located in four distinct areas, each area covering approximately 15 square feet and thickness up to 1½ inches deep, in the same general area as a 95% nitric acid tank

Potential for Harm: Major, based on:

- The cadmium-cyanide crystals are ***reactive*** and pose a serious threat since they are in the same general area as the 95% nitric acid tank
- In the event of an acid spill over the crystals (such as during an earthquake), the resulting ***cyanide gas*** generation could ***kill several employees*** immediately and severely endanger many others
- ***One gram*** of cyanide compounds can be considered instantly lethal (by ingestion) in half the population, based on toxicological data *(see Section 6.6.2 for more information)*. ***Inhaled*** cyanide gas (the more realistic exposure method) is just as serious.

Extent of Deviation: Major, based on:

- Regulations state that the facility must be maintained to minimize the possibility of a fire, explosion or unplanned release
- ***Large areas*** of the floor, in four distinct areas, had contamination
- Crystals were caked ***1½ inches deep*** in some areas
- By the operator's admission, this situation has existed for ***years***

VIOLATION EXAMPLE 6

An electroplating facility placed incompatibles in tanks without a dike, berm, wall, or other means to segregate them.

Other Details:

- Two adjacent concrete sumps in the wastewater treatment area, one containing acid wastes and the other containing cyanide wastes, had only a concrete partition between them.

Potential for Harm: Major, based on:

- The wastestreams involved were acids and cyanides, so this violation constitutes inadequate segregation of ***incompatibles***
- In the event of seismic activity, the incompatible wastes could splash over the existing inadequate partition and mix, potentially generating lethal ***hydrogen cyanide gas***
- In the event of an ***accident***, the failure to adequately segregate incompatibles presented a potentially large threat to the employees who work in the plating area all day

Extent of Deviation: Major, based on:

- Regulations require that a containment area holding hazardous waste that is incompatible with a waste stored nearby in another containment area ***be separated*** by means of a dike, berm, wall, or other device
- The act deviated from the requirement to such an extent that ***none*** of the provisions were complied with

VIOLATION EXAMPLE 7

An electroplating facility failed to have secondary containment for two concrete waste collection sumps under the floorboards in the plating area.

Other Details:

- One sump accumulated acids; the other cyanides

Potential for Harm: Major, based on:

- In the event of a leak from either of the two sumps, the situation presented a ***serious threat to employees***

Extent of Deviation: Major, based on:

- Regulations require that secondary containment be provided for the sumps
- There was no secondary containment mechanism ***at all***
- The act deviated from the requirement to such an extent that ***none*** of the provisions were complied with.

VIOLATION EXAMPLE 8

An electroplating facility failed to prepare an adequate written waste analysis plan and an adequate sampling plan for hazardous wastes treated onsite.

Other Details:

- The wastestreams involved included cyanide-bearing and heavy metal wastes

Potential for Harm: Major, based on:

- Inadequate testing and analysis of all hazardous wastes means that workers were potentially exposed to ***unknown hazards***
- The facility could not ensure safe handling and safe treatment of hazardous waste since they were unaware of all hazards

Extent of Deviation: Moderate, based on:

- The sampling plan did not list specific ***test methods*** to be used
- There was no written procedure for sample ***chain of custody*** and there was not a distinction made between *hazardous waste* analysis and *wastewater* analysis (which could lead to inaccurate reporting)
- The extent of deviation is ***not major*** because it contained some ***basic elements*** of a waste analysis plan

VIOLATION EXAMPLE 9

An electroplating facility failed to have an adequate training plan to identify ongoing training needs of key personnel.

Other Details:

- Numerous ***other violations*** were observed at the same facility, so the training deficiency suggests that employees were ***not prepared*** to effectively manage hazardous waste.
- Training records were incomplete for the plating manager; training records for other employees were adequate, but not applied to the actual workplace, based on the extensive number of other violations found

Potential for Harm: Major, based on:

- The facility manages wastes including cyanide, acids, cadmium, chromium, and other heavy metals at high volumes
- Failure to receive and maintain adequate training increases the risk that these wastes may be ***mismanaged***, potentially causing harm to human health or the environment

Extent of Deviation: Moderate, based on:

- Training records were ***incomplete*** for the plating manager, who is in direct contact with hazardous waste and oversees others
- Training records for other employees was ***adequate***, although it was clear that many of the topics supposedly learned during ***training had not been applied*** to the actual workplace
- There was ***some attempt*** to comply with training requirements, but not to prepare an actual training plan as required
- Cal. Code Regs., title 22, article 2 of chapter 22 elaborates on the ***dollar figures*** associated with major, moderate, and minimal potential for harm and extent of deviation. Penalty amounts for enforcement cases are outside the scope of this manual; however, there are ***several other factors*** for discussion when assessing the compliance of any electroplating facility (referred to as a *Respondent* in enforcement situations), as covered in section 6.5 below.

6.5 Other Compliance Factors Used to Characterize a Facility

Other factors that that will figure into characterizing an electroplating facility Respondent are:

Cooperation:

- Did the plating facility meet stipulated deadlines in returning to compliance?
- If not, did they request an extension(s) in a timely manner, based on reasonable circumstances?
- Did the facility ignore your requests for information?

Ability to Pay:

- Remember that a facility cannot be given a credit against penalties for the money spent to return to compliance, since they were required to finance compliance in the first place

Prophylactic Effect

- "Prophylactic effect" is an upward or downward adjustment to the total base penalty to ensure that it is sufficient to ***adequately discourage*** such future violations on behalf of both the violator *and* the regulated community

Compliance History:

- Does the facility have a history of compliance problems, including ***past enforcement actions***, ***repeated violations***, or other indications that they are a recalcitrant and/or chronic violator?

Multiday Penalties:
Multiday penalties can be imposed against facilities that fail to meet the return to compliance dates you impose after an inspection. Formulas exist for ***calculating*** multiday penalties; these penalties can add up quickly.

Intent:
You may determine the electroplating facility's intent factor based on whether their violation was intentional or not. Proving that the act was intentional requires an understanding of the ***circumstances*** that led up to the violation. A violator's intent can double or even triple a specific violation's penalty amount.

Economic Benefit:
DTSC provides information on how to calculate the economic benefit of noncompliance for many violations. You can review this information at:
http://www.dtsc.ca.gov/LawsRegsPolicies/Policies/HazardousWaste/HazardousWaste_policies.cfm

6.6 Enforcement Routes and Preparation

6.6.1 Types of Formal Enforcement

Depending on the nature of your regulatory agency, you may request the services of a District Attorney (DA), City Attorney (CA), Attorney General (AG), Circuit Prosecutor, U.S. Attorney, DTSC, or the Cal/EPA Deputy Secretary to provide the legal expertise necessary to take enforcement against an electroplating facility. If you work for a local regulatory agency and note Class I violations at a plating facility that your agency does not have the resources to address via formal enforcement, you should ***request assistance*** on the case from DTSC.

Most agencies are familiar with ***administrative enforcement actions*** (AEOs). For more information on AEOs, you may refer to the guidance document at http://www.calcupa.net/technical/adm-enforcement/AEO_FAQ_3-15-2005.pdf, prepared by the Unified Program Administration and Advisory Group (UPAAG) Enforcement Steering Committee.

The referral and violation criteria for criminal and civil actions are less well-known than those for AEOs.

Criminal Actions are generally referred to DAs or CAs, but may also be referred to the AG, the Circuit Prosecutor, or the U.S. Attorney. In order to proceed with a criminal case, you and your legal team must be willing and able to assume the “Criminal Burden of Proof.” In order to consider a criminal action, the electroplating facility should be characterized as follows:

- Violations are ***severe***
- Acts are ***intentional***
- Civil or administrative actions are ***inadequate***

Civil Actions
DTSC has taken civil actions against many electroplating facilities. Factors for pursuing a civil action include:
The need for ***injunctive relief*** (see section 6.6.3 below)

- Existing DTSC or CUPA enforcement orders were violated
- The need to utilize judicial discovery
- The desire to establish a judicial precedent

As you might expect, ***administrative orders*** typically have the least amount of preparation time and legal involvement; civil and criminal cases, the most.

Besides understanding the different basic types of enforcement, here are some other important enforcement issues to keep in mind:

Multimedia enforcement issues: electroplating facilities occasionally, but infrequently, require an enforcement response from a water board or air district for respective multimedia issues. Follow your agency’s protocol on making any appropriate referrals. Many agencies have access to an available ***task force*** that could assist with multimedia issues.

Temporary suspension or denial of a permit (or other type of authorization) is a very aggressive enforcement response and requires ***extensive justification***. See section 3.3.8 for information on the ***alternative*** of issuing an Imminent and Substantial Endangerment Order, and verify whether your regulatory agency is in a position to proceed with a suspension, denial, or revocation. However, only DTSC has authority to suspend or revoke Tiered Permit authorization.

6.6.2 Toxicologists’ Role in an Enforcement Case

If you are proceeding with a large-scale enforcement case and wish to prove *past or present chemical exposure* to electroplating facility employees, which can greatly support your case in front of a trial, you may enlist the services of a ***toxicologist***, if one is available. Toxicologists can provide *quantitative and qualitative risk information* based on what type of specific data you can provide about the site.

You may work with a toxicologist to build an ***exposure scenario*** at the facility, which can provide valuable information in assessing ***potential for harm***.

To build a scenario and help the toxicologist make a risk-based determination, you should be prepared to provide or research the following types of information:

- Data on concentration, chemical nature, pH, and volume of plating bath tanks
- ***Dimensions*** of the plating room, from wall to wall and including ceiling height
- Dimensions (including thickness) of the ***grates*** composing the floorboards
- Any ***air flow data*** for the facility (e.g., exhaust fan capacity, locations, and/or air exchange rate inside the facility)
- Any protective gear and/or ***health monitoring*** for employees, and if protective gear was actually ***worn*** during working hours
- How ***frequently*** health monitoring is performed
- Others specific to your case and the electroplating facility

Using such information, a toxicologist can determine such factors as:

- Approximate volume concentration of ***HCN gas liberated*** in the event of a spill
- Potential ***acute*** exposure of employees
- ***Chronic*** exposure of employees

Remember, the chances are slim that the toxicologist will have been to the facility; they will be relying on you (and any legal team) to provide the data they need to make their determination.

6.6.3 Injunctive Relief

As part of settlement of a *civil* enforcement order, you may ask the court to impose injunctive relief on the electroplating facility Respondent. Injunctive relief includes ***specific stipulations*** that are intended to ensure that a facility does not ***lapse back into noncompliance*** once the case has settled. While injunctive relief generally should not include items that require the facility to go "above or beyond" statutory and regulatory requirements, it may *elaborate* and *specify* actions to be taken to address historical compliance problem areas.

Some examples of injunctive relief stipulations for an electroplating facility are as follows:

1. *Clean plating floors at least once weekly. Clean up any leak or spill when it occurs, including those which could result in the long or short-term formation of chemical crystals in, below or around floorboards.*

2. *Include in both the training plan and operating procedures the **method** and **process** for cleaning the floor weekly.*

3. *Install **drain boards** and/or implement a spray-rinse process to minimize the spillage of plating chemical solutions to the floor.*

4. *Maintain and make available a log of floor cleaning, including volume of washdown water accumulated, and management and disposal of that washdown water. Include dates and **manifest numbers documenting disposal**.*

5. ***Update** the training plan within 30 days in the event of a process change, change in employee job specification, or other element which would affect the duties of personnel responsible for handling hazardous waste.*

6. *Allow DTSC or the CUPA to inspect the facility during normal business hours without the need for a warrant for a period of five years from the date of the injunction.*

Besides injunctive relief, enforcement follow-up can consist of:

- Follow-up inspection(s)
- Periodic soil sampling around a tank treatment unit that has leaked
- Other methods appropriate for a specific facility or according to your regulatory agency's protocol

Now that we have covered violations and enforcement in detail, we can take a look at strategies to eliminate generation of the waste in the first place: ***Pollution Prevention.***

CHAPTER 7 - POLLUTION PREVENTION IN THE PLATING INDUSTRY

7.1 Overview

It is appropriate to conclude this inspection manual with a chapter on ***Pollution Prevention***. Pollution prevention (P2) reduces or eliminates waste at the source, and therefore has important applications to electroplating facilities. By reducing the amount of waste to be managed, P2 saves ***natural resources*** and has practical consequences such as:

- ***Protecting*** worker health and safety
- Saving facilities ***money***
- ***Reducing*** regulatory obligations

As an inspector, you can do the business you inspect a great service by informing them about source reduction opportunities.

California law defines source reduction as one of the following:

- Any action that causes a ***net reduction*** in the generation of hazardous waste
- Any action taken ***before*** the hazardous waste is generated which results in a ***lessening of the properties*** that cause it to be classified as a hazardous waste

DTSC maintains a Pollution Prevention Branch, in the Office of Pollution Prevention and Green Technology of approximately 40 staff whose mission is to provide state leadership and assistance to industry, local government, and other environmental agencies on P2 issues. More information, including P2 liaison contact information, is available at
http://www.dtsc.ca.gov/PollutionPrevention/index.cfm

7.2 Benefits of Pollution Prevention

The California Hazardous Waste Source Reduction and Management Review Act of 1989**,** also known as Senate Bill 14 (or SB 14), requires hazardous waste generators to consider source reduction as the ***preferred method*** of managing their hazardous waste.

Source reduction is preferable over recycling and treatment options because source reduction:

- Avoids waste management costs
- Avoids future management liability

Source reduction also provides the very ***best protection*** for public health and the environment. In California, businesses that generate more than 12,000 kilograms of hazardous waste (including aqueous hazardous waste) ***or*** 12 kilograms of extremely hazardous waste per year are required to do source reduction planning on a ***four-year cycle***.

Businesses subject to this requirement must Maintain their source reduction documents on site and make them available to inspectors.

Therefore, as part of a routine generator inspection, you should ensure that facilities subject to SB 14 have prepared the ***appropriate documents***. You can find more information on this regulatory requirement at: http://www.dtsc.ca.gov/PollutionPrevention/index.cfm#Hazardous_Waste_Source_Reduction.

A P2 checklist for inspectors is provided in Appendix D.

7.3 Pollution Prevention Options in Electroplating

You may find opportunities for P2 implementation and source reduction when you inspect electroplating facilities.

P2 can be applied to many aspects of plating operations, including:

- Material handling and storage
- Changes in drag-out procedure
- Changes in rinsewater management
- Material recycling, reuse, and recovery
- Process modification
- Process and maintenance changes

These options are all described in more detail in Appendix D.

7.4 Pollution Prevention Resources

DTSC can provide copies of the "*Hazardous Waste Minimization Checklist & Assessment Manual for the Metal Finishing Industry*" (P2 publication #402, October 1993) to plating facilities. You may wish to review this document before you start conducting inspections of plating facilities. ***Provide a copy*** of this document to the facility at the end of the inspection to assist operators who wish to reduce waste generation.

There are also P2 publications related to the metal finishing industry available at:http://www.dtsc.ca.gov/PollutionPrevention/index.cfm#Publications_and_Forms, including the following informational documents *(as of November 2008*):

- *"Metal Finishing Model Shop Program"*
- *"Pollution Prevention Page"*
- *"What is the Metal Finishing Model Shop Program?"*
- http://www.dtsc.ca.gov/PollutionPrevention/MFMS/index.cfm
- *"Model Shop Program General Business Information Form"*
- *"Jewelry Manufacturing Pollution Prevention Recommendations"* http://www.dtsc.ca.gov/PublicationsForms/prog_pubs.cfm?prog=Pollution%20Prevention

Another resource for P2 information is the Western Regional Pollution Prevention Network (www.wrppn.org). The WRPPN operates a "rapid response" feature to provide you or the businesses you inspect with timely information.

Finally, there is an extensive selection of U.S. EPA P2 ***fact sheets*** available at: http://www.epa.gov/p2/

As discussed in section 2.1.2, ***rinse waters*** account for the majority of hazardous wastes generated by most metal plating operations. Therefore, lowering the rate of hazardous rinse waters generation is likely to lead to a significant reduction in the amount of hazardous waste generated by a plating operation.

Facilities may also wish to consider ***recycling*** rinse waters (which was covered in section 3.3.9). Because California's source reduction program includes ***aqueous*** hazardous waste streams, this strategy can significantly reduce the quantity of hazardous waste generated.

In the event of an enforcement action, a P2 activity or concept can make a great ***Supplemental Environmental Project*** (SEP). Be sure that such a SEP is *not redundant* of what the facility already has described in their Source Reduction Plan (SRP).

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(5) Investigation into the Ion Exchange of the Cyanide Complexes of Zinc(2+), Cadmium(2+), and Copper(1+), Gupta, A., Johnson, E.F., and Schlossel, R.H. American Chemical Society. Princeton NJ. 1987.

(6) Policy and Procedure: Conducting Inspections, EO-02-006-PP. Department of Toxic Substances Control. 2003.

(7) Policy and Procedure: Enforcement Response Policy, EO-02-003-PP. Department of Toxic Substances Control. 2002.

(8) Policy and Procedure: Implementing Quarantine Authority, EO-02-002-PP. Department of Toxic Substances Control. 2002.

Appendix A – Example of Health and Safety Appraisal Form

State of California – California Environmental Protection Agency — Department of Toxic Substances Control

HAZARD APPRAISAL AND RECOGNITION PLAN PRESITE VISIT FORM

SECTION A. FIELD TEAM

Prepared by: DTSC inspector
Date: 6/1/2006
Phone: (916) xxx-xxxx

	Name	Unit/Agency	Responsibility (Lead Field Staff)
1.	DTSC inspector	DTSC	Lead
2.	DTSC staff	DTSC	Support
3.	DTSC staff	DTSC	Support
4.	DTSC staff	DTSC	Support
5.			
6.			

SECTION B. SITE DESCRIPTION

Site Name: ABC Platers, Inc.
PCA No: 37160 Project #: 3xxxx WP: 33
Address: 1 Anyplace
City: Los Angeles State: CA Zip: 90001
Site Phone No: (213) xxx-xxxx

NOTE: Attach Map of Site and Directions to Hospital

Contact Person: Owner/Operator name
Type of Operation/Waste Stream (Describe): Electroplating
Purpose of Visit (Describe): Complaince inspection, with sampling
Site Visit Date (s): June 10, 2006
Estimated Time on Site: Hours/Day: 8 hour Days: 1
Nearest Hospital and Address: (Attach map and contact information)
Phone No.: (213) xxx-xxxx

SECTION C. NUMBER OF SAMPLES TO BE COLLECTED

Air:	0	Surface Impoundment:	0
Drum (s):	0	Surface Water:	0
Groundwater:	0	Tank (s):	9
Soil/Sediment:	2	Waste/Sludge:	1
Sump/Pit:	1	Other:	0

SECTION D. POTENTIAL HAZARDS

1. Chemical Hazards

☒ Carcinogens: Cr, Ni, Cd
☒ Corrosives:
☐ Developmental Health Hazards (Teratogen):
☐ Explosives:
☒ Dusts:
☐ Flamables:
☐ Inorganic Vapor Gases:
☒ Metals:
☐ Oxidizers:
☐ PCBs:
☐ Pesticides:
☐ Reproductive Health Hazards:
☒ Skin Absorption: Cyanide
☒ Solvents:

2. Physical Hazards

☐ Confined Space (Source:)
☐ Heat or Cold Stress (Expected (Temp: °F)
☐ Machinery Construction:
☒ Noise (Source/Decibels): ?
☐ Oxygen Deficiency:
☐ Radioactive materials:
☐ Biohazards:
☐ Other(Specify):

(Use this space to describe hazards)
Facility does cyanide-metal electroplating, and generates wastes that contain cyanide, chrome, cadmium, zinc, silver, nickel, and copper, as well as, corrosive alkaline and acidic wastes. It is not known if facility does any polishing or buffing, but it is possible, so staff will carry ear plugs. Samples will be collected, but there is no indication SCBAs will be requuired. SCBAs and four staff will be present during sampling, in case SCBAs are needed.

SECTION E. BASIC INFORMATION ON POTENTIAL HAZARDS
(Attach copies of HARP Chemical Data Sheets or other appropriate information as suggested in instructions.)

SECTION F. EXPOSURE CONTROL METHODS

☐ Engineering (E) ☒ Administrative (A) ☒ Work Practices (WP)

Describe: Staff will not approach areas where wastes are generated or stored unless wearing PPE, and will remain upwind of waste areas. Staff will immediately exit areas where fumes are encountered, or where alarms on monitioring equipment sound. Staff will wash boots and hands upon exiting facility, and will use general good hygiene practices.

SECTION G. REQUIRED PERSONAL PROTECTIVE EQUIPMENT

Level of Protection: ☒ B ☐ C ☒ D

Gloves (s) Outer = O, Inner = I
☐ Cotton/Vinyl
☒ Silver Shield/4H
☒ Neoprene
☐ Nitrile
☐ Grip/Glove/Kevlar (when needed)
☐ Viton

Suit:
☒ Tyvek
☒ P.E. Tyvek
☐ Saranex
☐ PVC
☐ Tychem

Respirator: ☐ A/P Cartridge: ______ ☒ SCBA ☐ Escape

Other Safety Gear:
☐ Boot Covers ☒ Hearing Protection Plugs ☒ Muffs ☒
☒ Boots ☒ Eye Protection ☐ Safety Vest
☒ Hard Hats ☐ Other:

SECTION H. SURVEY EQUIPMENT

☐ Combustible Gas/Oxygen Meter ☐ Radiation Meter
☒ Photoionization Detector ☒ Lamp: 10.6 eV
☐ Organic Vapor Analyzer (OVA) ☐ Aerosol/Particle Monitor
☐ CMF Chip (Specify:) ______ ☐ Noise Dosimeter
☒ PAC III ☐ WBGT Meter
☒ Other (Specify:) PacIII with HCN sensor. Leave area if PacIII goes above 2.5 ppm. Backaway if PID reads @5RRU. Level B with SCBA's required if PacIII goes above 4.7 ppm in breathing zone.

SECTION I. OTHER HYGIENE AND SAFETY EQUIPMENT

Available On Site	Bring	
☐	☐	Canopy/Tarp/Umbrella
☐	☒	Drinking Water
☐	☐	Shower/Eye Wash
☐	☐	Fire Extinguisher
☐	☒	First Aid Kit
☐	☐	Plastic Sheeting/Buckets/Bags
☐	☐	Portable Toilets
☐	☐	Washing Facilities

SECTION J. PERSONAL MONITORING

Do You Need Industrial Hygiene Monitoring? ☐ Yes ☒ No

SECTION K. REVIEW/APPROVAL

Industrial Hygienist (Review) ______ Date ______

Supervisor (Approval) ______ Date ______

DTSC 1031 (6/12/03)
(Formerly DHS 8299 A)

(Original—Exposure Records Copies—Site File, Department, Supervisor)

HOW TO FILL OUT THE HARP FORM

The following are very brief instructions for filing out this form. For complete HARP instructions, see your HARP manual. If you have further questions, ask your regional industrial hygienist.

SECTION A: *Field Team:* Make sure correct unit (SEB, Permits, SMB, ATD, etc.) or Agency (Water Board, EPA, etc.) is noted. This form is intended for DTSC staff only, so include other agencies only if you are working together as one team.

Under "Responsibility," note which task each team member will be doing, such as: Site Safety Officer, Instrument Technician, Sampletaker, etc. Also indicate lead ***staff person***; is same as Site Safety Officer, indicate as such.

SECTION B: *Site Description:* Note site name, PCA code number, address, contact person, and site and hospital map should be attached.

Site Phone: Phone number at facility if it is available. If no phone, give closest phone number, if known.

Type of Operation/Waste Stream: Accurately describe what is being manufactured, treated, stored, or discharged at this site.

Purpose of Visit: Accurately describe what you intend to do during the visit. Possibilities include: taking samples, walk-through (for what purpose?). Overseeing contractor (what is contractor doing?), etc.

Site Visit Date: Self-explanatory.

Estimated Time on Site: Give best estimate of time, number of days.

Nearest Hospital: Call the nearest hospital to confirm that it can accommodate emergency cases from a hazardous waste site. Get the correct phone number for emergencies. Attach the correct page from a Thomas Brother's or other street map, with hospital clearly marked and instructions.

SECTION C: Note type and estimated number of samples to be taken.

SECTION D: *Potential Hazards;* Write in specific name of chemical whose group you have checked and note highest concentration or lab data, if available. Use space to describe hazards.

SECTION E: Collect and attach information on the hazards involved. Information may be obtained from file, complainant, HARP Data Sheets, etc. Include layout of site, if available. When no data sheets are available, attach a summary of acute and chronic effects.

SECTION F: Check appropriate box for Engineering and Administrative control or Work Practices. Describe.

SECTION G: Check level of protection.

Glove(s): Indicate appropriate glove used by "O" or "I"; example: outer glove – O = viton, inner glove – I = Cotton.

Suit: Check type of suit used.

Respirator: Check appropriate box. Indicate type of cartridge for APR.

Other Safety Gear: Check appropriate items.

SECTION H: Check appropriate items.

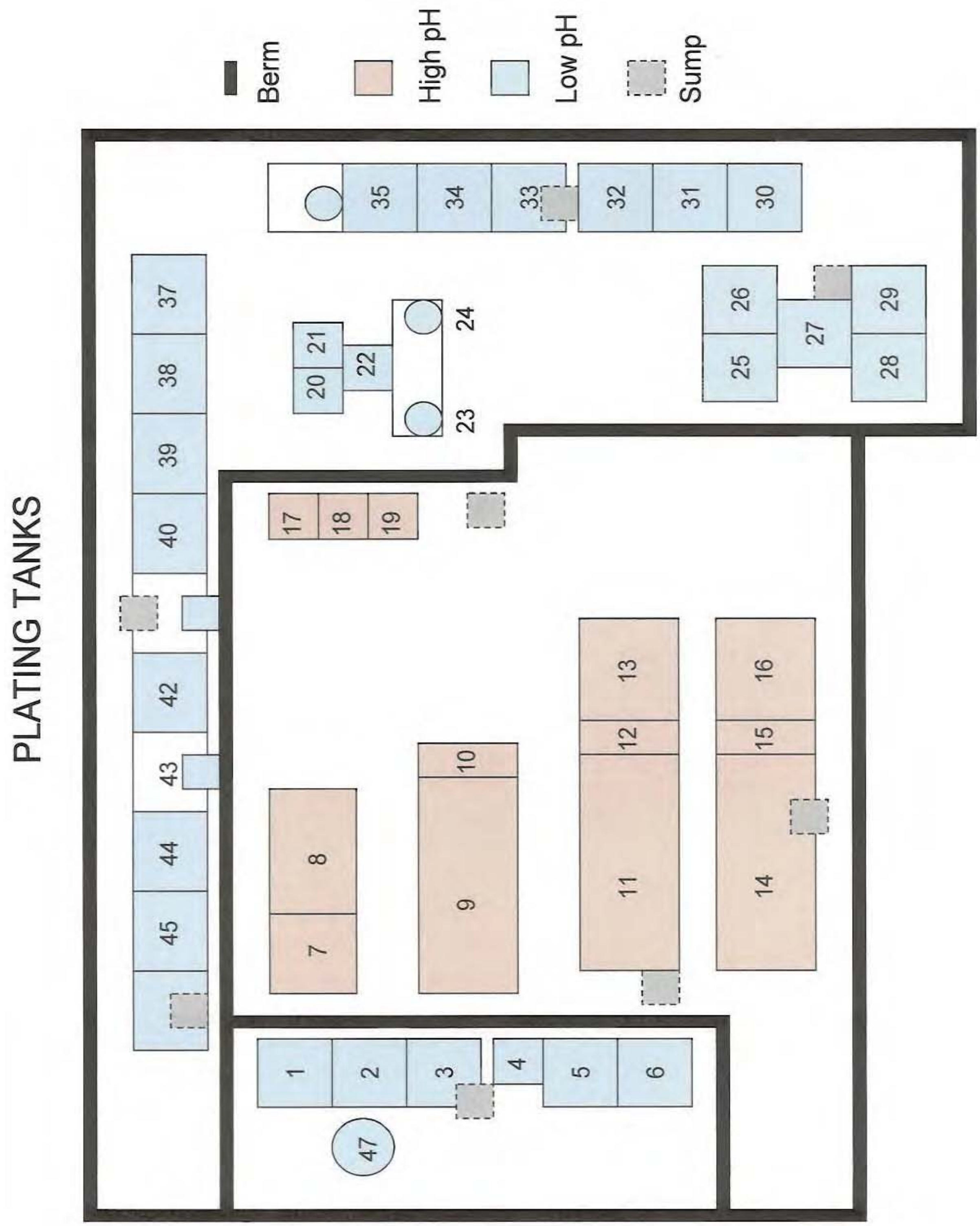
SECTION I: Check appropriate items.

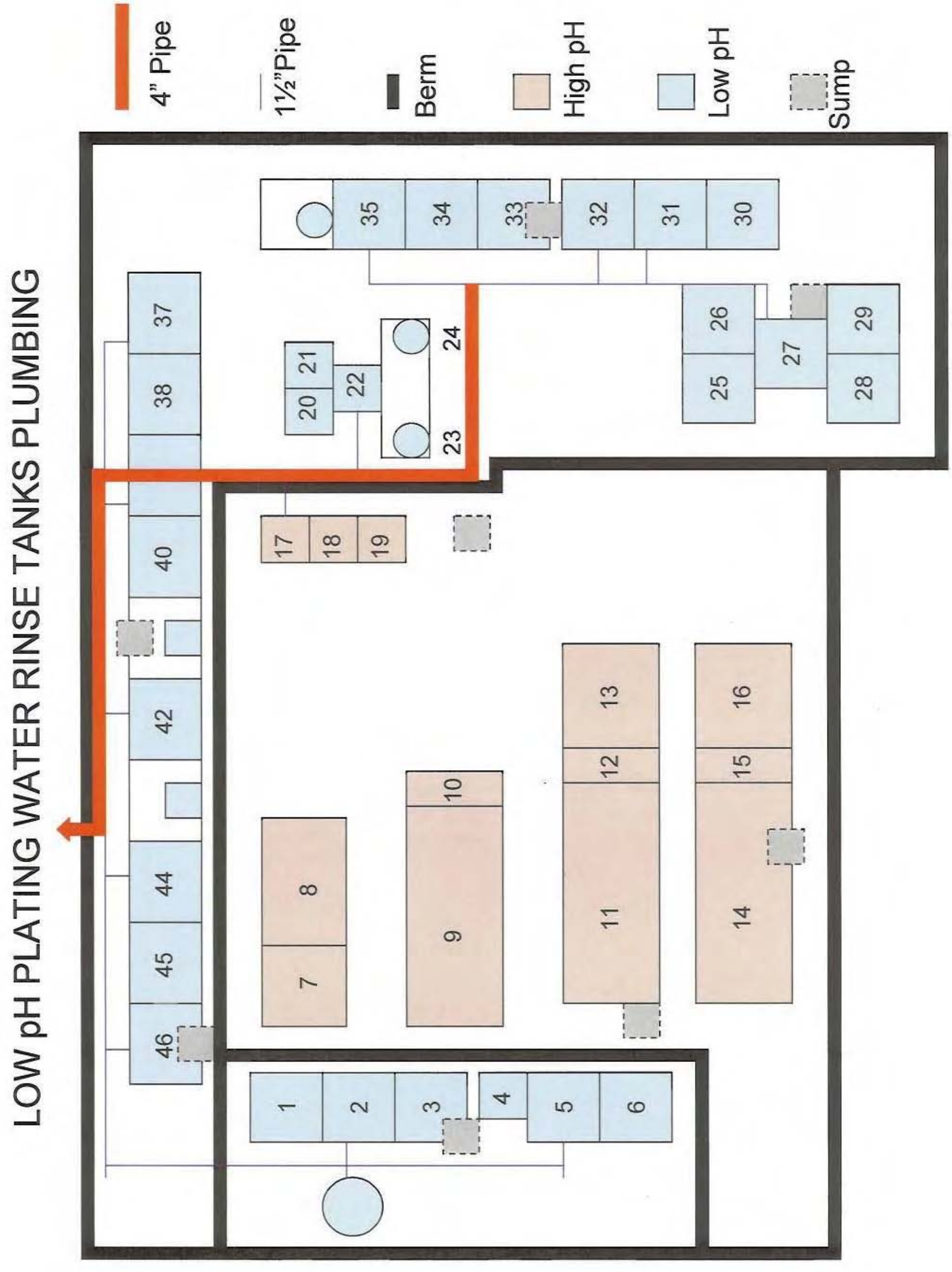
SECTION J: Check boxes, if applicable.

SECTION K: Industrial hygienist should review HARP Form prior to supervisor's signature.

DTSC 1031 (6/12/03)
(Formerly DHS 8299 A)
(Original—Exposure Records Copies—Site File, Department, Supervisor)

Appendix B – Sample Diagrams of Secondary Containment, Sumps, and Berms




4" Pipe
1½"Pipe
Berm
High pH
Low pH
Sump
LOW pH PLATING WATER RINSE TANKS PLUMBING
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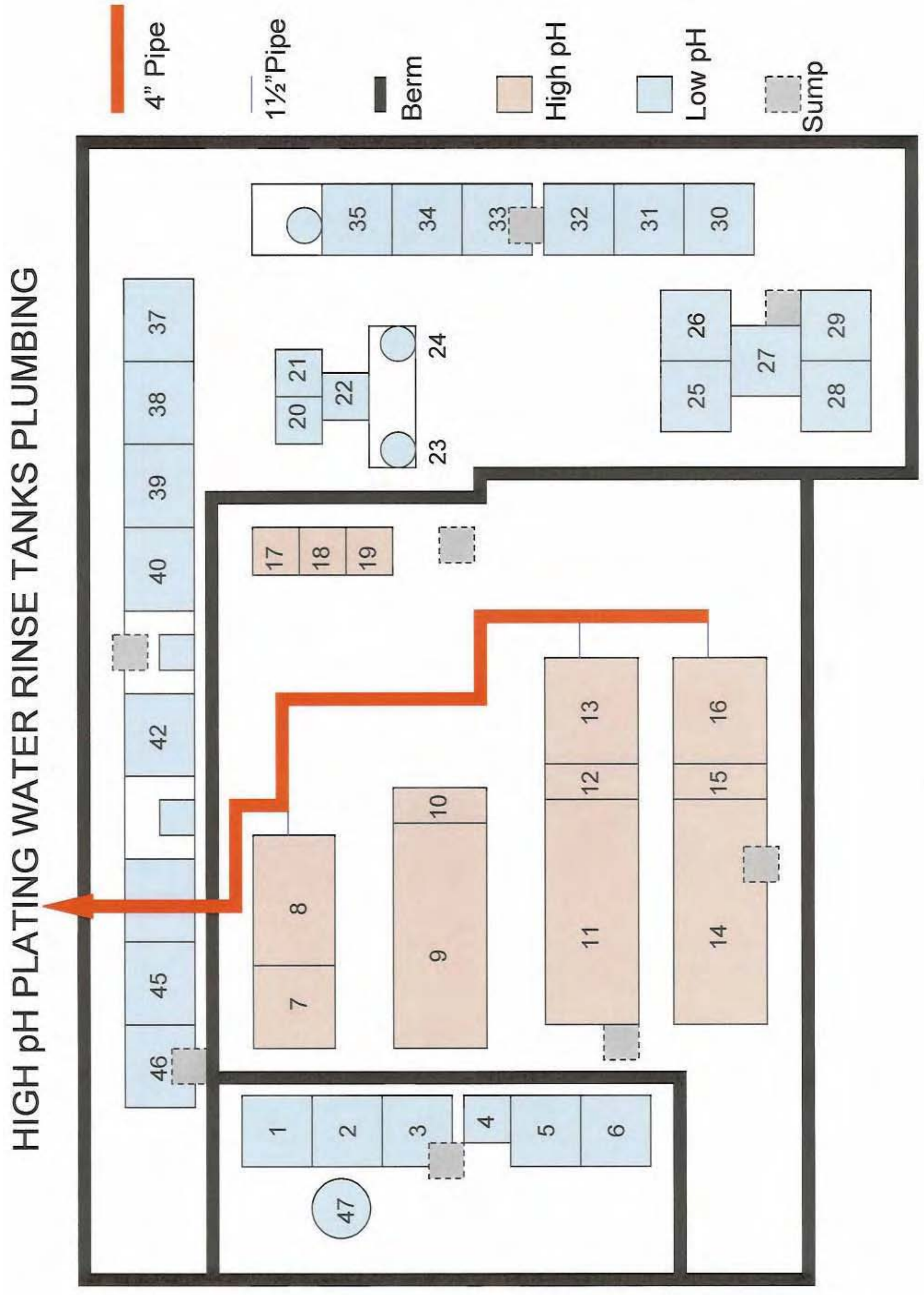
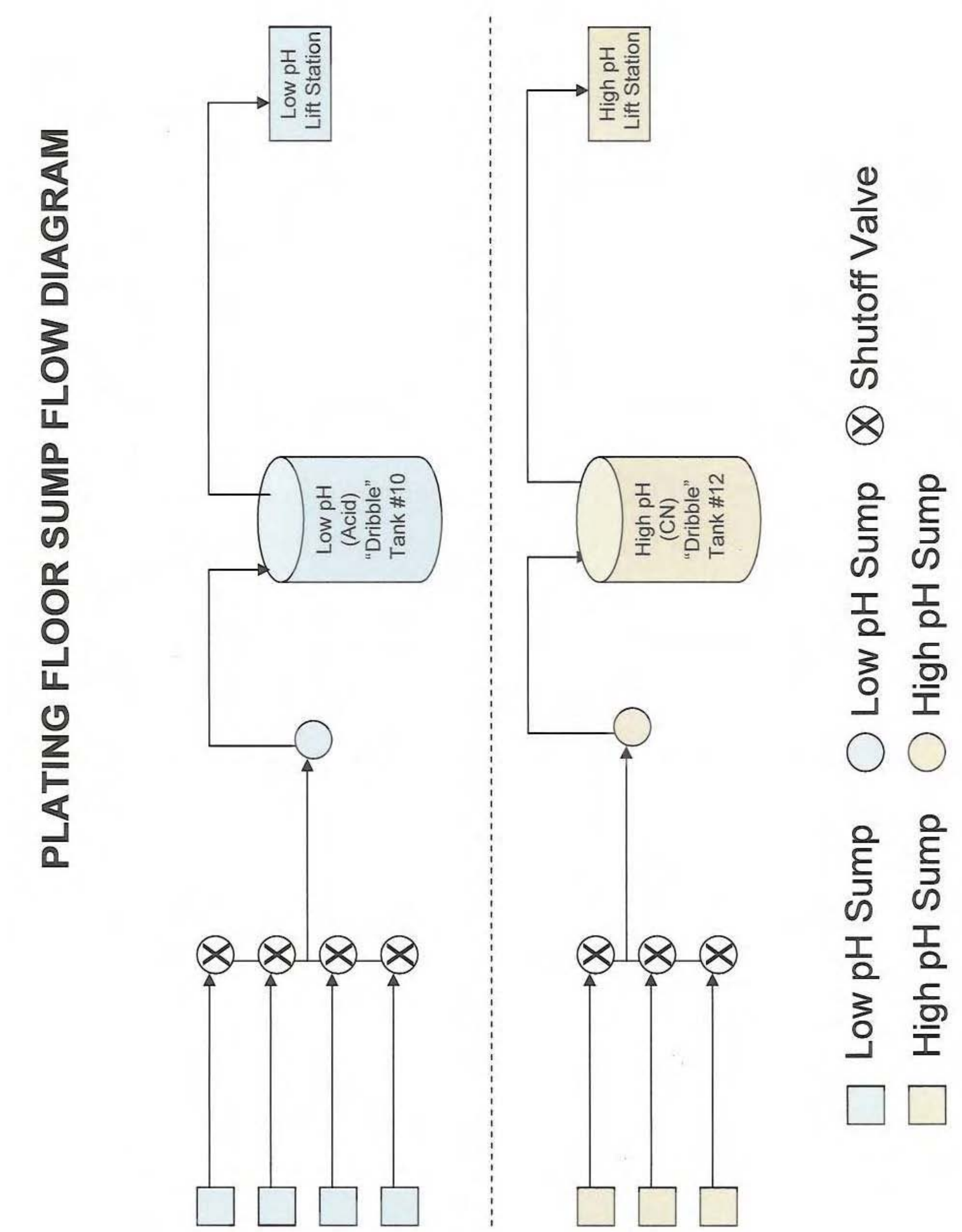

HIGH pH PLATING WATER RINSE TANKS PLUMBING
4" Pipe
1½"Pipe
Berm
High pH
Low pH
Sump

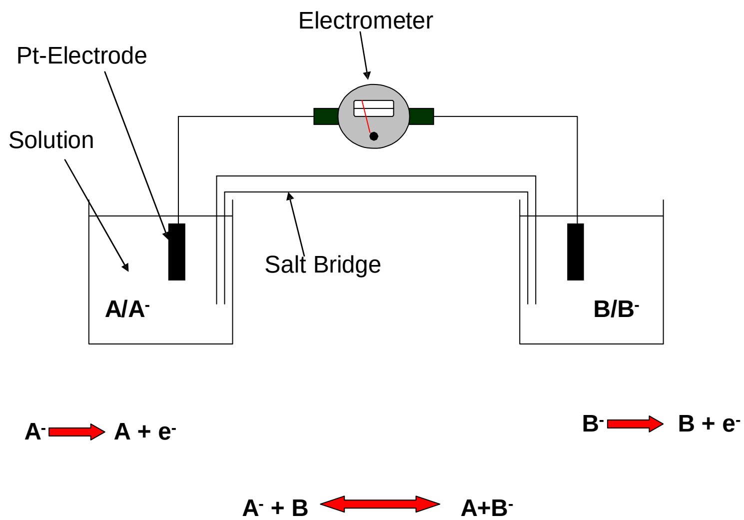

PLATING FLOOR SUMP FLOW DIAGRAM
Low pH Lift Station
Low pH (Acid) "Dribble" Tank #10
High pH Lift Station
High pH (CN) "Dribble" Tank #12
Low pH Sump
High pH Sump
Low pH Sump
High pH Sump
Shutoff Valve

Appendix C – Plating Chemistry

Electroplating

Although a detailed description of plating chemistry is beyond the scope of this manual, it is generally helpful for inspectors to have some basic knowledge of the chemistry involved in the plating process. Therefore, a brief description of plating chemistry is presented here.

The following diagram depicts a generic redox reaction in an electrochemical cell:



Overall reaction:

$$A^- + B \Longleftrightarrow A + B^-$$

In the above reaction, A^- is the donor, and B is the acceptor. An electric charge, in the form of an electron, is transferred from A^- to B. In plating reactions, the metal that will be plated onto the surface of the work piece acts as both the donor and acceptor.

In "electroplating", a work piece is immersed in a plating solution. The tank or container holding the plating solution, in effect, comprises an electrochemical cell. The plating solution contains the dissolved (ionized) metal that will be deposited, or plated, onto the surface of the work piece. Electric current applied causes the deposition of the dissolved metal onto the surface of the work piece via a redox reaction. The redox reaction that occurs in the plating solution literally converts the dissolved (ionized and charged) metal into its elemental (uncharged) form directly on the surface of the work piece. We will now examine how this happens in more detail.

The elemental form of the metal that is dissolved in the plating solution serves as the "anode", and the work piece serves as the "cathode". When the work piece is immersed in the plating solution, and an electrical current is applied, oxidation (i.e., ionization) occurs at the "anode", and reduction (and deposition of the dissolved metal from the plating solution onto the work piece) occurs at the cathode (i.e., the surface of the work piece). Reduction at the cathode depletes dissolved metal from the plating solution, while oxidation at the anode replenishes it.

The redox reaction that occurs in the plating solution may be written as follows:

Cathode half reaction 1) $M^0 \longrightarrow M^{+1} + e^{-1}$

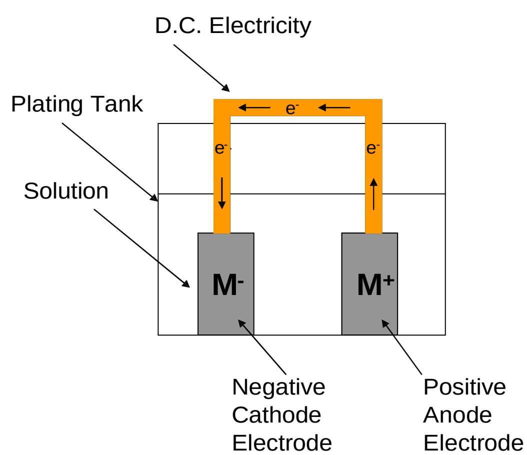
Anode half reaction 2) $M^{+1} + e^{-1} \longrightarrow M^0$

Net reaction: $M^0 \longrightarrow M^0$

Where M is the metal being plated onto the surface of the work piece.

When a current is applied to the plating solution containing dissolved ion M^{+1} as the "electrolyte", and the anode is made of elemental atom M^0, oxidation (or the loss of electrons) will occur at the "anode", and reduction (or gain of electrons) will occur at the "cathode". The net result will be that elemental atom M in the above diagram will lose an electron at the anode, and become a positively charged ion that is dissolved in solution. At the cathode (i.e., the surface of the work piece) M^{+1} ions dissolved in solution will gain an electron and become deposited as elemental metal M. (Metals commonly used for electroplating include zinc, nickel, chromium, copper, cadmium, gold, silver, palladium, and others.)

The following diagram depicts the electrochemical reactions that occur in a plating tank or container when an electrical current is applied:



M = Metal

Electroplating Mechanism: The (-) charge is comprised of the metal/conducting surface to be coated, whereas the (+) charge is comprised of the plating metal. The plating metal dissolves and replaces any deposit adhering to the (-) electrode.

A Word About Cyanide Use in Electroplating

Cyanide may be the single most toxic chemical used in metal finishing. Cyanide is commonly used as an electrolyte for electroplating many different types of metals, especially zinc, copper, cadmium, gold, silver, and some others. The source of cyanide is typically sodium or potassium cyanide, which is added directly to the plating solution.

Cyanide has many properties that make it especially well suited for use in metal plating. For example, it readily joins with a variety of metal ions to form charged metal- cyanide complexes in aqueous solution. According to the US EPA Capsule Report on Managing Cyanide in Metal Finishing, the use of cyanide in plating stems from its ability to weakly complex many metals in aqueous solution (1). According to Lowenheim, Schwartz and Swalheim, the formation of a metal-cyanide complex alters the "reduction potential" of the metal ion, changing the potential required for metal deposition to occur in the plating process (2, 3). This shift may improve plating and prevent "immersion deposits" from forming, and causes an even metal deposit to form that has lower sensitivity to impurities present in the plating solution (see http://www.pprc.org/pubs/metalfin/rt_appc.html).

Indeed, although less toxic alternatives to cyanide have been available for some time, cyanide continues to be used extensively in the plating industry because cyanide-based plating solutions have a tendency to be much less affected by impurities than other plating solutions. Cyanide in the plating solution may also remove tarnish or other undesirable films from surfaces to be plated. In other words, cyanide has a number of properties that facilitate the plating process and make it easier and cheaper to maintain plating solutions.

According to the US EPA Capsule Report on Managing Cyanide in Metal Finishing, cyanide can also shift the reduction potential for two different metals, to make them nearly identical (1). The metal with the lowest "reduction potential" will typically plate first when a current is applied; however, if the electrical reduction potentials of two different metals are close, they can be plated simultaneously to create an "alloy", such as brass or bronze.

A Word About Carbonates and Cyanide Plating

Carbonates are salts of carbonic acid (H_2CO_3), where metal ions replace the two hydrogen atoms:

$$H_2CO_3 + 2M^+ \longrightarrow M_2CO_3 + 2H^+$$

Where M is a dissolved metal ion from the plating solution.

Carbonates readily form in metal-cyanide plating solutions, and the metal-carbonate complex has a tendency to precipitate out of solution at high concentrations or low temperatures.

In cyanide plating solutions, carbonate typically comes from two sources: during plating, cyanide is converted directly into carbonate by electrolysis. Also, in cyanide-metal plating solutions, free cyanide exists in equilibrium with cyanide-metal complexes. When the pH of the cyanide plating solution is lowered, free cyanide in the solution will combine with available hydrogen ions to form hydrogen cyanide (HCN) gas that may escape from the solution. Therefore, most cyanide-metal plating solutions are maintained at a high pH (>10) to prevent the release of extremely toxic HCN gas. (Gold-cyanide plating solution is an exception; cyanide has a high affinity for gold, and the gold-cyanide complex is extremely stable, even under acidic conditions.) High pH (i.e., alkaline) solutions readily absorb carbon dioxide gas from the air to form carbonates:

$$CO_2 + OH^- \longrightarrow HCO_3^-$$

which can combine with dissolved metal ions in the plating solution to form metal carbonates.

According to Mandich, bicarbonate ion ($HCO3^-$) actually serves as a useful buffer in the pH range (10.8 – 11.5), where most metal cyanide plating solutions are maintained (4). However, excessive carbonate accumulation is unfavorable as it generally leads to problems with the plating process. For example, excessive carbonate accumulation in copper plating baths produces rough and grainy copper deposits on the work piece, instead of smooth, bright deposits. Agitation or aeration of the plating solution facilitates carbonate formation. According to an article on Pollution Prevention and Control Technologies for Plating Operations published by the National Metal Finishing Resource Center, "excessive carbonates cause increased resistance in the plating solution, yielding low plating current densities, which accentuate the poor appearance that metallic impurities cause. An excessive carbonate concentration can also affect the smoothness of deposits, plating efficiency and plating range. Both sodium and potassium baths are affected by carbonates. However, the sodium bath is affected at a much lower concentration (14 oz/gal vs. 40 oz/gal)" (see: http://www.nmfrc.org/bluebook/tocmain.htm).

(It should also be noted that, according to Pollution Prevention for the Metals Finishing Industry - A Manual for Pollution Prevention Technical Assistance Providers, published by the North Carolina Department of Environment and Natural Resources (see: http://www.p2pays.org/ref/03/02454/plating.htm), the buildup of carbonate salts can increase process solution drag-out by as much as 50 percent. Drag-out will be discussed in more detail in the section of this manual dealing with hazardous wastes generated in plating processes.)

There are many different options for treating sodium cyanide baths to remove excess carbonate accumulation. “Carbonate freezing" or crystallization is one such option. The carbonate freezing process takes advantage of the low solubility of carbonate salts in the bath. Bath temperature is lowered to approximately 26 degrees Fahrenheit to crystallize the salts, which can then be removed by filtration. Carbonate freezing is used most often in cadmium cyanide plating, zinc cyanide plating, copper cyanide plating, and copper cyanide strike. Sodium cyanide baths can be treated by carbonate freezing. However, carbonate freezing does not work on potassium cyanide plating solutions.

Precipitation is an alternative method to carbonate freezing, and will work for both sodium and potassium cyanide plating solutions. In this process, specific chemicals are used to selectively precipitate carbonates. Chemicals used for this purpose include barium cyanide, barium hydroxide, calcium hydroxide, calcium sulfate, or calcium cyanide.

Excessive carbonate accumulation, combined with contaminants in the plating solution, lead to the accumulation of precipitates in the plating solution. Also, the processes of carbonate freezing and selective precipitation of carbonates generate precipitates. These precipitates are generally and collectively referred to as “plating bath residues”. Filtration or gravity sedimentation are used to remove these residues. Recovered plating bath residues are generally not classified as aqueous waste, or “waste water”, because they typically contain far more than 1% solids by weight. Plating bath residues from plating operations where cyanides are used in the process are listed as F008 RCRA hazardous wastes on the basis of their toxicity and reactivity.

These residues tend to contain very high concentrations of cyanide and precipitated metals. Filters contaminated with F008 wastes are classified as F008 wastes. The costs of transportation, and offsite treatment and disposal for F008 wastes, are usually high because of the extremely hazardous and reactive nature of the waste. Therefore, it is common for plating shops to treat their F008 wastes. However, because this waste is considered extremely hazardous and reactive, it is not eligible for treatment under California’s onsite treatment tiers, and, in California, its treatment requires a full or standardized hazardous waste treatment permit from the Department of Toxic Substances Control.

Metal Finishing Pollution Prevention Opportunities Checklist

Prepared by Allison Gemmel
CH2M Hill and
Philip Lo, CSDLA, 12/90.

Solid Waste Management
County Sanitation Districts Of Los Angeles County
1955 Workman Mill Road, Whittier, CA 90603-4998

Mailing Address:

PO. Box 4998,
Whittier, CA 90607-4998

Charles W Carry
Chief Engineer and General Manager
Telephone: (213) 699-7411, (213) 685-5217,
Fax: (213) 695-6139

Pollution Prevention Opportunities for Metal Finishing

The keys to pollution prevention in metal finishing are to minimize chemical dragout; minimize the amount of water used for rinsing; and recover, reuse, and recycle plating chemicals.

Y/N	Opportunities	Comments
	I. Material Handling and Storage	
	Control inventory	Do not allow material to exceed shelf life. Use materials on a first-in, first out basis.
	Buy appropriate amounts	Buy materials in small quantities if only small amounts are required.
	Cover outdoor storage	Divert clean stormwater away from storage areas.
	Install spill	Spills can be contained and managed. Reduces
	Containment	wastewater treatment upsets.

	II. Dragout	
	Lengthen dragout time	Allows more chemical to drip back to process tank, so reduces the amount of chemical introduced in rinsewater
	Establish dragout timing	Post dragout times at tanks to remind employees.
	Install drain boards or drip guards	Boards and guards minimize spillage between tanks and are sloped away from rinse tanks so dragout fluids drain back to plating tanks.
	Install drip bars	Drip bars allow personnel to drain part hands free without waiting, so personnel will not use too short a dragout time.
	Mechanize dragout	Eliminates possibility of employee using too short a dragout time, maintains product QA/QC standards if timing is set properly.
	Reduce pockets on parts	Place parts on dragout rack to minimize chances of chemical pooling in corners or in other pockets.
	III. Rinsing	
	Use static rinses	Static rinses usually follow the plating bath and capture the most concentrated dragout for returning to the plating bath or for metal recovery.
	Use countercurrent rinses	These rinses dramatically reduce the amount of water required for rinsing and therefore reduce the amount of wastewater to be treated or sent for metal recovery.
	Use conductivity sensor	This sensor gives an indication of the cleanliness of the rinsewater. Sensor can be designed to trigger clean rinsewater flow when the tank water gets too dirty. Also allows better QA/QC.
	Use spray or fog rinsing	Reduces rinsewater amount required and can also be used over plating baths.
	Use foot pump or photosensor to activate rinse	These items allow use of sensor to activate rinsewater only when processing parts. A photosensor may be used on automatic plating lines
	Agitate rinse bath	Agitation promotes better rinsing. Agitate water or part.
	Install flow restricters	
	Install flow control meters	

	IV. Material Recycle, Reuse, and Recovery	
	Reuse deionized rinsewater	Depending on product, this rinsewater can be reused in a plating bath as evaporated water makeup.
	Ion exchange on rinsewater	Ion exchange can be used to concentrate metals in rinsewaters and metal can be recovered from the ion
	Reuse spent acid/alkaline	Spent acid can be used to neutralize an alkaline waste stream. Spent alkali can be used to neutralize an acid waste stream.
	Reverse osmosis	Concentrate dragout for reuse in plating bath; the water stream can also be reused.
	Evaporation	Concentrate dragout for reuse; the water condensate can also be reused.
	Electrodialysis	Recover chromium from hard chromium plating baths and rinsewaters.
	Electrowinning	Recover metals from spent plating baths or ion exchange acid regenerant streams.
	Reuse mild acid rinsewater	Use mild acid rinsewater as influent to rinse following alkaline cleaning bath. Improves efficiency of rinse, so less rinsewater
	V. Process Modification	
	Eliminate cyanide baths	Change to a noncyanide plating bath. Alternate chemistries are available with the exception of copper strike.
	Use deionized (DI) water	Use DI water in plating baths, static rinses, and if practical in running rinses. DI water reduces impurities in the plating bath to extend its life and minimizes the precipitation of minerals in water as sludge.
	Segregate waste streams	Increases recovery and treatment technology efficiencies. Acidic/alkaline. Chrome/non-chrome. Concentrated/dilute. Chelated/non-chelated. Cyanide/noncyanide.
	Use different process	Replace toxic cadmium plating with relatively nontoxic aluminum ion vapor deposition to achieve metal hardening properties.
	Eliminate intermittent jobs	Stop performing small plating operations that generate intermittent waste streams that personnel are not familiar with treating.
	Convert to dry floor	Reduces chances of spills reaching floor drains or causing upset in wastewater pretreatment plant.

	VI. Process Operation and Maintenance	
	Increase bath temperature	Evaporates bath water so relatively clean waste rinsewater can be reused as bath makeup water. Reduces solution viscosity so more chemical drains back to process tank during dragout *Do Not Use On Cyanide or Hexavalent Chromium Baths.*
	Optimize bath concentrations	Only replace plating chemical when necessary. Lengthens bath life.
	Install bath filter	Filter can remove particulates and trace contaminant organics in the process bath, lengthens bath life. Use a filter that can be unrolled, cleaned and reused.
	Raw material purity	Use high quality raw materials in bath so bath will not become contaminated as quickly.
	Reduce bath dumps	Optimize bath operation so bath dumps are infrequent.
	Spill cleanup procedures	Establish procedures for what to do with a Spill. Mitigates chance of spill being discharged to wastewater treatment plant.
	Perform preventive maintenance	Routinely check for leaks in valves and fittings. Repair immediately.

D R A F T

SB 14 Compliance Checklist for DTSC and CUPA Field Inspectors

Facility Name:______________________ EPA ID Number:_______________

Reporting year: ______________ Baseline year:__________

A. APPLICABILITY [22 CCR 67100.2]

1. Does facility pretreat hazardous waste on-site in a wastewater treatment system, and then discharge the effluent to the sewer? ___Yes ___No
2. If yes to No. 1, enter the approximate volume of wastewater prior to pretreatment generated in the reporting year. *If the amount is greater than 3,165 gallons, SB14 applies.* _________ *If not, proceed to No. 3.*
3. Convert the value from No. 2 to pounds (8.34 lbs/gallon). _________
4. Review hazardous waste manifest data (Haznet data) and subtract from the reporting year total: a) exempted waste streams; b) nonroutinely generated wastes; and c) hazardous waste treatment residuals. *(May need to work with the facility to make determination regarding routine generated wastes)* _________
5. Add the values from No. 3 and No. 4. _________
6. Does the total from No. 5 exceed 26,400 lbs? ___Yes ___No

If "No," SB14 does not apply. If "Yes," proceed to Section B.

B. ARE SB14 DOCUMENTS PREPARED?

1. Does the generator have a Source Reduction Plan available at the site for review [22 CCR 67100.5]? ___Yes ___No
   1a. If "No," is the generator a small business and does it have a completed Compliance Checklist or equivalent document [22 CCR 67100.2(f)]? ___Yes ___No
2. Does the generator have a Performance Report available at the site for review [22 CCR 67100.7]? ___Yes ___No
   2a. If no, is the generator a small business and does it have its most recent biennial generator report available for review [22 CCR 67100.2(f)]? ___Yes ___No
3. Is the generator aware of the requirement to submit an SPR and have they submitted one to DTSC [22 CCR 67100.9]? ___Yes ___No
   Contact OPPTD to find out if generator submitted an SPR (optional).
   Facilities that have not prepared SB14 documents should obtain the SB14 Guidance Manual from OPPTD by calling (916) 322-3670 or accessing the website [http://www.dtsc.ca.gov/PollutionPrevention].

C. CHECK COMPLIANCE INDICATORS

1. Does the Plan include process descriptions, including block flow diagrams [22 CCR 67100.5(i)(3)]? ___Yes ___No
2. Does the Plan identify and quantify hazardous waste generation by California Waste Code (CWC) [22 CCR 67100.5(i)]? ___Yes ___No
3. Does the Plan identify source reduction alternatives for each major waste stream [22 CCR 67100.5(j)]? ___Yes ___No
4. Does the Plan include a schedule for implementing selected source reduction alternatives [22 CCR 67100.5(p)]? ___Yes ___No
5. Does the Plan include signed technical and financial certification statements [22 CCR 67100.13]? ___Yes ___No
6. Does the Performance Report compare reporting year hazardous waste generation with that of the baseline year for each major waste stream [22 CCR 67100.8(a)(3)(A)]? ___Yes ___No

Appendix E - Treatment of Aqueous Waste Containing Cyanide under Permit by Rule

The cyanide-bearing waste is generally presumed to be reactive and extremely hazardous. Until August 6, 2008, extremely hazardous or reactive waste was normally ***not eligible*** for onsite treatment authorization under a Permit by Rule (PBR), or any lower tier of the Tiered Permitting system. Therefore, a grant of authorization from DTSC was required to treat any hazardous waste containing cyanide, *even if it was generated onsite.* DTSC provided this "other authorization" in the form of a cyanide treatment authorization Consent Order from 1997 through 2002.

Even though most hazardous waste generated in electroplating is regulated under RCRA, the treatment of this waste is exempt from federal permit requirements so long as it is:

a) Treated in waste water treatment units (tanks) as defined in 40 Code of Federal Regulations, part 260.10, and discharged to a publicly owned treatment works (POTW) operating under a National Pollutant Discharge Elimination System (NPDES) permit, or

b) Treated in an accumulation tank or container within 90 days of the date it is first generated, for large quantity generators (or 180 or 270 days for facilities that generate between 100 kg and 1000 kg of hazardous waste per month), or

c) A listed waste discharged directly to the POTW where it is mixed with domestic sewage, as described in the California Code of regulations (Cal. Code Regs.), title 22, section 66261.4(b)(2) (this is the Domestic Sewage Exclusion; see Section 2.3.2.1 for more information).

DTSC issued Consent Orders to electroplating facilities authorizing onsite treatment of dilute aqueous waste streams containing cyanide. Consent Orders were issued to facilities on a case-by-case basis, and only ***under the condition*** that the cyanide waste treatment be conducted in accordance with all standards applicable to PBR. In addition, DTSC inspected each facility prior to issuing a Consent Order to ensure that the facility was operating in compliance with the Hazardous Waste Control Law and all applicable regulations. Consent Orders were only issued to facilities in full compliance with all applicable hazardous waste regulations and laws.

DTSC determined that onsite treatment of wastewaters containing relatively low levels of cyanide does not present an increased risk to public health and safety, or the environment, so long as the treatment is conducted in accordance with certain standards.

"The PBR for the Treatment of Aqueous Wastes Containing Cyanides" regulations became effective on August 6, 2008.

What are facilities expected to do since the cyanide regulations are enacted?

Since August 6, 2008, facilities treating cyanide waste onsite, which qualify for the PBR treatment, have the following options:

1. File an ***amended*** PBR notification with the CUPA in order to keep operating if they have not already done it
2. ***Close*** their unit if they no longer wish to treat cyanide, following all the requirements for tank closure as described in Cal. Code Regs., title 22, section 66265.197

If a cyanide treatment facility does ***not*** qualify for PBR treatment under the new regulations, they have the following options:

1. ***Close*** their unit, following all the requirements for tank closure as described in Cal. Code Regs., title 22, section 66265.197.
2. File a ***standardized*** or ***full permit*** application.
3. ***Modify*** their cyanide treatment process to be eligible under PBR.

Pursuant to the Consent Order, Stipulation and Order, or Non-Notifier Order, facilities are no longer authorized to treat cyanide wastes under the previously issued cyanide Consent Orders. .

A cyanide treatment facility does not qualify for interim status. Facilities seeking a standardized or full permit was required to submit their permit applications to DTSC within 60 days of the termination of their cyanide consent order if they wished to continue operating.

Treatment of Aqueous Waste Containing Cyanide under PBR:
The following are highlights of the new regulations effective August 6, 2008, for PBR for Aqueous Waste Containing Cyanide. (Cal. Code Regs., title 22, section 67450.11, subsection (d)):

(1) Applicability
(2) Eligible waste streams
(3) Eligible treatment processes
(4) Best Management Practices
(5) Non-aqueous not allowed under PBR
(6) Electrowinning of process solutions
(7) Dilution (bleeding) of process solutions

(1) Applicability

- Treatment is not regulated under the federal Resource Conservation and Recovery Act (RCRA);
- Waste is a hazardous waste because it contains cyanide with or without metals;

- Treatment is conducted with processes listed;
- Treatment is conducted in tanks or containers;
- Operator is in compliance with the best management practice (BMP) requirements; and
- Discharges to air comply with applicable air pollution control and worker safety regulations.

(2) Eligible Waste Streams
The following waste streams can be treated with any of the below named eligible treatment methods: **aqueous wastes generated by**

1. Rinsing workpieces and fixtures holding workpieces that were processed in cyanide-containing solutions;

2. Reverse osmosis or the regeneration of demineralizer (ion exchange) columns that were used for recycling of wastewaters at facilities that maintain zero discharge of wastewaters derived from the treatment of cyanide-containing aqueous waste;

3. Rinsing containers, pumps, hoses, and other equipment used to transfer cyanide solutions onsite;

4. Rinsing spent anode bags or empty containers prior to onsite reuse; or

5. Onsite laboratories conducting analyses and testing.

Additional Eligible Aqueous Waste Streams/Treatment Method Activities for Aqueous Waste Streams Containing Cyanide

1. Spent process solutions containing recoverable amounts of metal may be treated by electrowinning in order to recover those metals; and

2. Spent process solutions may be treated by diluting into the aqueous waste, provided the resulting solutions are further treated by any of the eligible treatment methods listed below.

(3) Eligible Treatment Processes

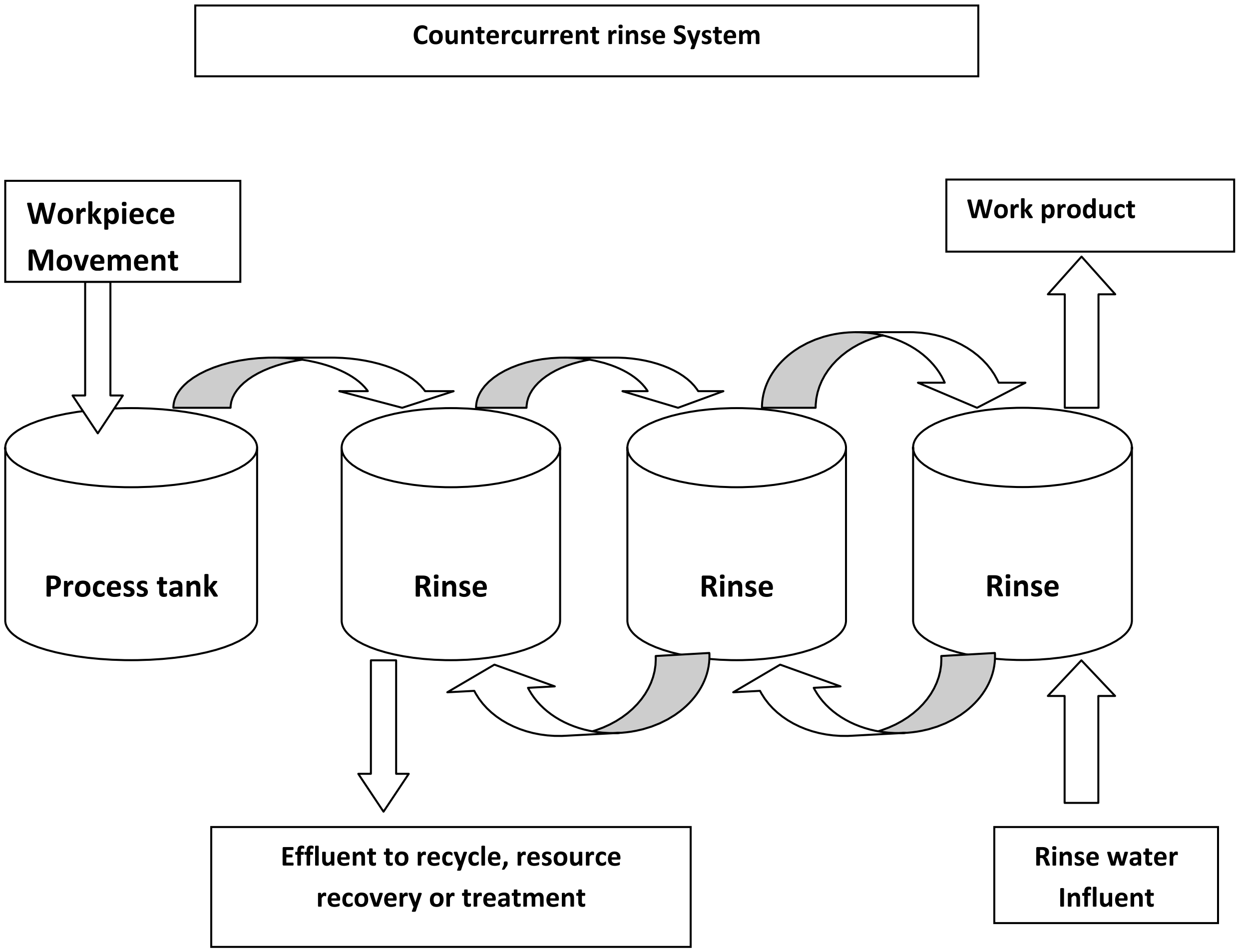
- Oxidation by addition of hypochlorite;
- Oxidation by addition of peroxide or ozone, with or without the use of ultraviolet light;
- Alkaline chlorination;
- Electrochemical oxidation;
- Ion exchange; or
- Reverse osmosis.

(4) Best Management Practices

There are many best management practices that facilities can use to reduce waste generation, and minimize or eliminate releases to work areas and the environment. The new regulation requires all facilities that chose to operate under PBR to treat cyanide waste to meet the following:

- Reduce waste generation, and minimize or eliminate releases to work areas and the environment
  - Use holding racks and/or drain boards between all process and rinse tanks to contain plating drag-out, rinse solution drag-out, and return drag-out solutions to process tanks.
  - Drain boards between tanks capture the dripping solution off of parts, and route it back to the bath. Depending upon bath chemicals, drip boards should be hinged to allow access between the tanks. By eliminating the space between bath and rinse tanks, you prevent the process chemicals from dripping onto the floor and generating an additional waste. Holding racks help make draining more efficient and reduce the amount of drag-out. The parts need to be placed so that:
    - The largest draining surface is as near to vertical as possible,
    - The longer dimension of the part is horizontal, so that the solution has the shortest distance to flow, and
    - The lower edge is slightly tilted, so that runoff is from a corner.
  - Use countercurrent rinsing to reduce water use and wastewater generation; when multiple sequential rinse tanks are used.
    - When multiple rinse tanks are used to provide rinsing, a countercurrent rinsing system can significantly reduce the use of water when compared to a conventional single stage rinse system. As the name indicates, the work piece flow moves in the direction opposite to the rinse water flow. Water exiting the last rinse tank that the work piece is immersed into becomes the feed water to the previous rinse tank, and so on for the number of tanks in the line.

(See next page.)



- Every 4 years, review the use of cyanide containing process baths to determine if a non-cyanide alternative with equivalent results is available as part of:
  i. the Source Reduction Evaluation Review and Plan pursuant to the California Health and Safety Code, section 25244.19,
  ii. an Environmental Management System, or
  iii. an environmental performance evaluation plan.
- Provide initial and annual training to employees, who handle cyanide process solutions, cyanide-containing rinse waters, or manage cyanide containing aqueous waste, on how to reduce wastes in the production area, including, but not limited to, procedures to:
  i. reduce drag-out of plating baths,
  ii. minimize contaminants in process baths,
  iii. extend process bath life,
  iv. minimize chemical spills and splashes from process and rinse solutions handling practices, and
  v. respond to chemical spills to reduce waste and minimize releases from process and rinse solutions handling practices.

Note: This is a new requirement to train employees who handle any cyanide materials.

(5) Non-aqueous waste not allowed

- Non-aqueous cyanide containing wastes may not be treated under this authority
  - o Aqueous is defined as less than or equal to 1% of suspended solids, as measured by Method 209C in “Standard Methods for Examination of Water & Wastewater”
    Cal. Code Regs., title 22, section 67450.11, subsection (b)
- Solids are not allowed to be treated under the current regulations

(6) Electrowinning of Process Solutions

- Spent process solutions containing recoverable amounts of metal may be treated by electrowinning in order to recover metals
  - o Incidental treatment of cyanide contained in the spent process solution by the electrowinning process is also authorized
  - o Electrowinning refers to, in this case, the electro-deposition of metals from spent process solution.

(7) Dilution of Process Solutions

- Spent cyanide-containing process solutions may be treated by slow addition to the rinseates for the purpose of reducing cyanide processing hazards provided:
  - o Solutions resulting from the authorized mixing are further treated by listed processes
  - o The Owner/Operator managing this cyanide-containing spent process solution complies with additional requirements.

There are Additional Requirements for the Dilution of Process Solutions

A. The concentration of cyanide in the receiving solutions does not exceed 5,000 milligrams per liter (mgl) or parts per million (ppm) of total cyanide;
B. The residual solids removed by any treatment process allowed in the Cal. Code Regs., title 22, section 67450.11 are recycled by a facility that recovers metals, or is determined not amenable due to technological or economic reasons;
C. A justification statement is prepared by January 30 for any residuals not recycled in the previous year. Details required in the justification statement are specified.
D. The justification statement may include other information that formed the basis of the generator’s decision not to recycle.
E. Records are maintained at the facility for three (3) years and are made available to authorized representatives of DTSC, the CUPA, or the U.S. EPA upon request, inlcuding;

- Written approval from the agency operating the POTW receiving the facility's discharges [required by the Cal. Code Regs., title 22, section 67450.3, subsection (a)(7)(A) or section 67450.3, subsection (c)(5)((A)];
- Written method documented in the waste analysis plan required by the Cal. Code Regs., title 22, section 67450.3, subsections (a)(10)(A) and (c)(8)(A) for ensuring that the concentration of total cyanide does not exceed 5,000 mgl in the aqueous waste resulting from the mixing authorized in the Cal. Code Regs., title 22, section 67450.11(d)(7); and
- Documentation that the residual materials generated by the treatment have been either sent to a recycling facility for metals recovery or determined not to be amenable for recycling in accordance with the Cal. Code Regs., title 22, section 67450.11(d)(7)(C).

A. 5,000 ppm is total cyanide

The testing does take more time but with a consistent process, the testing interval can be lengthened. Conversely, for processes that vary greatly batch to batch, this may not be a good alternative.

B/C/D -Recycling the residuals

A justification statement is prepared when any treatment residual solids are not recycled in accordance with the Cal. Code Regs., title 22, section, 67450.11, subsection (d)(7)(B)(1) in a calendar year. Owners or operators shall complete this justification statement by January 30, for any shipment of residual solids not recycled in the previous calendar year. The justification statement shall include all the following:

1. chemical composition of the residual solids, including but not limited to, the concentration and type of metals present, cyanide concentration, and water content; and the total weight or volume of the residual solid not recycled during the previous calendar year.

2. chemical composition of the spent process solutions, including but not limited to, the concentration and type of metals present, and cyanide concentration; and the total weight or volume of the spent process solution treated during the previous calendar year.

3. current year cost estimates expressed in dollars per pound or dollars per gallon for the following hazardous waste management options, including transportation:

   - offsite disposal of the residual solids including treatment;
   - offsite recycling of the residual solids;
   - offsite treatment of process solutions; and
   - onsite treatment of process solutions.

4. (a) basis for the decision to not recycle the residual solids. DTSC does want a comparison of cost of disposal vs. recycling of sludge only

   (b) economic and provide a comparison of the hazardous waste management costs including, but be not limited to, all costs listed in the Cal. Code Regs., title 22, section 67450.11, subsections (d)(7)(C)1 and (7)(C)2 for both managing the residual solids and managing the spent process solutions;

Conclude if the basis for the decision to not recycle the residual solids as either: Technological or Economic

- technological and provide the chemical, physical, hazardous characteristics, or other properties that affect recycling the residual solids; or
- economic and provide a comparison of the hazardous waste management costs for both managing the residual solids and managing the spent process solutions;

The justification statement may include any other information that influenced or formed the basis of the generator’s decision to not recycle the residual solids. This supplemental information may include the availability of suitable processing technology and facilities; or the marketability of the residual solid or its reclaimed components.

Glossary

Aboveground tank: a device meeting the definition of a *tank* that is situated so that the entire surface area is completely above the plane of the adjacent surrounding surface, and the entire surface area of the tank (including the tank bottom) is able to be visually inspected.

Acid pickling: a chemical treatment which removes oxide or scale from the surface of a metal. It most often refers to the use of sulfuric or hydrochloric acid to remove scale formed on mild and low-alloy steel during hot forming operations.

Acute toxicity: the ability of a substance or mixture of substances to cause injury, illness or damage to humans, animals or other living organisms by a single exposure of a duration measured in seconds, minutes, hours or days or, in the case of oral ingestion, by a single dose.

Adhesion: the process of the electroplating solution metal sticking to the workpiece.

Ancillary equipment: any device including, but not limited to piping, fittings, flanges, valves and pumps, that is used to distribute, meter or control the flow of hazardous waste from its point of generation to a storage or treatment tank(s), between hazardous waste storage and treatment tanks to a point of disposal onsite, or to a point of shipment for disposal offsite.

Anode: the positive electrode in electrolysis, at which negative and positive ions are discharged, positive ions are formed, or other oxidizing reactions occur.

Anodizing: a process used to impart corrosion resistance or surface hardness to a metal.

Aqueous solution: a solution where water is the solvent. An aqueous solution in an equation describing a chemical reaction is denoted by the abbreviation *(aq)*.

Assessment (tank unit): a technical review of a tank unit's design, integrity, and containment, signed off and certified by a civil, structural, or geotechnical engineer.

Biennial report: a document required from facilities that generate hazardous waste in volumes greater than 1,000 kg/month, and also from treatment, storage, and disposal facilities, that records information about the type and destination of waste shipped off. The report is due to DTSC by March 1st of every even-numbered year.

Brightening agent: an addition agent that leads to the formation of a bright plate, or that improves the brightness of a deposit.

Buffing: a specific type of mechanical polishing that uses a high-speed disc made from layers of cloth, leather, or plastic impregnated with an abrasive. The workpiece is pressed against the disc for buffing.

Cadmium: a natural element in the earth's crust, usually found as a mineral combined with other elements such as oxygen. Cadmium does not corrode easily and therefore has important uses in producing metal coatings. Cadmium-cyanide salts can be highly toxic.

Captive shop: a plating shop that provides service to one customer, or that conducts metal finishing as part of a larger manufacturing operation. A captive shop is also referred to as an in-house operation, generally used to support a specific manufacturing process. Many circuit board manufacturers are captive shops. See also *job shop*.

Cathode: The negative electrode in electrolysis at which positive ions are discharged, negative ions are formed, or other reducing actions occur.

Chain of custody: a form or set of forms that document the collection and transfer of samples taken.

Chelate compound: a compound in which the metal is contained as an integral part of a ring structure and is not readily ionized.

Chelating agent: a compound capable of forming a chelate compound with a metal ion.

Chromium: a hard, brittle, grayish heavy metal used in tanning, in paint formulation, and in plating metal for corrosion protection. It is toxic at certain levels and, in its hexavalent (versus trivalent) form, chromium is listed as a cancer-causing agent under Proposition 65.

Clarifier: a tank or basin in which wastewater is held for a period of time, during which heavier solids settle to the bottom and lighter material floats to the surface.

Class I Violation:
(a) a deviation from the requirements specified in Chapter 6.5 of Division 20 of the Health and Safety Code, or regulations, permit or interim status document conditions, standards, or requirements adopted pursuant to that chapter, that represents a significant threat to human health or safety or the environment, because of (1) the volume of the waste; (2) the relative hazard of the waste; or (3) the proximity of the population at risk, or that is significant enough that it could result in a failure to accomplish the following:
(A) Ensure that hazardous wastes are destined for and delivered to an authorized hazardous waste facility;
(B) Prevent releases of hazardous waste or constituents to the environment during the active or post closure period of facility operation;
(C) Ensure early detection of such releases;
(D) Ensure adequate financial resources in the case of releases; or
(E) Ensure adequate financial resources to pay for facility closure;
(F) Perform emergency clean-up operation or other corrective action for releases; or
(b) The deviation is a Class II violation which is a chronic violation or committed by a recalcitrant violator.

Class II Violation: a deviation from the requirements specified in Chapter 6.5 of Division 20 of the Health and Safety Code, or regulations, permit or interim status document conditions standards, or requirements adopted pursuant to that chapter, that is not a Class I violation.

Closure Cost Estimate (CCE): an estimate of the costs to address each item and activity identified in a closure plan. Although the cost estimate is not as inclusive or detailed as a closure plan, it should accurately summarize what tasks need to be accomplished during closure of the treatment unit(s).

Closure plan: a document prepared by most permitted facilities, including those electroplating facilities operating under *Permit by Rule* and *Conditional Authorization*, that describes the procedure for terminating hazardous waste operations and managing remaining wastes at a facility in a timely, responsible, and complete manner.

Coliwasa: an acronym for Composite Liquid Waste Sampler. A long glass or plastic tube which, when immersed in liquid, allows representative sampling of stratified liquid wastes.

Compatible (wastes): wastes that can be mixed together without undesirably altering their separate effects or the physical properties of the mixture.

Conditional Authorization (CA): a type of tiered permit obtained from the CUPA by generators who will treat certain wastes onsite. The CA permit differs from *PBR* in that treated CA wastestreams may only be hazardous for one property, thereby disqualifying most electroplating wastestreams. Some etching facilities, however, will qualify for a CA permit.

Consent Order (CO): a type of enforcement document issued to a facility as part of the most simple and straightforward of the formal enforcement processes (see also *Enforcement Order* and *Stipulation and Order*). COs are frequently issued to facilities warranting formal enforcement but with relatively less serious, and routine violations; when no compliance schedule is required; when not dealing with recalcitrant/repeat violators; and when prompt settlement is anticipated.

Containment: enclosing or containing hazardous substances in a structure to prevent the migration of contaminants into the environment.

Contingency plan: a document setting out an organized, planned, and coordinated course of action to be followed in case of a fire, explosion, or other accident that releases toxic chemicals, hazardous waste, or radioactive materials that threaten human health or the environment.

Corrective action: the measure(s) taken by a facility in violation to return to compliance.

Corrosion: the wearing down of metals by physical, chemical, or electrolytic processes. Oxidation, the most common form, is most obvious in mild and low-alloy steels. When exposed to high temperatures, metals will almost invariably corrode due to oxidation of metal surfaces. Chemical corrosion is the result of attack by acids or alkaline compounds which dissolve the metal surface. Electrolytic corrosion occurs when two metals in contact with each other have different electrode potentials.

Corrosive: able to cause destruction of living tissue or steel surfaces by chemical action.

CUPA (Certified Unified Program Agency): a city or county program authorized to carry out several of the various hazardous materials regulatory programs, including the hazardous waste generator program, administered by the State.

Cyanide: a highly toxic chemical often used in metal finishing or in extraction of precious metal from ore. Cyanide is a rapidly acting, potentially deadly chemical that can exist in various forms. Hydrogen cyanide (HCN) gas formation is of serious concern at plating facilities, and results from the mixture of acid and cyanide. Cyanide can exist in crystal form such as cadmium cyanide, sodium cyanide (NaCN), or potassium cyanide (KCN). Cyanide is often described as having a "bitter almond" smell.

Cyanide Consent Order (CNCO): an authorization provided by DTSC to treat cyanide-bearing wastes, for an applicant electroplating facility whose hazardous waste activities are in full compliance.

Dangerous goods packaging: Department of Transportation-mandated preparation and shipping standards for hazardous substances and wastes, to minimize the risk and effect of a transit spill.

Dermal exposure: contact between a chemical and the skin.

Dike: a long, narrow embankment, usually of cement or stone, intended to segregate incompatible wastes or contain spills or leaks of wastes.

Dissolution: dissolving; the process of going into solution. A form of chemical weathering in which water molecules, sometimes in combination with acid or another compound in the environment, attract and remove oppositely charged ions or ion groups from a metal.

Domestic sewage exclusion: a federal exclusion referenced by Cal. Code Regs., tit. 22, section 66261.4(b)(2), that allows a facility to discharge listed waste to the *publicly owned treatment works (POTW)* if it is mixed with domestic sewage. To apply, the electroplating facility can only discharge listed hazardous waste (e.g., not characteristic hazardous waste) directly to the POTW, as long as it is mixed with domestic sewage (i.e., from residential sources prior to treatment or storage at the POTW).

Drag-out: the solution that adheres to the objects removed from a plating bath.

Drain board: a board next to a rinse tank which is angled slightly to allow chemicals to drip off hanging parts (and back into the tank and not on the floor).

Drip pan: a low, shallow container used under or around a tank to hold any leaking fluid from overhead dripping parts.

Duplicate sample: a sample provided to the facility that is collected from the same sampling location, using the same equipment and sampling technique, and placed into an identically prepared and preserved container. See also *split sample*

Economic benefit: the costs avoided or delayed by the violator while failing to be in compliance.

Electrode: a conductor through which current enters or leaves an electrolytic cell, at which there is a charge from conduction by electrons to conduction by charged particles of matter, or vice versa.

Electroless plating: deposition of a metallic coating by a controlled chemical reduction that is catalyzed by the metal or alloy being deposited.

Electroplating: the process of depositing an adherent metallic coating on an electrode to give it surface properties or dimensions different from those of the metal.

Enforcement Order (EO): a type of unilaterial enforcement document (most often administrative, or AEO) issued to a facility (see also *Consent Order* and *Stipulation and* Or*der*).

Unlike the CO, the AEO is issued to the facility without formal discussion or negotiation. It is often used when the business is a repeat violator and/or the violations are more serious. Depending on the facility's response (i.e., whether an administrative hearing is requested following the issuance of the AEO), an AEO may be followed by a *Stipulation and Order.*

Etching: a surface preparation technique prior to electroplating which uses a chemical solution to remove unwanted metals from a surface.

Filter cake: a mostly solid mixture of sediments that results from filtering and dewatering of treated wastewater.

Filter press: a device for filtering and absorbing wastewater moisture to produce filter cake. Considered *ancillary equipment*.

Financial Assurance (FA): any of a variety of financial mechanisms (such as a surety bond or trust fund) that a facility operating under Permit by Rule, Conditional Authorization, or higher tiers is required to have in order to cover the cost of the items described in the closure plan. Electroplating facilities operating under Tiered Permit must submit a Certification of Financial Assurance form to the local CUPA.

Formaldehyde: a water-soluble gas used widely in the chemical industry and in the construction and building industries, largely in wood products and in foam insulation. It is also used in some deodorizing preparations, in fumigants, and as a tissue preservative in laboratories. Formaldehyde is listed as a cancer-causing agent under Proposition 65.

Freeboard: the vertical distance between the top of a tank or surface impoundment dike, and the surface of the waste contained therein.

Full permit: an authorization provided by EPA to the most complex facilities that treat, store, and/or dispose of RCRA wastes accepted from offsite. The full permit involves considerable document preparation and review, and substantial fees.

Holding time: the maximum amount of time a sample may be stored before analysis; differs by type of waste.

Ignitable: capable of being set afire, or of bursting into flame spontaneously or by interaction with another substance or material.

Imminent and Substantial Endangerment (ISE): a situation that involves hazardous waste violations that may pose an immediate threat to public health or safety or the environment. An ISE determination authorizes DTSC to require a facility to take immediate correction action. See also *quarantine.*

Incompatible (wastes): wastes that cannot be mixed with one another without the possibility of a dangerous reaction, and which are unsuitable for: **(a)** placement in a particular device or facility because it may cause corrosion or decay of containment materials (e.g., container inner liners or tank walls); or **(b)** commingling with another waste or material under uncontrolled conditions because the commingling might produce heat or pressure, fire or explosion, violent reaction, toxic dusts, mists, fumes, or gases or flammable fumes or gases.

Industrial wastewater: the spent or used water from an industrial process that contains dissolved or suspended matter.

Inhalation exposure: exposure to a hazardous substance by breathing contaminated air.

Job shop: an independent manufacturing enterprise devoted to producing special or custom-made parts or products, usually in small quantities for specific customers. See also *captive shop*.

Leak detection system: a device used to detect leaks in a facility, in lieu of conducting visual daily inspections. Leak detection systems may consist of alarms, sensors, and probes. Others may consist of cameras, mirrors, and access ports under and around floorboards.

Manifest: a form used by haulers transporting waste that lists EPA identification numbers, type and quantity of waste, the generator it originated from, the transporter that shipped it, and the storage or disposal facility to which it is being shipped. It includes copies for all participants in the shipping process.

Nickel: a metal used in alloys to provide corrosion and heat resistance for products in the iron, steel and aerospace industries. Nickel is used as a catalyst in the chemical industry. It is toxic and, in some forms, is listed as a cancer-causing agent under Proposition 65.

Oxidation: a chemical process in which a metal, such as silver, is blackened as a reaction to oxygen.

Oxidation-reduction: a reversible chemical reaction in which one reaction is an oxidation and the reverse is a reduction. See both *oxidation* and *reduction.*

Permit by Rule: a type of tiered permit obtained from the CUPA by generators who will treat waste onsite. Many electroplating facilities qualify for this tier. The PBR permit differs from the *CA* permit in that treated PBR wastestreams are hazardous for more than property, and generally covers treatment of more hazardous wastes. Operating requirements include fees and annual paperwork submissions.

Personal Protective Equipment (PPE): specialized clothing or equipment (hard hat, safety boots, respirator, gloves, etc.) worn by an employee to protect against a hazard.

Phase I Environmental Assessment: a preliminary site assessment conducted by DTSC or the CUPA to identify potential environmental liabilities associated with current and past uses of property. A Phase I is generally characterized by a visual inspection of the subject property and a review of the historical records pertaining to the property.

Point source: pollution that comes from an identifiable source, such as a discharge pipe.

Primary rinse: in the plating process, the rinse of a metal workpiece following its immersion in the cleaning or acid pickling bath. See *secondary rinse* and *tertiary rinse.*

Prophylactic effect: an upward or downward adjustment to a total base penalty to ensure that it is sufficient to adequately discourage such future violations, on behalf of both the violator and the regulated community.

Publicly Owned Treatment Works (POTW): any device or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature which is owned by a "State" or "municipality" (as defined by 33 U.S.C. section 1362). This definition includes sewers, pipes or other conveyances only if they convey wastewater to a POTW providing treatment.

Quarantine: a restraint placed on an operation to protect the public from a health hazard.

Reactive: having properties of explosivity or of chemical activity which can be a hazard to human health or the environment.

Reassessment (tank unit): a periodic technical review, usually required once every five years, of a tank unit's design, integrity, and containment, signed off and certified by a civil, structural, or geotechnical engineer.

RCRA: abbreviation for the Resource Conservation and Recovery Act (RCRA). A federal law enacted in 1976 to address the treatment, storage, and disposal of solid and hazardous waste. It also established a "cradle-to-grave" tracking and liability system for hazardous waste.

Recalcitrant: a violator who fails to cooperate, delays compliance, or creates unnecessary obstacles to achieving compliance.

Reduction: the opposite of oxidation; the process of adding hydrogen, removing oxygen, or removing electrons. A chemical reaction in which one or more electrons are gained by the substance reduced.

Retrofit: the modification of an existing building or facility to include new systems or components, such as a *leak detection system*.

Rinsewater: the use of the purest water available to remove chemicals from a metal surface. Most plating and etching processes are immediately followed by a rinse.

Saturated zone: the part of the earth's crust in which all voids are filled with water.

Secondary containment: a structure designed to capture spills or leaks, as from a container or tank. For containers and aboveground tanks, it is usually a bermed area of coated concrete. For underground tanks, it may be a second, outer, wall or a vault. Construction of such containment must meet certain requirements, and periodic inspections are required.

Secondary rinse: in the plating process, the rinse of a metal workpiece following its immersion in the primary rinse, used to further prepare the workpiece for the plating solution. See *primary rinse* and *tertiary rinse.*

Seismic zone: a region in which earthquakes are known to occur. All of California is a seismic zone.

Self Contained Breathing Apparatus (SCBA): a mask and air tank worn to protect from toxic gases.

Soluble Threshold Limit Concentration (STLC): the limit concentration for toxic materials in a sample that has been subjected to the California Waste Extraction Test (WET), a state test for the toxicity characteristic that is designed to subject a waste sample to simulated conditions of a municipal waste landfill. If the concentration of a toxic substance in the special extract of the waste exceeds this value, the waste is classified as hazardous in California. This is distinct from the *TTLC*. The *WET* procedure is more stringent than the federal *TCLP.*

Solvent: a liquid capable of dissolving another substance to form a solution. Water is sometimes called "the universal solvent"; however, organic solvents are used in paints, varnishes, lacquers, and industrial cleaners.

Split sample: a single sample, usually divided by the analytical laboratory, split into two separate samples. Each sample is prepared and analyzed independently as an indication of analytical variability and comparability. Not to be confused with *duplicate sample.*

Standardized permit: an authorization provided by DTSC to facilities that treat or store non-RCRA waste received from offsite. This tier provides lower application and annual fees than the *full permit* tier, but differs from *PBR* and *CA* which only concern the treatment of waste generated onsite.

Stipulation and Order (S&O): a type of unilateral enforcement document (unlike a *Consent Order*) that may follow the issuance of an (Administrative) *Enforcement Order*. The S&O would be issued if the business requests settlement discussions in lieu of requesting a hearing, and the facility and DTSC (or the CUPA) are able to agree on the violations and settlement.

Stripping: the process of removing a chemical from a metal surface.

Sump: a pit or tank that catches liquid runoff for drainage or disposal.

Supplemental Environmental Project (SEP): an environmentally beneficial project which a defendant/respondent agrees to undertake as part of the settlement of an enforcement action, but which the defendant/respondent is not otherwise legally required to perform. SEPs may also include donations to such organizations as Cal/EPA's Environmental Education Account. They may account for only a limited percentage of the total penalty.

Surfactants: substances which diminish the surface tension of liquids.

Tank: a stationary device, designed to contain an accumulation of hazardous waste that is constructed primarily of nonearthen materials (e.g., wood, concrete, steel, plastic) that provide structural support.

Tank assessment: *see Assessment (tank unit)*

Tank system: a hazardous waste transfer, storage or treatment tank and its associated ancillary equipment and containment system.

Task force: a temporary group of individuals or representatives established for the purpose of accomplishing a multimedia or multi-jurisdictional investigation of a facility. A task force will report its findings to a larger group or legislative body, such as DTSC.

Tertiary rinse: in the plating process, the rinse of a metal workpiece following its immersion in the primary rinse and secondary rinse. After the tertiary rinse, the workpiece is ready to be dipped into the plating solution tank(s).

Total Threshold Limit Concentration (TTLC): a test for the Toxicity Characteristic. If the total concentration of a toxic substance in a waste is greater than the TTLC, the waste is classified as hazardous in California. This is distinct from the *Soluble Threshold Limit Concentration*, or *STLC*, which is concerned with only the soluble concentration.

Toxicity: the ability to harm the environment or human health, resulting in injury, death or cancer. One of the criteria used to determine whether a waste is a hazardous waste (the Toxicity Characteristic).

Toxicity Characteristic Leaching Procedure (TCLP): a federal test for the Toxicity Characteristic (TC). If the concentration of a toxic substance in a special extract of a waste exceeds the TC value, the waste is classified as hazardous in the United States (a “RCRA waste”). The extraction procedure is different from that of the California *Waste Extraction Test (WET)*.

Trowel: a small hand tool with a handle and flat metal blade that is frequently used to assist in collecting and scooping samples.

Unit: a tank, a container, or a combination of tanks or tank systems and/or containers located together that are used in sequence to treat or accumulate one or more compatible hazardous wastestreams. The devices are either plumbed together or otherwise linked so as to form one system. This definition only applies to Conditional Exemption, *Conditional Authorization*, and *Permit by Rule* operations.

Waste Extraction Test (WET): a state test for the Toxicity Characteristic that is designed to subject a waste sample to simulated conditions of a municipal waste landfill.

Waste minimization: a facility requirement based on the Hazardous Waste Source Reduction and Management Review Act, or Senate Bill 14, which requires a facility that generates greater than 1,000 kg/month (with some exclusions) to document the elimination or reduction of hazardous waste. It includes any source reduction of total volume or quantity of hazardous waste, or the reduction of toxicity of the hazardous waste, with the goal of minimizing present and future threats to human health and the environment.

Wastewater treatment unit: a device that receives and treats or stores an influent wastewater; generates, accumulates, treats or stores a wastewater treatment sludge; **and** meets the definition of a *tank* or *tank system*.

Wet-floor operation: a popular plating process that utilizes open baths and requires movement of metal pieces from bath to bath, increasing the chance of spills and of incompatible wastes mixing. Dry floor operations are preferable from a health and safety standpoint, but few facilities can or will retrofit to accommodate a dry floor operation.

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