

## Supplement 1. Safe Handling of Hazardous Substances

### Appendix 1-2 Effect of Cyanides & Heavy Metal on the Human Body

Heavy Metal	Direct Effect	Chronic Effect
Cyanides	<p>Cyanides cause suffocation in a tissue of a living organism and lead to death. Normally, in a few seconds or minutes, symptoms of poisoning such as headache, dizziness, loss of consciousness, twitching, and cooling of body appear and lead to death. If the amount is small, headache, vomiting, increase in breathing, increase in pulse rate, loss of consciousness, and twitch are common symptoms.</p> <p>Lethal dose is 150~300 mg by KCN.</p>	<p>Chronic poisoning will be caused when cyanides are consumed in small portion over a long period of time. Common symptoms are headache, retching, respiratory problems, and nausea and vomiting.</p>
Alkylmercury	<p>When alkylmercury is consumed in large amounts, symptoms such as retching, vomiting, abdominal pain, diarrhea, oral ulcers, trembling hands will appear.</p>	<p>When alkylmercury is consumed over a long period of time, CNS (Central Nervous System) damage is caused with symptoms such as deterioration of memory, concentration problems, headache, insomnia, taste and smell abnormality, drooling, neurasthenic symptom, etc. (cause of Minamata disease)</p>
Total Mercury	<p>When total mercury is consumed in large amounts, gums will decay and blood will disappear in the stool.</p>	
Organic Phosphorus compounds	<p>Mild Case: languor, headache, dizziness, drenching sweats, nausea, vomiting</p> <p>Half-severe Case: ptyalism, contraction of pupils, contraction of muscle line fiber, speech disorder, decreased vision</p>	

	Severe Case: Unconsciousness, jerking throughout the body, and incontinence will lead to death.	
Cadmium	Re-breathing function of the kidney and urinary cell is blocked and calcium gets lost. The calcium in the body gets unbalanced and osteomalacia is caused. De-conditioning of endocrine secretion caused by pregnancy, breast-feeding, menopause, and aging becomes an unfavorable condition for the calcium balance. In addition, it is considered that change in the bones and lack of calcium and protein work as an incentive that exacerbates bone deformation. (cause of Itai-Itai disease)	
Lead	When a huge amount of lead enters into a body, acute poisoning occurs. Abdominal pain, vomiting, diarrhea and urinary retention will appear. The shock caused by severe gastroenteritis can be fatal.	When a small amount of lead enters into a body over a long period of time, the following symptoms will appear; lack of appetite, constipation, fatigue, headache, languor, anemia, articular pain, abdominal pain, paralysis of four limbs, vision disability, cramp, and coma.  Lead accumulation occurs when more than 0.5 mg per day of lead is absorbed into the body.
Chrome (VI)	When a large amount of chrome is taken in, the following symptoms will appear leading to death; vomiting, abdominal pain, decrease in urinary volume, urinary retention, shock, cramp, coma uremia, etc. When chrome is applied to the skin, skin inflammation, edema, ulcers, etc. will appear. Concentration of more than 100 ppm can have an affect on human skin. When chrome is consumed by mouth, concentration of over 0.1 ppm will cause vomiting.	
Arsenic	Ingestion of a large amount of arsenic will cause acute poisoning. Within an hour after the ingestion, symptoms such as nausea, vomiting, diarrhea, dehydration, abdominal pain, garlic-smelling breath, ptyalism, thirst, decrease in	When small amount of arsenic is taken in over a long period of time, limb paresthesia will appear. Skin color will become bronze, palms and soles of feet will become cornified. Nausea, vomiting, abdominal pain, ptyalism, hepatic

	<p>urinary volume will appear.</p> <p>By increased volume of ingestion, symptoms such as severe gastroenteritis, blood in the stool, body temperature decrease, decrease of blood pressure, cramp, coma, circulatory disorder will appear leading to death. Although the lethal dose is about 120mg, 20 mg can be fatal.</p>	<p>hypertrophy, kidney inflammation will appear; and circulatory disorder can be fatal.</p> <p>The intoxicating dose for chronic poisoning is about 0.2 ~ 0.4 ppm by drinking water.</p>
<p>Disaster-prevention Handbook, Safety Committee of Applied Chemistry, School of Engineering, the University of Tokyo</p>		