

# Technical Factsheet on: CYANIDE

## [List of Contaminants](#)

As part of the Drinking Water and Health pages, this fact sheet is part of a larger publication:  
**National Primary Drinking Water Regulations**

### Drinking Water Standards

MCLG: 0.2 mg/l

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HAL(child): 1- to 10-day: 0.2 mg/L; Longer-term: 0.2 mg/L

### Health Effects Summary

Acute: EPA has found cyanide compounds to potentially cause the following health effects from acute exposures at levels above the MCL: rapid breathing, tremors and other neurological effects.

Short-term exposures in drinking water considered "safe" for a 10-kg (22 lb.) child consuming one liter of water per day: upto a 7-year exposure to 0.2 mg/L.

Chronic: Cyanide compounds have the potential to cause the following chronic health effects from long-term exposures at levels above the MCL: weight loss, thyroid effects, nerve damage.

Cancer: There is inadequate evidence to state whether or not cyanide compounds have the potential to cause cancer from lifetime exposures in drinking water.

### Usage Patterns

The most commonly used form, hydrogen cyanide, is mainly used in manufacturing other cyanides, particularly adiponitrile which is used in nylon, and acrylonitrile - used in acrylic/modacrylic fibers and resins. Other cyanides such as dichlobenil, bromoxynil and bantrol, are used as herbicides. Tabun is used as a chemical warfare agent. Potassium cyanide is used for silver plating and for dyes and specialty products.

Available production data on cyanides: hydrogen cyanide, 1 billion lbs. in 1987; acrylonitrile-2.5 billion lbs. 1993; adiponitrile-1.4 billion lbs. in 1991; bromoxynil-2.6 million lbs in 1990; acetonitrile-35 million lb. in 1989.

### Release Patterns

The major sources of cyanide releases to water are reported to be discharges from metal finishing industries, iron and steel mills, and organic chemical industries. Releases to soil appear to be primarily from disposal of cyanide wastes in landfills and the use of cyanide-containing road salts. Cyanide released to air from car exhaust is expected to exist almost entirely as hydrogen cyanide gas.

Some foods may also naturally contain cyanides, including lima beans and almonds.

Chlorination treatment of some wastewaters can produce chloroacetonitriles as a by-product. Cyanide has been found in drinking water at levels on the order of a few parts per billion.

From 1987 to 1993, according to the Toxics Release Inventory cyanide compound releases to land and water totalled about 1.5 million lbs., of which about 65 percent was to water. These releases were primarily from steel mills and metal heat treating industries. The largest releases occurred in California and Pennsylvania.

### **Environmental Fate**

Nitriles are generally highly volatile and biodegradable when released to water, and are not expected to bioconcentrate in aquatic organisms. Nitriles have the potential to leach to ground water as they do not adsorb to soil. They tend to be resistant to hydrolysis in soil or water. Cyanide-containing herbicides have more moderate potential for leaching, but again are readily biodegraded so they are not expected to bioconcentrate.

Soluble cyanide compounds such as hydrogen and potassium cyanide have low adsorption to soils with high pH, high carbonate and low clay content. However, at pH less than 9.2, most free cyanide is expected to convert to hydrogen cyanide which is highly volatile. Soluble cyanides are not expected to bioconcentrate.

Insoluble cyanide compounds such as the copper and silver salts may adsorb to soils and sediments, and generally have the potential to bioconcentrate. Insoluble forms do not biodegrade to hydrogen cyanide.

Tabun is rapidly hydrolyzed in soil and water, and so is not expected to leach or bioconcentrate.

### **Chemical/Physical Properties**

CAS Number: Hydrogen cyanide- 74-90-8

Color/ Form/Odor: Cyanide is a carbon-nitrogen chemical unit which may be combined with a variety of organic and inorganic components. The most common is hydrogen cyanide, a colorless, flammable liquid or gas.

Soil sorption coefficient: Kocs of 1 to 70 for most soluble forms, with the nitriles having highest mobility in soils. Insoluble forms are expected to adsorb to sediments.

Cyanide-containing compounds:

Organics: Nitriles like Acetonitrile, butanenitrile, etc; bromoxynil, cyanocobalamin, cyanogens, cyanohydrins, tabun

Inorganics: combined with hydrogen, calcium, barium, sodium, zinc, nickel, mercury, potassium, copper, silver

Bioconcentration Factor: BCFs of <1 to 50 for most soluble forms, which are not expected to bioconcentrate in aquatic organisms. Insoluble forms may bioconcentrate.

Solubilities:

nitriles low to moderate  
cyanohydrin highly soluble  
cyanogens moderate to high  
tabun soluble  
other organics slightly soluble  
Hydrogen soluble

sodium 48% at 10 deg C  
 potassium 50% in cold water  
 mercuric 10% at 14 deg C  
 barium 80% at 14 deg C  
 calcium soluble  
 copper insoluble  
 nickel insoluble  
 silver insoluble  
 zinc insoluble

**Other Regulatory Information**

Monitoring:

-- For Ground Water Sources:

Initial Frequency-1 sample once every 3 years

Repeat Frequency-If no detections for 3 rounds, once every 9 years

-- For Surface Water Sources:

Initial Frequency-1 sample annually

Repeat Frequency-If no detections for 3 rounds, once every 9 years

-- Triggers - If detect at > 0.2 mg/L, sample quarterly.

**Analysis**

<u>Reference Source</u>	<u>Method Number</u>
EPA 600/4-79-020	335.1*; 335.2; 335.3
NTIS PB 91-231498	D2036-89A; D2036-89B*
Standard Methods	4500-CN-D,E&,F; 4500-CN-G*

**\*- measure "free" or amenable cyanide; other methods screen for "total" cyanide.**

**Treatment/Best Available Technologies:** Ion Exchange, Reverse Osmosis, Chlorine

**Toxic Release Inventory - Releases to Water and Land, 1987 to 1993 (in pounds):**

	<b>Water</b>	<b>Land</b>
<b>TOTALS</b>	<b>939,611</b>	<b>641,082</b>
<b>Top Ten States</b>		
CA	0	430,886

PA	208,239	4,909
IN	187,377	20,242
OH	160,203	850
TX	54,379	83,394
MD	89,438	23,503

**Major Industries**

Blast furnaces + steel	747,970	53,404
Metal heat treating	0	430,886
Ind organic chems	49,098	82,912
Plating + polishing	29,486	29,636

**For Additional Information:**

EPA can provide further regulatory and other general information:  
EPA Safe Drinking Water Hotline - 800/426-4791  
Other sources of toxicological and environmental fate data include:  
Toxic Substance Control Act Information Line - 202/554-1404  
Toxics Release Inventory, National Library of Medicine - 301/496-6531  
Agency for Toxic Substances and Disease Registry - 404/639-6000