

Cyanide Fact Sheet

This fact sheet is distributed as part of the San Jose/Santa Clara Water Pollution Control Plant's (Plant) cyanide control program. This program is intended to help the Plant meet its cyanide limit for discharge into the San Francisco Bay (Bay) by raising awareness of the issues surrounding the use of cyanide. Other elements of the cyanide control program include:

- determining the sources of cyanide to the Plant
- increased monitoring in the sewer lines to detect illegal dumping of chemical wastes
- lowering the local discharge limit for cyanide to 0.5 mg/liter

Effluent Limits to the San Francisco Bay

The California Regional Water Quality Control Board for the San Francisco Bay Region regulates the Plant's effluent for discharge of cyanide into the Bay. The Plant's cyanide discharge limit is 5 µg/liter (5 parts per billion), and is based on the total of all forms of cyanide present. The Plant does not effectively remove cyanide. As a result, when there have been high influent concentrations, cyanide has often passed through the Plant and into the Bay, violating the Plant's discharge limits.

Sources of Cyanide to the Plant

Flow to the Plant is divided into three main groups: permitted industrial (industrial), residential, and commercial (types of industry generally not permitted).

The industrial sector is the only known major user and discharger of cyanide. Historically, cyanide has been a major component of metal-plating solutions.

The residential sector makes up about 80% of the Plant's influent flow. Cyanide measurements were made on residential sewer flows. The results indicate that the residential sector is not a significant contributor of cyanide to the Plant.

Sampling conducted on several commercial sector sewer flows revealed concentrations similar to the residential sector. Although it is expected that certain commercial facilities may use chemicals containing cyanide, cyanide is not a significant component of the wastewater discharged from this sector.

Free and Complexed Cyanide

The alkali metal cyanides, such as sodium cyanide (NaCN), dissociate completely in water. Completely dissociated cyanide is known as **free cyanide**. Industries using free cyanide operate treatment systems to break down cyanide into harmless gases.

Other metal finishing processes such as chromating and some etching processes contain potassium ferricyanide $K_3Fe(CN)_6$ and potassium ferrocyanide $K_4Fe(CN)_6$. These forms of cyanide are considered to be low in toxicity because the cyanide is **complexed**, or tightly bound, to the iron. However, when exposed to direct sunlight (as it is in the

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Plant's effluent) dilute solutions of these forms of cyanide may decompose to yield toxic hydrogen cyanide (HCN) gas. The Plant has limits on the total cyanide in its discharge to the Bay and must, therefore, regulate permitted companies for the total of all forms of cyanide.

Cyanide in Chemistries

The presence of potassium ferricyanide and potassium ferrocyanide in metal-finishing solutions and other chemicals can be difficult to determine, and in some cases, may not be listed in the Material Safety Data Sheet (MSDS). (MSDSs are required to report toxic substances, only, if they are present at greater than 1% [10,000 parts per million].) Examples of products commonly used for chromium baths that contain iron cyanide complexes are Alodine 1200 and Corcoat 764-5. Both of these contain from 10-30% potassium ferricyanide. Some printed circuit board chemistries may also contain much lower levels of cyanide. If your MSDSs do not show cyanide, but you exceed your discharge limits, have your solutions tested for cyanide. You must request an analysis for total cyanide to determine the total amount of cyanide present, as complexed forms of cyanide will not be detected in an analysis for free cyanide.

Other Issues

Occasionally, process or treatment chemicals in a wastewater sample may interfere with the analysis of cyanide, causing a false cyanide determination. . Some dithiocarbamates used in metal precipitation may cause a sulfide interference with cyanide analysis. The laboratory doing the analysis can prevent this by precipitating the sulfide. If you are concerned about the possibility of a false cyanide reading, you should institute a testing and monitoring program to adequately identify any such reading.

When cyanide baths need to be "iced" due to carbonate accumulation, the crystals removed from the tanks, like all plating wastes, are presumed by the State of California to be hazardous wastes. You must dispose of crystals from "icing" cyanide baths according to State regulations. They may not be disposed of to the sanitary sewer.

Measures to Minimize Cyanide Discharge

To meet the public's need for safety, environmental protection, and clean water and air, the ongoing regulatory cycle involves ever-tightening restrictions on hazardous materials and their discharge. For cyanide users, this is exemplified by more stringent discharge restrictions, stricter storage requirements, mandatory use of cyanide gas sensing/detection systems in some jurisdictions, etc. All of these requirements raise the stakes for industrial users who wish to continue using cyanide processes. Non-cyanide process alternatives are becoming increasingly more available and cost-effective as the cost of managing cyanide waste increases. If you are still using cyanide, the following are some of the steps that can be taken to reduce your cyanide discharge:

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1. Reduce the flow in cyanide wastestreams. This will allow increased waste treatment dwell time, which will result in more efficient cyanide destruction and create less cyanide-bearing wastewater.
2. Segregate cyanide waste streams to prevent other substances from interfering with your cyanide waste treatment process.
3. Use pollution prevention methods of over-tank drip-off, dragout-augmented counterflow rinsing, process bath concentration reduction, good housekeeping, and evaporation to further reduce the volume to be treated.
4. Investigate opportunities to reuse cyanide-bearing rinse water where possible (for example, using ion-exchange).
5. Use process control methodologies to optimize your cyanide waste treatment process.

For more information on Pollution Prevention, refer to:

1. EPA Office of Compliance Sector Notebook Project's, *Profile of the Fabricated Metal Products Industry*, September 1995. This document includes pollution prevention techniques (including cyanide pollution prevention) and contacts for more information. For copies of relevant portions, please contact Charlie Roberson at 945-3044 or your Source Control Inspector. This document can also be viewed and downloaded through the **Fabricated Metal Products Industry link** at Internet address, <http://es.inel.gov/comply/sector/index.html>
2. The National Metal Finishers Resource Center (NMFRC) web site at Internet address, <http://www.nmfrc.org/>, can be searched using the search words *pollution prevention*. At this site, *Pollution Prevention and Control Technologies for Plating Operations, Section 5.4* discusses survey results of platers using cyanide substitution/reduction technologies.
3. Many of the pollution prevention measures included in Source Control's *Reasonable Control Measures Plan* are applicable to cyanide pollution prevention. Please contact your Source Control Inspector if you need a copy of this document.
4. *Guides To Pollution Prevention: The Metal Finishing Industry*
Order Number: EPA625R92011

Order from the:

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