



# TRINITROGLYCEROL (TNG)

## PROFILE OF DRINKING WATER CONTAMINANTS FOR EMERGENCY RESPONSE

### GENERAL INFORMATION

Trinitroglycerol, or glyceryl trinitrate, has been widely used in commercial blasting and military explosives. It is also used extensively as a therapeutic vasodilator in the treatment of cardiovascular disease.

TNG is a chemically stable solid at temperatures below 13.5°C and may be stored below 50°C for many years. At 50-60°C it rapidly volatilizes and decomposes.

TNG is produced for the military at selected Army ammunition plants.

Information on the environmental fate of TNG is not available. However, TNG dissolves in wastewater, is incompletely transformed by bacteria, and has been shown to be toxic to microflora in activated sludge.

### PHARMACOKINETICS

TNG is rapidly and completely absorbed following ingestion by rats, mice, and dogs and is distributed mainly to liver, skeletal muscles, and kidneys in these species. Excretion of radiolabeled TNG and its metabolites is primarily in urine. TNG is almost completely transformed in the body, but the role of the liver or other organs in its biotransformation is not established.

### HEALTH EFFECTS

#### Humans

Data gathered from clinical and occupational studies indicate that sublingual, dermal, or inhalation exposures cause severe headaches, flushing, postural hypotension, psychic disturbances, convulsions, difficulty in breathing, and cyanosis (a bluish discoloration of the skin). Death is often due to respiratory failure. With repeated exposures, tolerance may develop to some adverse effects.

Occupational health surveys of workers at an Army ammunition plant indicated that atmospheric TNG levels of 0 to 12.5 mg/m<sup>3</sup> cause ischemic heart disease, chest pain, headaches, rash, and death. Other occupational studies found reduced blood pressure, peripheral circulatory disorders, Raynauds phenomena, peripheral neuropathy, and severe coronary sclerosis.

Although TNG has been used extensively as a therapeutic vasodilator, there are no reports of carcinogenicity in humans.

### HEALTH EFFECTS

#### Experimental Animals

Tests in rabbits show that TNG is a very mild skin irritant but not an eye irritant. In guinea pigs, TNG is a moderate skin irritant.

The only adverse effects observed in 4-week oral studies of TNG toxicity in rats, mice, and dogs were decreased food consumption and weight gain.

After 13 weeks of oral exposure to TNG, the only significant effect observed in rats, mice, and dogs was elevated SGOT levels in high-dose rats.

The toxic effects of 12-24 month dietary exposures to TNG in rats, mice, and dogs included decreased weight gain and food consumption in rats and mice and pathologic changes in blood in all three species and in liver and testes of rats.

Reproductive effects in rats were attributed to TNG induced testicular tumors and malnutrition.

TNG is weakly mutagenic in some strains of *Salmonella*. It is not mutagenic in yeast and mammalian assays.

In a 24-month study, rats exposed to TNG in their diets exhibited liver carcinomas and tumors of the testes.

### OTHER CRITERIA, ANALYSES, AND TREATMENT TECHNOLOGIES

Methods for the analysis of TNG below 10 parts per million in aqueous solutions include high pressure liquid chromatography followed by ultraviolet detection of nitrate esters and gas-liquid chromatography using electron capture. Other methods are available for analysis of high concentrations of TNG in water.

Treatment technologies for the removal of TNG in wastewater include activated sludge with lime pretreatment and hydrolysis using ethanol or Ca(OH)<sub>2</sub>. Biotransformation studies show that bacteria incompletely degrade TNG.

## Physical and Chemical Properties

<b>Empirical Formula</b>	$C_3H_5(NO_3)_3$	
<b>Synonyms</b>	TNG, 1,2,3-Propanetriol trinitrate, Glyceryl trinitrate, Trinitroglycerol, Nitroglycerin, Trinitrin	
<b>CAS Number</b>	55-63-0	
<b>Physical State</b>	Pale yellow, viscous liquid	
<b>Molecular Weight</b>	227.09	$CH_2 - ONO_2$
<b>Boiling Point</b>	145°C	
<b>Melting Point</b>	13.5°C	$CH - ONO_2$
<b>Specific Gravity</b>	1.592 at 20°C	
<b>Vapor Pressure</b>	$2.6 \times 10^{-4}$ mm Hg at 20°C	$CH_2 - ONO_2$
<b>Solubility</b>	In water: 0.18% w/v. In ethanol: 25% w/w.	
<b>Flash Point</b>	256°C	
<b>Autoignition</b>	250-260°C	

## Health Effects Data and Advisory Values

<b>Genotoxicity</b>	Results in <i>in vitro</i> <i>Salmonella typhimurium</i> tests were negative to weakly genotoxic. Negative in <i>in vitro</i> Chinese hamster ovary assays. Negative in <i>in vivo</i> bone marrow and kidney cells (rat), dominant lethal (rat), and kidney cells and lymphocytes (dog and rat).	
<b>Reproductive and Developmental Effects</b>	Severe infertility observed in a three-generation reproduction study in rats was attributed to TNG-induced testicular tumors and malnutrition. Results of teratological studies were inconclusive.	
<b>Cancer Classification</b>	Not classified by EPA.	
<b>Reference Dose (RfD)</b>	Not determined	
<b>Drinking Water Equivalent Level (DWEL)</b>	Not determined	
<b>Health Advisory Values</b>	One-Day	0.005 mg/L
	Ten-Day	0.005 mg/L
	Longer-Term	0.005 mg/L
	Lifetime	0.005 mg/L

This summary was developed using information from the Drinking Water Health Advisory.  
For further information contact EPA's Office of Science and Technology at (202) 260-7571.

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