Sources of Exposure

General Populations
- The general population is most likely to be exposed to chlorine dioxide and its by-products (e.g., chlorite ion) through ingestion of treated water.
- Exposure through inhalation is not likely because chlorine dioxide and chlorite do not persist in the atmosphere.

Occupational Populations
- The primary route for occupational exposure to chlorine dioxide and chlorite is inhalation in the immediate vicinity of their use.
- Exposure may occur at facilities that use these chemicals as bleaching agents (pulp and paper mills) or water disinfectants (water-treatment plant).

Toxicokinetics and Normal Human Levels

Toxicokinetics
- Due to its highly reactive nature, little absorption of chlorine dioxide across lung tissue is expected following inhalation exposure.
- Being both a strong oxidizer and water soluble, chlorine dioxide is not likely absorbed in the gastrointestinal tract to any great extent.
- Chlorine dioxide rapidly dissociates predominantly into chlorite (which is also highly reactive) and chloride ion.
- The chloride ion is slowly cleared from the blood and widely distributed throughout the body.
- The chloride ion is primarily eliminated in the urine.

Normal Human Levels
- No data available.

Biomarkers/Environmental Levels

Biomarkers
- Presently, no chemical-specific biomarkers of effect are known to exist for chlorine dioxide or chlorite.

Environmental Levels

Air
- Chlorine dioxide degrades rapidly in air and should only be detected near its source of production or use.

Sediment and Soil
- Concentrations of chlorine dioxide or chlorite are expected to be small or nil.

Water
- In a survey of chlorite levels in water samples from publicly-owned treatment works facilities that use chlorine dioxide, 16% had levels of 0–0.1 ppm, 16% had levels of 0.5–0.6, and 16% had levels >1 ppm.

Reference

Contact Information:
Division of Toxicology and Environmental Medicine
Applied Toxicology Branch
1600 Clifton Road NE, F-62
Atlanta, GA 30333
1-800-CDC-INFO
1-800-232-4636
### Chemical and Physical Information

**Chlorine Dioxide is a Gas**
- Chlorine dioxide is a yellowish to reddish-yellow gas that can decompose rapidly in air.
- Chlorite does not persist in the atmosphere either in ionic form or as chlorite salt.
- When it reacts with water, chlorine dioxide forms chlorite ion.
- Chloride dioxide is used as bleach at paper pulp mills, in public water-treatment facilities to kill bacteria and microorganisms, and to decontaminate public buildings.

### Routes of Exposure

<table>
<thead>
<tr>
<th>Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inhalation</strong></td>
</tr>
<tr>
<td>No MRL was derived for acute-duration inhalation exposure to chlorine dioxide (≤14 days).</td>
</tr>
<tr>
<td>An MRL of 0.001 ppm has been derived for intermediate-duration inhalation exposure to chlorine dioxide (15–364 days).</td>
</tr>
<tr>
<td>No MRL was derived for chronic-duration inhalation exposure to chlorine dioxide (≥1 year).</td>
</tr>
<tr>
<td>No inhalation MRLs were derived for chlorite.</td>
</tr>
</tbody>
</table>

**Oral**
- No oral MRLs were derived for chlorine dioxide. |
- No MRL was derived for acute-duration oral exposure to chlorite (≤14 days). |
- An MRL of 0.1 mg/kg/day was derived for intermediate-duration oral exposure to chlorite (15–364 days). |
- No MRL was derived for chronic-duration oral exposure to chlorite (≥1 year). |

### Relevance to Public Health (Health Effects)

#### Health Effects
- Human and animal studies indicate that chlorine dioxide acts primarily as a respiratory tract and ocular irritant.
- In animal studies, exposure to chlorine dioxide and chlorite during critical periods of neurodevelopment resulted in delayed brain growth, decreased locomotor and exploratory behavior, and altered auditory response.
- Ingestion of large amounts of chlorine dioxide or chlorite may result in irritation of the digestive tract and increased levels of methemoglobin in the blood.
- IARC and EPA have determined that chlorine dioxide and chlorite are not classifiable as to human carcinogenicity.

#### Children’s Health
- Infants may exhibit a greater degree of methemoglobinemia than adults following oral exposure to chlorine dioxide or chlorite.