

## Sources of Exposure

## Toxicokinetics and Normal Human Levels

## Biomarkers/Environmental Levels

ToxGuide™

for

RDX

$C_3H_6N_6O_6$

CAS# 121-82-4

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U.S. Department of Health and  
Human Services  
Public Health Service  
Agency for Toxic Substances  
and Disease Registry  
[www.atsdr.cdc.gov](http://www.atsdr.cdc.gov)

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## General Populations

- RDX is a military explosive that does not occur naturally in the environment.
- Exposure to RDX is primarily limited to areas around ammunition plants and military installations where it is manufactured, converted to munitions, packed, loaded, or released through the demilitarization of antiquated munitions.
- Exposure may occur by inhalation, ingestion, or dermal absorption. The most likely mode of exposure is by consumption of contaminated water or agricultural crops irrigated with contaminated water.

## Occupational Populations

- Occupational exposure to RDX can occur when workers handle RDX at Army munitions plants.

## Toxicokinetics

- RDX is well absorbed by the oral route and poorly absorbed through the skin. RDX is also absorbed through the respiratory tract, although the extent of absorption is not known.
- Once absorbed, RDX is widely distributed throughout the body. There is no evidence that RDX accumulates in the body during longer-term exposure.
- RDX is extensively metabolized with very little of an oral dose being excreted unchanged.
- In animals administered radiolabelled RDX via gavage, the highest levels of radioactivity were detected in expired air and in the urine.

## Normal Human Levels

- RDX is not normally detected in humans.

## Biomarkers

- RDX has been detected in the blood shortly after exposure. Five reported cases of accidental ingestion reported serum levels of 268–969 pg/mL three hours after ingestion (estimated doses: 37–250 mg/kg).

## Environmental Levels

### *Air*

- There are no recent air monitoring data for RDX. Indoor levels of 0.032–60 mg/m<sup>3</sup> were detected at an ammunition plant.

### *Water*

- RDX has been detected in groundwater and surface samples at several Army ammunition plants; the concentrations ranged from 0.0087 to 13,200 ppb in groundwater and 0.73 to 249 ppb in surface water.

### *Sediment and Soil*

- RDX has been detected in soil and sediment samples at Army ammunition plants. Soil levels ranged from 0.587 to 75,000 mg/kg and sediment levels ranged from 0.363 to 14,100 mg/kg.

## Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for RDX. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

## Chemical and Physical Information

## Routes of Exposure

## Relevance to Public Health (Health Effects)

### RDX is a solid

- The chemical name for RDX is hexahydro-1,3,5-trinitro-1,3,5-triazine.
- RDX is a white crystalline solid.
- Pure RDX is a highly explosive compound that can be initiated by impact, temperature or friction. It can be combined with other compounds to make plastic explosives (C-4 contains 91% RDX).
- It is not used in consumer products.

### RDX in the Environment

- Effluents and emissions from ammunition plants are responsible for the release of RDX into the environment.
- RDX is expected to exist in the atmosphere in the particulate form and may be subject to removal from air by dry deposition.
- RDX is slow dissolving in water. It does not bind significantly to soils and can leach to groundwater from soil.
- Bioconcentration does not appear to be significant for RDX.
- RDX has been shown to be taken up by plants, including some food crops.

- Inhalation – Minor route of exposure for general population. Predominant route of exposure for workers.
- Oral – Predominant route of exposure to for non-occupational exposure. Exposure can occur through ingestion of contaminated drinking water or consumption of agricultural products irrigated with contaminated water.
- Dermal – Skin contact may occur during manufacture of RDX.

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

### Minimal Risk Levels (MRLs)

#### *Inhalation*

- No acute-, intermediate-, or chronic-duration inhalation MRLs were derived for RDX.

#### *Oral*

- An MRL of 0.2 mg/kg/day has been derived for acute-duration oral exposure ( $\leq 14$  days).
- An MRL of 0.1 mg/kg/day has been derived for intermediate-duration oral exposure (15–364 days).
- An MRL of 0.1 mg/kg/day has been derived for chronic-duration oral exposure ( $\geq 1$  year).

### Health Effects

- The most sensitive target of toxicity is the nervous system. Seizures, convulsions, and tremors have been observed in humans and animals ingesting RDX.
- Some studies have found changes in serum chemistry parameters suggestive of impaired liver function; histological alterations have not been found in the liver and the changes in clinical chemistry parameters were not considered biologically significant.
- Small decreases in erythrocyte and hemoglobin levels have been found in rodents, but this has not been consistently found longer-term studies.
- EPA has determined that RDX is a possible human carcinogen based on the presence of liver tumors in mice exposed to RDX in the diet for 1–2 years. However, a re-evaluation of this mouse study resulted in a re-classification of some of the hepatocellular adenomas as foci of cytoplasmic alterations.

### Children's Health

- Children are expected to be affected by RDX poisoning in the same manner as adults.
- Developmental effects including lethality and impaired growth have been observed at maternally toxic doses in animal studies.