H-R2 METALS		First Responder EMT AEMT Paramedic

NOTE: Poison Control may be contacted **[1-800-222-1222]** for **INFORMATION ONLY.** Treatment modalities must utilize these guidelines, or may be received through online Medical Control.

Metals

- In order of ascending atomic weight, the following metals are toxic to humans: beryllium, vanadium, cadmium, barium, osmium, **mercury**, thallium, and **lead**.
    - Acute poisoning generally causes direct irritation to the superficial tissues:
        - GI - nausea, vomiting, abdominal pain, GI bleeding/hemorrhagic gastritis, etc.
        - Inhalation - mucous membrane irritation/burning, pneumonitis with wheezing/bronchoconstriction (Metal Fume Fever), pulmonary edema, etc.
        - Skin exposure - inflammation (i.e. dermatitis), ulceration, etc.
    - Chronic poisoning/exposure commonly leads to vague and progressive cellular dysfunction:
        - Neurologic - e.g. peripheral neuropathies, ataxia, weakness
        - Psychological and cognitive symptoms
        - Hematologic disturbance - aplastic anemia or hemolytic anemia, neutropenia, etc.
- *Metalloids*
    - Chemical elements with properties intermediate to those of metals and nonmetals, that tend to have these two general properties: (1) they are semiconductors of electricity, and (2) they form amphoteric oxides.
    - In order of ascending atomic weight, the following metalloids are considered toxic: boron, silicon, germanium, **arsenic**, antimony, tellurium, and polonium.
- **Metal Fume Fever** is the clinical syndrome of fever and other “flu-like” symptoms resulting from inhalation of dust or fumes containing zinc, aluminum, or magnesium oxide.

Specific Metals

Substance	Notes	Treatment (beyond typical supportive care)

Arsenic
 	
Weed killers, pesticides, taxidermy, wood preservatives, etc.
	• Acute exposure
	  ○ GI: **severe, prolonged gastroenteritis** with nausea, vomiting, and cholera-like diarrhea; possible hemorrhage
	  ○ CNS: Altered mental status, seizures and possibly coma
	• Subacute/chronic exposure
	  ○ CNS: peripheral neuropathy
	  ○ Hematologic: anemia
		ED Treatment:
		Dimercaprol or succimer

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Bismuth *Antidiarrheals (bismuth subsalicylate*	• Acute: GI; nephrotoxicity • Chronic: Neurologic	ED Treatment: **Dimercaprol** (limited evidence)
Cadmium *Contaminated soil; welding, soldering, jewelry, and batteries*	• Acute ingestion: GI/hemorrhagic gastritis • Acute inhalation: pneumonitis/pulmonary edema • Chronic: nephrotoxicity	ED Treatment: **Succimer** (limited evidence)
Chromium Corrosion inhibitors (e.g., heating systems), pigment production, leather tanning, metal finishing, dietary supplements, prosthetic joints	• Acute: Skin irritation/dermatitis; GI sxs irritation, renal and pulmonary failure • Chronic: chronic skin irritation, chronic mucus membrane/pulmonary irritation	ED Treatment: **Acetylcysteine** (animal studies suggest efficacy)
Cobalt "Hard metal dust" (tungsten–cobalt mixture), flexible magnets, drying agents, prosthetic joints	• Acute: Contact dermatitis, asthma • Chronic: Metal lung disease (spectrum ranging from alveolitis to fibrosis), cardiomyopathy	ED Treatment: **Acetylcysteine** (animal studies suggest efficacy)

Copper
Copper pipes/containers; fungicide (copper sulfate); welding (copper oxide)
	• Acute:
	  ○ *Ingestion*: resembles iron poisoning (i.e. GI sxs); **blue vomitus** (copper salts), hemolysis, methemoglobinemia
	  ○ *Inhalation*: metal fume fever
	• Chronic: Hepatotoxicity (cirrhosis)
		ED Treatment:
		Dimercaprol or succimer

Iron
Iron pills/supplements
	• **Stage 1 (<6 hours) - Acute GI symptoms:**
	  ○ Directly corrosive to the GI tract
	  ○ The absence of GI symptoms within 6 hours essentially excludes a significant ingestion
	• **Stage 2 (6-24 hours) - Latent Stage:**
	  ○ GI symptoms improve
	  ○ Systemic deterioration begins
	• **Stage 3 (24-48 hours) - Systemic Toxicity:**
	  ○ Iron-induced disruption of cellular
		ED Treatment:
		Deferoxamine

	metabolism with resultant shock and lactic acidosis ○ Coagulopathy/bleeding, cardiomyopathy and multisystem organ failure may also occur ● **Stage 4 (2-5 days) - Hepatotoxicity** ● **Stage 5 (4-6 weeks) - Delayed Sequelae**	
Lead Ingestion (children): *lead paint (banned in the 1970's), ammunition, fishing weights, imported toys, etc.* Inhalation (adults): *battery manufacturing, stained glass, lead smelting, radiator repair, etc.*	● Acute = GI symptoms ● Chronic = Neurologic & cognitive disorders, anemia, renal failure	ED Treatment: **Dimercaprol** (previously known as *British anti-Lewisite or BAL*), *or* **Edetate calcium disodium** (EDTA), *or* **Succimer** (also known as *dimercapto-succinic acid or DMSA*)
Mercury *<u>Elemental</u>: jewelry, battery, and thermometer manufacturing; dentistry* *<u>Inorganic</u>: taxidermy, cosmetics, manufacturing* *<u>Organic</u>: contaminated* ***seafood***	● GI (N/V/D) & Neuro (HA, weakness, etc.) symptoms predominate. ● Ingestion of inorganic form = caustic injury ● **Ingestion of elemental mercury (i.e. liquid in thermometers) generally causes little, if any, toxicity.** ● Inhalation = pneumonitis/pulmonary edema	ED Treatment: **Dimercaprol or succimer**
Silver Colloidal (metallic) silver, cauterizing and antiseptic agent (silver nitrate); jewelry, wire	● Acute: Skin & mucosal irritation (silver oxide or nitrate) ● Chronic: Argyria (permanent skin discoloration)	ED Treatment: **Selenium** (possible role)
Thallium Rodenticides (banned in the US); contaminated herbal products; medical	● Acute: ○ Early: GI symptoms ○ Intermediate (>24 h): painful ascending neuropathy, cardiac	ED Treatment: **Prussian Blue**

radioisotope; homicide (majority)	dysrhythmias, altered mental status ○ Delayed (2 wk): alopecia ● Chronic: Sensorimotor neuropathy, psychosis, hepatotoxicity	
Zinc *Smelting, electroplating, zinc lozenges, welding/ galvanizing (zinc oxide)*	● Acute: ○ Ingestion: GI symptoms ○ Inhalation: mucosal irritation, metal fume fever (zinc oxide) ● Chronic: copper deficiency, anemia, neutropenia	ED Treatment: **Edetate calcium disodium** (EDTA)