United States Environmental Protection Agency | Office of Water 4601 | EPA 811-F-95-004a-T October 1995

EPA

National Primary Drinking Water Regulations

Acrylamide

Chemical/ Physical Properties

CAS Number: 79-06-1

Color/ Form/Odor:
White odorless flake-like crystals derived from benzene. Available in powder form or as an aqueous solution of 50% acrylamide monomer.

M.P.: 84.5° C **B.P.:** 125° C

Vapor Pressure: 0.007 mm Hg at 20° C

Octanol/Water Partition (Kow):
Log Kow = -0.67

Density/Spec. Grav.: 1.122 at 30° C

Solubility: 2.2 kg/L of water at 25° C; Extremely soluble in water

Soil sorption coefficient:
N/A; High mobility in soil

Odor/Taste Thresholds: N/A

Bioconcentration Factor:
BCFs of 0.86 to 1.12 in fish; not expected to bioconcentrate in aquatic organisms.

Henry's Law Coefficient:
3.2×10^{-10} atm-cu m/mole;

Trade Names/Synonyms:
2-Propenamide, Acrylic amide, Ethylenecarboxamide, Amresco Acryl-40, Acrylagel, Optimum

Drinking Water Standards

MCLG:	zero mg/L
MCL:	Treatment Technique
HAL(child):	1 day: 1.5 mg/L
	10-day: 0.3 mg/L

Health Effects Summary

Acute: EPA has found acrylamide to potentially cause the following health effects from acute exposures at levels above the MCL: damage to central and peripheral nervous systems, weakness and ataxia in legs.

Drinking water levels which are considered "safe" for short-term exposures: For a 10-kg (22 lb.) child consuming 1 liter of water per day: a one-day exposure of 1.5 mg/L; a ten-day exposure to 0.3 mg/L; upto a 7-year exposure to 0.002 mg/L.

Chronic: Acrylamide has the potential to cause the following health effects from long-term exposures at levels above the MCL: damage to central and peripheral nervous systems, paralysis.

Cancer: There is some evidence that acrylamide may have the potential to cause cancer from a lifetime exposure at levels above the MCL.

Usage Patterns

Demand for acrylamide was projected to increase slightly: from 110 million lbs. in 1987 to 120 million lbs in 1992 (projected). In 1987 it was estimated that industries consumed it as follows: Water treatment, 45%; oil drilling, 20%; pulp and paper, 20%; mineral processing, 10%; other, 5%.

The greatest use of acrylamide is as a flocculant in the treatment of sewage, waste and drinking water.

Other uses of include: as an intermediate in the production of organic chemicals; synthesis of dyes, in the sizing of paper and textiles; in ore processing; in the construction of dam foundations and tunnels.

Toxic Release Inventory - Releases to Water and Land: 1987 to 1993

	Water	Land
TOTALS (in pounds)	36,287	5,818
Top Releases by State*		
MI	12,200	0
WA	8,000	0
CT	5,690	0
LA	4,367	500
PA	2,505	20
Major Industries*		
Plastics and resins	19,002	2,177
Pulp mills	8,000	0
Indust. organics	3,107	2,200

* Water/Land totals only include facilities with releases greater 100 lbs.

Release Patterns

Acrylamide may be released into wastewater during its production and use in the synthesis of dyes, manufacture of polymers, adhesives, paper, paperboard and textile additive, soil-conditioning agents, ore processing, oil recovery, and permanent press fabrics, and in the manufacture of polyacrylamides for use as a flocculating agent for water treatment. The latter is the largest end use, being employed in processing mineral ores as well as treating waste water and drinking water. Improvements in the polymerization process has reduced the monomer content of these polymers from 5% to 0.3%. Other sources of release to water is from acrylamide-based sewer grouting and recycling of waste paper.

From 1987 to 1993, according to EPA's Toxic Chemical Release Inventory, acrylamide releases to land and water totalled over 40,000 lbs., of which about 85 percent was to water. These releases were primarily from plastics industries which use acrylamide as a monomer. The largest releases occurred in Michigan.

Environmental Fate

Acrylamide degrades rapidly with acclimation in biodegradability screening tests. Acrylamide degraded in filtered river water in 4 to 12 days. Adsorption to sediment should not be significant.

If released on land, acrylamide would be expected to leach readily into the ground and biodegrade within a few weeks based on experimental data. In 5 surface soils that were moistened to field capacity, 74-94% degradation occurred in 14 days in 3 soils and 79 to 80% degradation occurred in 6 days in the other two soils.

In order to access the efficiency of sewage works in removing acrylamide, two sewage works were dosed for four times longer than the residence time. Little loss of acrylamide occured during initial or final settling. However 50 to 70% was lost in the activated sludge plants. Further studies showed that high loss rates required high microbial activity or, in particular, contact with surfaces of high microbial activity. Studies of the river into which the sewage works discharged its effluents suggest that microbial degradation is unlikely to affect the level of acrylamide in river water for several hours, and possibly days, even in a river into which acrylamide is continually discharged. Degradation was however, more marked in the summer.

In the atmosphere, the vapor phase chemical should react with photochemically produced hydroxyl radicals (half-life 6.6 hr) and be washed out by rain.

Bioconcentration in fish is not significant. Uptake of acrylamide was studied in fingerling trout for 72 hr found the BCF in the carcass and viscera was 0.86 and 1.12, respectively, indicating that no appreciable bioaccumulation had occurred. The uptake was rapid in the first 24 hr and then leveling off to a plateau after 72 hr. When the fish were transferred to fresh water, levels of acrylamide declined to 75% of the initial concn after 96 hr.

In another report, the rate of accumulation of acrylamide monomer in fish was about 0.8 times the concentration in the rearing water (10 ppm) at day 40. The accumulation of acrylamide monomer in fish from polymer was nondetectable. Therefore, it is concluded that the use of acrylamide polymer as a coagulant may not cause serious problems for human health.

Human exposure will be primarily occupational via dermal contact and inhalation, although exposure to the general public has resulted from the leaching of the acrylamide monomer from polyacyrlamide flocculants used in water treatment.

Other Regulatory Information

Monitoring and Analysis:

No analytical methods are available so monitoring is not required. This contaminant is being regulated by requiring use of a treatment technique to limit its use by drinking water systems.

Treatment

Treatment technique: When acrylamide is used in drinking water systems, the combination of dose and monomer level may not exceed the following level:

0.05 % dosed at 1 mg/L

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