



# National Primary Drinking Water Regulations

## Thallium

### CHEMICAL/ PHYSICAL PROPERTIES

**CAS NUMBER:** 7440-28-0 (metal)

**COLOR/ FORM/ODOR:** Thallium is a metallic element that exists in nature only in as salts and other combined forms.

**SOIL SORPTION COEFFICIENT:** N/A; strongly adsorbed to some clays at alkaline pH.

**BIOCONCENTRATION FACTOR:** Log BCFs = 5 to 5.2 in fish, invertebrates; expected to bioconcentrate

### SOLUBILITIES:

acetate very soluble  
carbonate- 4% (w/w) cold water  
chloride- 2.9 g/L at 15.5 deg C  
nitrate- 39.1 g/L to 95.5 g/L at 20 deg C  
oxide- insoluble  
sulfate- 48.7 g/L at 20 deg C

**COMMON ORES:** Thallium is a trace metal associated with potassium in copper, gold, zinc, and cadmium ores.

### DRINKING WATER STANDARDS

**MCLG:** 0.0005 mg/l

**MCL:** 0.002 mg/l

**HAL(child):** 1- to 10-day: 0.007 mg/L  
Longer-term: 0.007 mg/L

### HEALTH EFFECTS SUMMARY

**Acute:** EPA has found thallium to potentially cause the following health effects from acute exposures at levels above the MCL: gastrointestinal irritation; peripheral neuropathy.

Short-term exposures considered "safe" for a 10-kg (22 lb.) child consuming one liter of water per day: upto a 7-year exposure to 0.007 mg/L.

**Chronic:** Thallium has the potential to cause the following health effects from long-term exposures at levels above the MCL: changes in blood chemistry; damage to liver, kidney, intestinal and testicular tissues; hair loss.

**Cancer:** There is no evidence that thallium has the potential to cause cancer from lifetime exposures in drinking water.

### USAGE PATTERNS

There is no domestic production of thallium. Approximately 4,500 lbs. of thallium and its compounds were imported in 1987. In 1984, US industry consumed thallium compounds as follows: electronics industry, 60-70%; the remainder was used in pharmaceuticals, alloys and glass manufacture.

Thallium compounds are used in infrared spectrometers, in crystals, in other optical systems, and for coloring glass; in semiconductor research; with mercury for switches and closures which operate at subzero temperatures; in photoelectric cells, lamps, and, in electronics, in scintillation counters; as catalyst in organic synthesis; as a rat poison, as an ant bait, and as a reagent in analytical chemistry. It was also formerly used as a depilating agent by dermatologists and as a cosmetic depilatory cream.

### RELEASE PATTERNS

In nature, thallium is present as a trace compound in many minerals, mainly associated with potassium and rubidium.

Man-made sources of thallium pollution are gaseous emission of cement factories, coal burning power plants,

### TOXIC RELEASE INVENTORY - RELEASES TO WATER AND LAND: 1987 TO 1993

	Water	Land
TOTALS (in pounds)	2,606	2,770
<b>Top Five States</b>		
TX	6	2,020
OH	1,500	0
MN	1,100	0
CO	0	500
IN	0	250
<b>Major Industries*</b>		
Primary copper smelting	1,856	765
Petroleum refining	750	1,255
Primary nonferrous metals	0	500
Blast furnaces, steelworks	0	250

and metal sewers. The leaching of thallium from ore processing operations is the major source of elevated thallium concentrations in water. Thallium is a trace metal associated with copper, gold, zinc, and cadmium.

Water concentrations of 1 to 88 parts per billion have been reported in rivers draining metal mining areas.

From 1987 to 1993, according to the Toxics Release Inventory thallium releases to land and water totalled over 5,000 lbs., of which about half was to water. These releases were primarily from copper smelting and petroleum refining industries. The largest releases occurred in Texas and Ohio.

#### **ENVIRONMENTAL FATE**

In a study of thallium movement in a simple aquatic ecosystem, concentrations of thallium decrease slowly in the water and increase tenfold in the vegetation and fish. Definite transport of thallium occurred among water, fish, and vegetation, but no transport was seen between the sand and other ecosystem components.

It was found that increasing pH decreased thallium-inorganic interactions. Increases in pH, however, produced extensive thallium-humic acid interaction. It appears that thallium-organic interactions may be important in most natural water systems.

In reducing environments, thallos species may precipitate as a sulfide; otherwise, it will remain in solution.

Thallium sulfate has been used as a rodenticide in Japan, where it was sprayed over forest areas, but was not found to persist in water for more than a month. Since thallium is soluble in most aquatic systems, it is readily available to aquatic organisms and is quickly bioaccumulated. Goldfish have a higher rate of uptake for thallium than for the five most common alkali metals. Some algae are able to concentrate thallium by a factor of 127 to 220 within one hour; in comparison, the concentration factors of 2.7 hours exposure were 114 for lead, 30 for cadmium, 80 for zinc, and 313 for copper.

Bioconcentration factors: in freshwater fish, factor of 100,000; in marine invertebrates, factor of 150,000; in marine fish, factor of 100,000; in freshwater and marine plants, factor of 100,000; in clams (*Mya arenaria*), factor of 17.6-18.6; in mussel (*Mytilus edulis*), factor of 10.9-12.4; and in Atlantic salmon, factor of 27-1430.

#### **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 > 0.002 mg/L, sample quarterly.

##### **ANALYSIS:**

REFERENCE SOURCE	METHOD NUMBERS
EPA 600/4-79-020	279.2
NTIS PB 91-231498	200.8; 200.9
Standard Methods	3113; 3113B

##### **TREATMENT**

###### **BEST AVAILABLE TECHNOLOGIES**

Activated alumina; Ion Exchange

##### **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