## CHART of HEAVY METALS, THEIR SALTS AND OTHER COMPOUNDS

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The 35 capitalized Elements listed on the following chart are those regulated by OSHA as Heavy Metals, including the italicized compounds [1]. Many of the compounds listed can be found in the *NIOSH Pocket Guide to Chemical Hazards and other databases* including *NIOSH* [21], *IDLHC* [22], and *ICSC* [23]. Others can be found in numerous chemical [7, 24-29] and environmental [30] listings, as well as conservation resources [31]. Although conservators may not typically be exposed to some of the OSHA chemicals listed their compounds may be components of complex objects including paper and textiles [8, 32-39], geological collections [36], herbariums [8], cultural property, building structures, or may be present in the environment [40]. The list includes commonly used pigments [5, 41], preservatives and pesticides [5-7, 36, 42-43], mineral sources [5, 6, 24, 31, 36, 43], industrial [45-47] and medically related compounds [5-6, 14-16, 21-23, 45]. The chart serves as a guide only and is not all-inclusive.

## Acronyms used in this chart and in references:

**CAS:** Chemical Abstract Service (chemical registry number)

MSDS: Material Safety Data Sheets

**PEL:** Permissible exposure limit - OSHA regulated concentrations

TLV: Threshold limit value - ACGIH suggested concentration guidelines

TWA: Time-weighted average - NIOSH recommended exposure limits (RELs)

ppm: parts per million (conversion factors: parts of vapor or gas per million parts of contaminated air by volume at 25°C and 1 atmosphere)

mg/m<sup>3</sup>: milligrams per cubic meter (conversion factors: milligrams of vapor or gas per cubic meter of contaminated air at 25°C and 1 atmosphere)

## For comprehensive lists of acronyms, health agencies and governing bodies refer to the following websites:

ACGIH: American Conference of Governmental Industrial Hygienists

CDC: Center for Disease Control and Prevention

DHHS: U.S. Department of Health and Human Services

EPA: U. S. Environmental Protection Agency

OSHA: Occupational Safety and Health Administration

NIOSH: National Institute for Occupational Safety and Health

www.cdc.gov

www.os.dhhs.gov

www.epa.gov

www.osha.gov

www.cdc.gov/niosh

CHEMICAL/ FORMULA / CAS # PHYSICAL DESCRIPTION	SYNONYMS/ TRADE/ MINERAL/ PIGMENTS	USES/ NOTES	OCCUPATIONAL EXPOSURE LEVEL
ALUMINUM (AL) 7429-90-5 Silvery-white, malleable, ductile, odorless metal; silvery-white to grey powder	Aluminium; Aluminum metal; Elemental aluminum; Aluminum powder (aluminum bronze powder)  Minerals: Bauxite ore; Feldspars; Cryolite; Alum; Aluminosilicate clays	Construction; building structures; transportation structures; aerospace industry; solid rocket fuels; electrical applications; electrical transmission lines; explosives; pharmaceuticals; medications (e.g. antacids, buffered aspirin); antiperspirants; medical therapy; cooking utensils; aluminum foil; packaging materials; food packaging; beverage cans; food additives; baking powder; processed cheese; cosmetics; "softened" water; tap water; soap; production of glass and ceramics; salts as textile mordents; aluminum powder used to make aluminum leaf for moisture and waterproof paints; geological specimens	OSHA PEL: TWA 15 mg/m³ (total); TWA 5 mg/m³ (resp); TWA 2 mg/m³ (soluble salts).  * Human dementia syndromes [6]

$\begin{array}{c} \textbf{alpha-Aluminum oxide} \\ Al_2O_3 \\ White odorless crystalline powder \end{array}$	Aluminium oxide; Aluminum oxide; Alumina; Aluminum trioxide; Emery powder (natural aluminum oxide) Mineral: Aloxite; Corundum Gem: Ruby (red form of corundum); Sapphire	Single electron transmitters; super conducting devices; hip replacements; polishing and abrasive applications; sandpaper; manufacture of zeolites; fire retardant; smoke suppressant; chromatography medium; sodium vapor lamps; coatings for compact fluorescent lamps; water filters; protective coatings on pre-finished wood floors; billiard chalk; toothpastes; jewelry; glass (beads); pigment coatings; geological specimens	OSHA PEL: TWA 15 mg/m³ (total); TWA 5 mg/m³ (resp) (as Al)
Aluminum hydroxide 21645-51-2 Al(OH) <sub>3</sub> Odorless white powder in various forms	Alumina hydrate; Aluminum oxide trihydrate; Trihydroxyaluminum; Transparent White <b>Mineral</b> : Bauxite	Transparent White is used in preparation of transparent lake pigments; filler for paints	TLV not established
Aluminum Indigo Carmine  C <sub>16</sub> H <sub>9</sub> AlN <sub>4</sub> O <sub>9</sub> Yellow-greenish powder	Trade names: C.I. Pigment yellow 100; C.I. 19140 Aluminum Lake; C.I. Food Yellow 4 Aluminum Lake; FD & C Yellow No. 5 Aluminum Lake; Japan Food Yellow 4 Aluminum Lake; Lakeolene B 3014; Pigment Yellow 100; Tartrazine Aluminum Lake; Yellow Lake T	Azo dye complex; pigments	*Azo, Diazo, and Azide compounds can detonate
Aluminum silicate clay, Bentonite 1302-78-9 (Calcium or sodium bentonite) Fine, natural clay, granules or powder in variable colors (decomposition of glass particles in volcanic ash)	Colloidal clay; Soap clay; Mineral soap; Gumbrin Mineral: Montmorillonite  Trade names: Fuller's earth; American clay; Wilkinite	Calcium bentonite: Absorbent clay; poultices Sodium bentonite: Water softener; emulsifier in Portland cement and concrete; increases plasticity in ceramic clay body; filler in insecticides, soaps, paper and paints	TLV not established
Aluminum stearate Al $(C_{18}H_{35}O_2)_3$ Hard thermoplastic white powder	Stearic acid aluminum salt; Aluminum (III) stearate; Octadecanoic acid aluminum salt; Daiwax WA1; Metaspa XX; Rofob 3	Soap made by saponification of tallow and treatment with alum; photographic emulsion; waterproofing agent for fabrics, ropes, paper, leather, concrete, and stucco; flattening agent in varnishes and lacquers; forms colloidal solutions or gels with oils, turpentine, mineral spirits; paint and varnish drier, thickener, and emulsifier; artist's oil pastes and prepared paints	OSHA PEL: TWA 15 mg/m³ (total); TWA 5 mg/m³ (resp); TWA 2 mg/m³ (soluble salts) (as Al)
Aluminum sulfate $Al_2(SO_4)_3$ Odorless white crystals or powder. Note: Aluminum sulfate is the general group name used to refer to as alum. Alum compounds include hydrated double salts usually consisting of aluminum sulfate, water, and a sulfate of another element e.g. potassium, sodium, ammonium, selenium, selenate (the first three being the most common, respectively)  Potassium aluminum sulfate $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$ White crystals or powder	Aluminum sulphate; Aluminum trisulfate; Aluminum (III) sulfate; Aluminum sesquisulfate; Fertosan; Aluminum alum; Alum; Alumen; Filter alum; Cake alum; Alumstone; Alum flour; Alum meal; Kalinite; Paper maker's alum; Patent alum; Pearl alum; Pickle alum; Sulfuric acid Aluminum (3) salt (3:2); Tai-Ace S150; NALCO 7530  Mineral: Alunogenite  Alum (most common alum compound); Native alum; Potash alum; Alumina; Alumnus; Alumnae; Alumni; Bitter salt  Mineral: Alunite; Acuminite  Naturally occurring: Potash alum	General uses of Alum compounds: Flocculating agent used to clarify water in gel precipitate of aluminum hydroxide; water purification; sewage treatments; medicinal as an astringent to prevent bleeding (e.g. styptic pencil), adjuvant to enhance immune response in human immunizations, antibacterial agent, antiseptic, emetic, home remedy for canker sores; make-up as a skin whitener; aftershave; wax for hair removal; hair stiffener; natural (crystal) deodorant; food pickling (as a preservative); food additive; some playdough recipes; fire retardant; foamite used in fire extinguishers for chemical and oil fires; leather tanning hardener for gelatin, plastic, cement; filler in paper, cement, paints; paper sizing; mordant in textile dying; preparation of lake pigments; geological specimens	NIOSH REL: TLV: 2 mg/m³ (as Al soluble salts) (ACGIH 1993- 1994)
Aluminum ammonium sulfate AlNH <sub>4</sub> (SO <sub>4</sub> ) <sub>2</sub> ·12H <sub>2</sub> O White crystalline powder	Ammonia alum; Ammonium aluminum sulfate Mineral: Tschermigite	Developing baths for black and white photography; baking powder; textile dying; leather tanning; substrate for lake pigments	

	Hydrated aluminium silicate; China clay; Argilla <b>Trade names:</b> Kaolin; Kaolite <b>Mineral</b> : Kaolinite	Commercial cleaning of fabrics, furs and carpets; porcelain production; filler in paints, pastels, papers, rubbers, cements; abrasives; absorbent for oils and grease; base for Lake pigments	NIOSH REL: TWA 10 mg/m³ (total); TWA 5 mg/m³ (resp)
Sodium aluminum fluosilicate $Na_5Al(SiF_6)_4$ White powder	Silicate hexafluoro-aluminum sodium <b>Trade names</b> : Larvex; Larvex mothproofing  Composition; Selig's Fabriteks (W)	Insecticide; mothproofer (discontinued 1930's); buffer in dye baths	OSHA PEL: TWA 2.5 mg/m³. The PEL applies to other solid fluorides (as F)
Sodium fluoroaluminate 15096-52-3 Na <sub>3</sub> AlF <sub>6</sub> Natural Cryolite mineral: white solid or powder; Synthetic: pink or brown tinted granular powder	Sodium aluminum fluoride; Sodium aluminofluoride; Sodium hexafluoroaluminate; Synthetic Cryolite <b>Trade Names</b> : Cryocide; Cryodust; Cryolite; Kriolit; Kryocide; Kryolith; Prokil <b>Mineral:</b> Cryolite	Used as a flux in solvent for bauxite in electrolytic production of aluminum; filler for bonded abrasive; enamel and glass production; insecticide	OSHA PEL: TWA 2.5 mg/m³ (as F)
Na <sub>2</sub> Si F <sub>6</sub> White powder tinted blue; white granular powder	Sodium silicofluoride; Disodium hexafluorosilicate; Sodium hexafluorosilicate <b>Trade Names</b> : Larvex; Larvex mothproofing; Earwig bait	Fluoridation agent for drinking water; glue; flotation; gelling agent in production of molded latex foam; production of enamels and enamel frit for china and porcelain; leather and wood preservative; insecticide, rodenticide; mothproofer (discontinued 1930's)  All pesticidal products canceled by early 1990's.	OSHA PEL: TWA 2.5 mg/m³ (as F)
ANTIMONY (Sb) 7440-36-0 Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder. *Metalloid; semi-metal. On contact with acids may emit toxic gas, Stibine	Antimony metal; Antimony powder; Antimony black; Antimony regulus; Stibium; C.I. 77050  Mineral: Boulangerite; Bournite; Bournonite; Cerrantite; Cerrusite; Jamisonite; Kermasite; Livingston; Polybasite; Pyragyrite; Scorodite; Senarmonite; Stephanite; Stibiconite; Stibnite; Tetrahedrite  Often found in trace amounts in ancient copper and lead alloys	Air pollution from industrial emissions; medicinal purposes; cosmetics; metal alloy; plumbing; diodes, infrared detectors; cable sheathing; small arms; tracer ammunition; solder; linotype printing machines; pewter ware; flame retardant; safety matches; fireworks; batteries; bullets; decorative metal; silver amalgams such as in early mirror production; forensic residue on archival materials; toys; incense burners; jewelry coatings; ceramics; enamels; glassware; pigments; weighted silks; geological specimens	OSHA PEL*: TWA 0.5 mg/m³ .*Note: The PEL also applies to other antimony compounds (as Sb)  Toxicity is similar to arsenic poisoning [5]  Minor toxic metal [6]
Antimony oxide Sb <sub>2</sub> O <sub>3</sub> White crystalline powder	Antimony trioxide; Antimony sesquioxide; Antimony (III) oxide; Diantimony trioxide; Flowers of antimony  Trade names: Antimony bloom 100A; Atox B; Atox F; Bluestar RG; Bluestar Z; Fire Shield H; Thermoguard B.  Minerals: Senarmonite, Valenitinite  Pigment: Antimony White pigment (synthetic: antimony and barium sulfate); Trade name: Timonox (1919)	Flame retardant; fiberglass composites; opacifying agent for glass, ceramics, enamels; pigments; geological specimens	OSHA PEL: TWA 0.5 mg/m³ (as Sb)  Antimony white: OSHA PEL: TWA 0.5 mg/m³ (as Sb) (as Ba)  *Carcinogenic [31]
Antimony sulfide $Sb_2S_3$ Odorless orange and red to black crystalline solid	Antimony sulphide; Sulfide of antimony; Antimonial glass; Vitreous antimony Mineral: Stibnite (Source of natural black pigment: Antimony Black; black powder also called Kohl) Pigment: Antimony vermilion (precipitate of antimony chloride and sodium thiosulphate or hydrogen sulfide to give orange-deep red globules)	Pigment used in rubber industry; colorant in ruby glass; pigment is fugitive and unstable in paints  Antimony black: Camouflage paints  Kohl: Eye paint in Egypt (Amarna period); also used to blacken edges of books since late 17 <sup>th</sup> century	OSHA PEL: TWA 0.5 mg/m <sup>3</sup> (as Sb)

	Antimony sulfide gives red hue; antimony trisulfide		
	gives orange hue	Antimony oxide sulfide: 19 <sup>th</sup> century red pigment	
Antimony trisulfide 1345-04-6 Sb <sub>2</sub> S <sub>3</sub> (same formula as antimony sulfide) Red-orange crystalline solid	Antimony (III) sulfide; Antimony sulfide; Antimony orange; Antimony red; Antimony vermilion; Antimony black; Hermus mineral  Pigment: Antimony vermilion (orange hue)	Fireworks; matches; colorant in ruby glass	OSHA PEL: TWA 0.5 mg/m³ (as Sb)
Stibine 7803-52-3 SbH <sub>3</sub> Colorless toxic gas with a disagreeable odor like hydrogen sulfide (rotten eggs); may be formed in etching; welding; or battery charging	Antimony hydride; Antimony trihydride; Hydrogen antimonide	Production of semi-conductors; fumigant	Stibine: OSHA PEL: TWA 0.1 ppm (0.5 mg/m³)  *Highly toxic gas; causes hemolysis [6]
ARSENIC (As)  Metal: Silver-gray or tin-white, brittle, odorless solid. Note: OSHA considers "Inorganic Arsenic" to mean copper acetoarsenite & all inorganic compounds containing arsenic except arsine.  *Metalloid; semi-metal	Arsenic metal: Arsenia; Grey arsenic  Minerals: Adamite; Annabergite; Arsenopyrite; Arsenolite; Caludetite; Cobaltite; Conichalcite; Enargite; Erythrite; Finnemanite; Georgiadesite; Glaucodot; Heliophyllite; Koettigite; Legrandite; Loellingite; Mimetite; Miccolite; Nickeline; Olivenite; Orpiment; Pharmacooite; Proustite; Realgar; Schultenite; Skutterudite; Tennantite	Environmental emissions from smelting industries; copper alloys; war gases; homicidal and suicidal weapon; semi-conductors for integrated circuits in supercomputers and cell phones; taxidermy; cell tissue preservative and fixative; human embalming fluid (1850's-1910); fungicides; herbicides; insecticides; pesticides; cosmetics; medicinal purposes; colorant in enamel and glass production (archaeological, contemporary imported glass beads); old wall paper; mordant in textiles; weighted silks; pigments; antifouling paints; geological specimens	OSHA PEL: [1910.1018] TWA 0.01 mg /m³  PEL limits are same for all As compounds unless otherwise noted  Major toxic metal [6]. *Carcinogen; suspect mutagen
Arsenic pentoxide 1303-28-2 As <sub>2</sub> O <sub>5</sub> White deliquescent crystals	Arsenic (V) oxide; Arsenic anhydride; Arsenic acid anhydride	Glass manufacturing; textile dyeing and printing; fungicide; insecticide	OSHA PEL: [1910.1018] TWA 0.01 mg /m <sup>3</sup> (as As)
Arsenic sulfide 56320-22-0 AsS / $As_2S_2$ / $As_2S_4$ 1303-32-8 Translucent to transparent orange-red to yellow-orange crystals	Sulphide of arsenic; Arsenic disulfide  Mineral and Pigment: Realgar  Pigment: Realgar; Red arsenic sulfide; Arsenic red; Red orpiment; Ruby sulfur; Burnt orpiment; Arsenic orange Unstable: Realgar will transform into Pararealgar on exposure to light and turn yellow-orange in color; See Arsenic trisulfide for Orpiment (decomposition product of Realgar)	Fireworks; leather tanning and de-hairing; arsenical paper (e.g. wallpaper, flypaper) used to print calico textiles; pigments; geological specimen	OSHA PEL: [1910.1018] TWA 0.01 mg /m <sup>3</sup> (as As)
Arsenic trichloride 7784-34-1 AsCl <sub>3</sub> Colorless, oily, fuming liquid with pungent odor	Arsenic III chloride; Arsenous chloride; Arsenious chloride; Caustic arsenic chloride; Fuming liquid; Butter of arsenic	Fumigant; insecticide	OSHA PEL: [1910.1018] TWA 0.01 mg /m³ (as As)
Arsenic trioxide 1327-53-3 $As_2O_3$ White or transparent lumps or crystalline powder	Arsenic (III) oxide; Arsenous oxide anhydride; White arsenic; Arsenous acid anhydride; Arsenic sesquioxide; Arsenous trioxide; Arsenic glass; White alum (prior to 1800)	Tissue preservative in taxidermy and natural history specimens; human embalming fluid (1850's-1910); arsenic compound most often used on collections in various pesticide solutions, pastes, soap, sprays; colorant in enamels and paints	OSHA PEL: [1910.1018] TWA 0.01 mg /m <sup>3</sup> (as As)
	Arsenic (III) sulfide; Yellow arsenic sulfide; Arsenic yellow; Arsenous sulfide; Arsenious sulfide; Auripigment	Fireworks; manufacture of infrared transmitting glass; arsenical paper (e.g. wallpaper, flypaper); leather tanning and de-hairing; used to print calico textiles;	OSHA PEL: [1910.1018] TWA 0.01 mg/m³ (as As)

		Mineral: Orpiment (decomposition product of Realgar) Pigment: Orpiment; King's Yellow (synthetic 18 <sup>th</sup> century pigment); Pigment yellow 39; C.I. 77085; C.I. 77086	pigments; geological specimens	
Arsine AsH <sub>3</sub> Colorless highly toxic gas with a mild odor	<b>7784-42-1</b> I, garlic-like	Arsenic hydride; Arsenic trihydride; Arseniuretted hydrogen; Arsenous hydride; Hydrogen arsenide	By-product of refining of non ferrous metals and manufacture of arsenicals when inorganic arsenic is exposed to nascent (freshly formed) hydrogen; chemical reaction occurs in an arsenic spot test; produced by specific organometallic micro-organisms found in the environment	OSHA PEL: TWA 0.05 ppm (0.2 mg/m³) NIOSH REL: 0.002 mg/m³, 15-minute CEILING *Highly toxic gas; causes hemolysis [6]
Gallium arsenide GaAs Grey cubic crystals	1303-00-0		Semi-conductor devices; integrated circuits; laser diodes; solar cells; mobile phones; field transistors; satellite communication; microwave point to point links; some radar systems; electronics; photo mixing	OSHA PEL: [1910.1018] TWA 0.01 mg/m³ (as As)
Iron arsenosulfide FeAsS Silver-white crystals or masses		Iron arsenopyrite; Pyrite; Arsenical pyrite; White metal; Mispickel  Mineral: Arsenopyrite (ore of arsenic)	Geological specimens	OSHA PEL: [1910.1018] TWA 0.01 mg/m³ (as As)
Potassium arsenate KH <sub>2</sub> AsO <sub>4</sub> Colorless or white crystals or powder.	7784-41-0	Arseniate of potash; Macquer's salt; Potassium dihydrogen arsenate; Potassium arsenate, monobasic; Potassium acid arsenate	Analytical reagent; insecticide; hide preservative; textile printing	OSHA PEL: [1910.1018] TWA 0.01 mg/m <sup>3</sup> (as As)
Potassium arsenite KAs <sub>2</sub> HO <sub>4</sub> White hygroscopic powder	10124-50-2	Arsenious acid, potassium salt; Arsenenous acid, potassium salt; Potassium metaarsenite; Fowler's Solution (in solution)	19 <sup>th</sup> century medicinal (coughs, emphysema, skin diseases); pesticide	OSHA PEL: [1910.1018] TWA 0.01 mg/m³ (as As)
Sodium arsenate AsH <sub>3</sub> O <sub>4</sub> . xNa Colorless to white crystals or powder	7631-89-2	Arsenic acid, disodium salt; Sodium arsenate dibasic; Disodium arsenate heptahydrate; sodium metaarsenate; Sodium orthoarsenate Trade Name: Sweeny's Ant-go; Fatsco Ant Poison Arsenic acid disodium salt; Disodium arsenate; Disodium hydrogen arsenate	Insecticide	OSHA PEL: [1910.1018] TWA 0.01 mg/m³ (as As)
Sodium arsenate dibasic AsHNa <sub>2</sub> O <sub>4</sub> Colorless to white crystals or powder	7778-43-0	Trade Name: Jones Ant Killer	Insecticide	
Sodium arsenite NaAsO <sub>2</sub> White granular crystals	7784-46-5	Arsenous acid, Sodium arsenite; Sodium metaarsenite; Arsenous acid sodium salt <b>Trade names</b> : Atlas A; Chem Pels C; Chem-Sen 56; Kill-All; Penite; Prodalumnol; Prodalumnol Double; Sibur; Sodanit	Antiseptic; preservative for hides; herbicides; insecticide; dye making  Siburizing refers to its use as a mothproofer	OSHA PEL: [1910.1018] TWA 0.01 mg/m³ (as As)
BARIUM (Ba) Yellowish to white lustrous solid in va	<b>7440-39-3</b> arious forms		Metal alloys; superconductors; spark plug wires; ammunition; analytical catalyst; radiopaque aid in x-rays; infrared applications; fireworks; soap; paper; plastic; rubber; ceramics; glass; pesticides; fillers; pigments; paints; geological specimens	OSHA PEL: TWA 0.5 mg/m³. *Note: The PEL also applies to other soluble barium compounds (as Ba)
				*Minor toxic metal [6]
Barium acetate Ba(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>2</sub> -H <sub>2</sub> O	543-80-6	Barium diacetate	Mordant in textile dyeing; drier for paints and varnishes	OSHA PEL: TWA 0.5 mg/m³ (as Ba)

White crystalline powder				
Barium carbonate BaCO <sub>3</sub> White powder	513-77-9	Barium monocarbonate; Carbonic acid barium salt Mineral: Witherite Pigment: C.I. Pigment white 10; C.I. 77099	Pesticide; rodenticide; production of bricks; mortar; synthetic marble; glassmaking; pigment in paints and glazes; geological specimens  Barium carbonate is a precipitate from barium hydroxide (alkalizing agent) and carbon dioxide for use as alkaline reserves in paper	OSHA PEL: TWA 0.5 mg /m³ (as Ba)
Barium chloride BaCl <sub>2</sub> Odorless white crystals	10361-37-2	Barium dichloride	Pesticide; leather tanning; mordant for acid dyes	OSHA PEL*: TWA 0.5 mg/m³ (as Ba)
Barium chromate BaCrO <sub>4</sub> Yellow powder (a Chromium (VI) compound [5])	10294-40-3	Chromic acid barium salt  Pigments: Barium yellow; Lemon yellow; Strontium yellow; Ultramarine yellow; Lemon chrome; Permanent yellow; Baryta yellow; Steinbuhl yellow; Pigment yellow 31	Metal primers; anti-corrosion pastes; colorant for glass and ceramic glazes; pigments	OSHA PEL: TWA 0.5 mg /m³ (Ba); OSHA PEL: TWA 0.5 mg /m³ (Cr)
Barium copper silicate Blue crystals: BaCuSi <sub>4</sub> O <sub>10</sub> Purple crystals: BaCuC <sub>2</sub> O <sub>6</sub>		Han blue; Han purple; Chinese blue; Chinese purple	Pigment in paints and ceramics glazes from Han dynasty (208 BCE-220 CE)	OSHA PEL: TWA 0.5 mg/m³ (as Ba)
Barium hydroxide Ba(OH) <sub>2</sub> White crystalline powder	17194-00-2	Barium hydrate; Caustic baryta	Corrosion inhibitor; used to remove sulfates in water; fungicide; insecticide; rodenticide; manufacture of glass and ceramic glazes; aqueous and non-aqueous neutralization and alkalization in paper; Baynes-Cope process (in methanol); cellulose stabilizer	OSHA PEL: TWA 0.5 mg/m³ (as Ba)
$\begin{array}{c} \textbf{Barium hydroxide, monohydrate} \\ BaH_2O_2 \ . \ H_2O \\ White powder \end{array}$	22326-55-2		Production of other barium chemicals; production of lubricating and oil additives; water purification	OSHA PEL: TWA 0.5 mg/m³ (as Ba)
Barium nitrate Ba(NO <sub>3</sub> ) <sub>2</sub> White crystals/fused mass	10022-31-8		Oxidizing agent; rodenticide; green fireworks; green signal lights; manufacture of glass and ceramic glazes	OSHA PEL: TWA 0.5 mg/m³ (as Ba)
Barium oxide BaO Yellowish-white solid in various form	<b>1304-28-5</b>	Barium monoxide; Barium protoxide; Calcined baryta; Heavy earth	Coating for electrodes of fluorescent lamps; dehydrating agent; glazes; pigments	OSHA PEL: TWA 0.5 mg/m³ (as Ba)
Barium sulfate BaSO <sub>4</sub> Odorless, white or yellowish crystals	7727-43-7 or powder	Barium sulphate; Artificial barite Minerals: Barite; Barytes, Heavy spar. Pigments: Barite; Barytes, Heavy spar Blanc fixe; Artificial barite; Barium white; Permanent white; Baryta white; Pigment white 21; C.I. 77120 (synthetic); Bologna white; Permalba	Petroleum production; radiocontrast agent for x-ray imaging; filler and extender in paper, wallpaper, linoleum, oil cloth, rubber, plastics, flannel, shoddy cloth; production of lithopone pigments (with ZnS); pigments; geological specimens	OSHA PEL: TWA 0.5 mg /m³ (as Ba)
Barium sulfide BaS Pale grey powder	21109-95-5	Barium sulphide; Lapis solis; Barium monosulfide; Black ash; Bolognian phosphorus; Bologna stone	Vulcanized rubber; de-hairing hides; the first synthetic phosphor; pigment in luminous paints	OSHA PEL: TWA 0.5 mg/m³ (as Ba)
Barium thiocyanate		Barium sulfocyanide	Photographic solutions; textile dyeing	OSHA PEL: TWA

Ba(SCN) <sub>2</sub> ·2H <sub>2</sub> O White needle shaped crystals			0.5 mg/m <sup>3</sup> (as Ba)
Barium thiosulfate BaS <sub>2</sub> O <sub>3</sub> ·H <sub>2</sub> O White crystalline powder	Barium hyposulfite; Barium thiosulphate	Photographic solutions; textile dyeing; pigments	OSHA PEL: TWA 0.5 mg/m³ (as Ba)
BERYLLIUM (Be) Grey to white powder	Glucinium  Mineral: Behoite; Bertrandite; Beryl; Bromellite; Crysoberyl; Euclase; Gadolinite; Milarite; Phenakite  Gems: Aquamarine Beryl (Be <sub>3</sub> Al <sub>2</sub> Si <sub>6</sub> O <sub>18</sub> ); Emerald (Be <sub>3</sub> Al <sub>2</sub> SiO <sub>6</sub> );	Air emissions from combustion of coal and oil, from beryllium extraction plants, from industrial uses such as ceramic production and beryllium alloy manufacture, and from cigarette smoke; metal alloys; free metal in nuclear reactions; nuclear weapons; missile fuels; space vehicles; space optics; space telescope mirrors; communication satellites; semiconductors; tweeter and loud-speaker construction; spot-welding electrodes; springs; x-ray detectors in analytical instruments; output windows for x-ray tubes; fluorescent light tubes; geological specimens; gemstones	OSHA PEL: 0.002 mg/m³ TWA; 0.005 mg/m³ CEILING. Major toxic metal [6] *Probable carcinogen [5]
Beryllium oxide BeO Refractory white powder	Beryllia, Beryllium monoxide	Electrical installation; abrasive for polishing hard metals; manufacture of glass, ceramics, glazes	TLV (as (TWA) ): ppm; 0.002 mg/m <sup>3</sup> A1 (ACGIH 1999)
BISMUTH TELLURIDE (undoped) 1304-82-1 Bi <sub>2</sub> Te <sub>3</sub> Gray, crystalline solid.	Bismuth sesquitelluride; Bismuth telluride; Bismuth tritelluride Minerals: Tellurobismuthite; Tetradymite; Bismuthinite	Semi-conductors; pharmaceuticals; medical therapy; cosmetics	OSHA PEL: TWA 15 mg/m³ (total); TWA 5 mg/m³ (resp)
BORON (B) 7726-95-6 Amorphous brown powder; black crystals *Metalloid; semi-metal		Brazing alloys; semi-conductors; aircraft and space applications; rocket propellant; fibers and filaments in composites; epoxy resins; ceramics; glass; metals; fabrics; tissue cell preservative; pesticide; oxygen scavenger; laundry soap	OSHA PEL: TWA 15 mg/m <sup>3</sup> ; varies
Borax 1303-96-4 B <sub>4</sub> O <sub>7</sub> Na <sub>2</sub> • 10H2O White crystals or crystalline powder	Sodium borate, decahydrate; Disodium tetraborate decahydrate; Sodium tetraborate decahydrate; Sodium pyroborate decahydrate; salt of Boric acid;  Trade Names: Jaikin, Pyrobor, Three Elephant, V-Bor Mineral: Borax	Gold extraction; anti-corrosion systems; adhesive manufacture; water softener; bactericides; germicides; anti-fungal compound for fiberglass; insecticide; tissue cell preservative; absorbent for natural history specimens; detergents; cosmetics; fire retardant; enamel glazes; buffering agent; curing agent; flux; drying agent; food additive (outside U.S.)	TLV: 1-5 mg/m <sup>3</sup> (ACGIH 1996)
Boric acid 10043-35-3 B(OH) <sub>3</sub> Odorless, colorless crystals or white powder	Boracic acid; Orthoboric acid; Acidum boricum <b>Trade Names</b> : Borid; Drax Ant Killer; It Works;  Mop-up  Mineral: Sassolite	Controls fissure rate of uranium in nuclear power plants; flat panel displays; component in original Silly Putty®; flame retardant; textile fiberglass; antiseptic; anti-bacterial; eye drops; cell tissue preservative; curing agent for hides and skins; insecticide (roaches, silverfish); wood preservative; ceramic production; jewelry manufacture	TLV not established
$\begin{array}{c} \textit{Decaborane} \\ \text{B}_{10}\text{H}_{14} \\ \text{Colorless to white crystals; strong musty or bitter} \\ \text{odor or characteristics sweet chocolate odor of} \end{array}$	Boron hydride; Decaboron tetradecahydride	Boron containing thin film; rocket fuel	OSHA PEL:TWA 0.3 mg/m³ (0.05 ppm) skin

Decaborane  B <sub>10</sub> H <sub>14</sub> Colorless to white crystals; strong musty or bitter odor or characteristics sweet chocolate odor of Boranes	Boron hydride; Decaboron tetradecahydride	Boron containing thin film; rocket fuel	OSHA PEL:TWA 0.3 mg/m³ (0.05 ppm) skin  Note: Explosive with
Diborane 19287-45-7 B <sub>2</sub> H <sub>6</sub> Colorless compressed gas; characteristics sweet chocolate odor of Boranes	Borane; Boroethane; Boron hydride; Borane hydride; Diboron hexahydride; Hydrogen boride	Reducing agent; doping agent for production of semi- conductors; rocket propellant; flame speed accelerant vulcanized rubber	osha PEL: TWA 0.1 ppm (0.1 mg/m³)
Pentaborane 19624-22-7 B <sub>5</sub> H <sub>9</sub> Colorless liquid with pungent odor similar to garlic, acetylene or sour milk	Pentaboron nonahydride	Initial experiments for rocket and jet fuel but was unsuccessful due to high toxicity* and spontaneous combustion	OSHA PEL: TWA 0.005 ppm (0.01 mg/m³) *Similar to nerve agents
CADMIUM (Cd) 7440-43-9 Soft blue-white metal lumps or grey powder. Malleable; turns brittle on exposure to 80°c and tarnishes on exposure to moist air  Cadmium fume (as Cd) 1306-19-0 CdO/Cd Odorless, yellow-brown, finely divided particulate dispersed in air	Cadmium metal, dust, powder Minerals: Hawleyite; Monteponite  Cadmium monoxide; Cadmium oxide fume; Cadmium; Cadmium (II) oxide	Emissions released into environment from ore smelting operations, from mist from cadmium-containing electroplating baths, from calcination (drying) of cadmium pigments, and from handling of powdered cadmium oxide in production of cadmium soaps (used to stabilize plastics); cadmium electrodes; electroplating; nickel-cadmium batteries; bearings; solder alloys; metal coatings; metal alloys; silver alloys; PVC stabilizers; television tubes; semi-conductors; fertilizers; cigarette tobacco; neon sculptures; phosphors; incandescent light filaments; former veterinarian treatment for worms and parasites; colorant in ceramic glazes and glass; pigment in phosphors	OSHA PEL: TWA 0.005 mg/m³  The PEL applies to all Cadmium compounds (as Cd) unless noted.  Major toxic metal [6]. *Known/Probable Carcinogen
Cadmium acetate 543-90-8 Cd(CH <sub>3</sub> CO <sub>2</sub> ) <sub>2</sub> Colorless crystals with characteristic odor	Acetic acid, cadmium salt; Bis(acetoxy) cadmium; cadmium acetate dihydrate	Fungicides for turf and tree bark (discontinued)	TLV: 0.01 mg/m³ (as Cd) A2 (ACGIH 2001)
Cadmium chloride CdCl <sub>2</sub> White crystalline solid	Cadmium Dichloride; Dichlorocadmium <b>Trade Name</b> : Caddy; Vi-CAD	Analytical agent; photography; fungicides for turf and tree bark; fabric printing	TLV: ppm; 0.01 mg/m <sup>3</sup> (as TWA) (as Cd); total dust A2 (ACGIH 1993-1994). TLV (as TWA): ppm; 0.002 mg/m <sup>3</sup> (as Cd); respirable dust A2 (ACGIH 1993-1994)
Cadmium sulfate 10124-36-4 CdSO <sub>4</sub> Odorless white solid	Cadmium sulphate Trade Names: Cad-Trete; CragTurf Fungicide; Kromad; Miller 531	Fungicides for turf and tree bark	TLV (as TWA): ppm; 0.01 mg/m³ (as Cd), A2 (ACGIH 1998)
Cadmium sulfide CdS Light yellow or orange crystals/ yellow to brown powder	Cadmium monosulfide  Mineral: Greenockite; Hawleyite  Pigment Trade names: Cadmium yellow; C.I. Pigment yellow 37; Cadmium golden 366; Cadmium lemon yellow; Cadmium orange; Cadmium primrose 819;  Cadmium yellow 10 G cone: Cadmium yellow cone	Coatings on photovoltaic cells; pigments	TLV: 0.01 mg/m <sup>3</sup> (as Cd), A2 (ACGIH 1996)

Cadmium sulpho-selenide Cd S(Se)	Pigment: Cadmium red	Pigment	OSHA PEL: TWA 0.005 mg/m³ (Cd)
Cadmium sulpho-selenide co-precipitated with Barium sulphate	Cadmium Red or Yellow Lithopone		
CALCIUM (Ca) 7440-70-2 Lustrous silver white metal (when freshly cut); turns bluish grey on exposure to moist air.	Elemental calcium	Reducing agent; alloying agent; tissue cell preservative; absorbent in natural history specimens; component in bones, shells; filler/flux in ceramic and glass manufacture	TLV not established; varies with compounds
Calcium acetate C <sub>4</sub> H <sub>6</sub> CaO <sub>4</sub> White powder (acetic acid with calcium carbonate or lime)		Metallic soap; liming rosin; curing and tanning skins; used to re-introduce calcium ions into weathered glass; mordant in textile dyeing and printing; used as neutralization and alkalization agent for aqueous and non aqueous treatments in paper conservation	TLV not established
Calcium arsenate 7778-44-1 As <sub>2</sub> Ca <sub>3</sub> O <sub>8</sub> Colorless to white, amorphous powder	Tricalcium arsenate; Tricalcium ortho-arsenate; Calcium ortho-arsenate; Calcium salt (2:3) of arsenic Acid; Arsenic acid, calcium salt  Trade Names: Spra-cal; Turf-Cal; Cucumber dust	Herbicide; insecticide; weed killer	OSHA PEL: [1910.1018] TWA 0.01 mg/m³ (as As)
Calcium bicarbonate Ca(HCO <sub>3</sub> ) <sub>2</sub> Aqueous solution of calcium carbonate in carbonic acid	Calcium hydrogen carbonate	Formation of stalactites, stalagmites, and caves; used as neutralization and alkalization agent in paper conservation	TLV not established
Calcium borate CaB <sub>4</sub> O <sub>7</sub> White powder	Mineral: Colemanite	Flux for ceramic glazes, glass and metallurgy	TLV not established
Calcium carbonate 471-34-1 CaCO <sub>3</sub> White, odorless powder or colorless crystals.	Calcium salt of carbonic acid; Paris white; Precipitated chalk; Vienna lime  Occurs in Nature as: Aragonite; Calcite; Chalk; Dolomite; Limestone; Marble; Oyster shells; Sea shells; Vaterite	Cement; mortar; limestone; marble construction; glass industry; chalkboard chalk; toothpaste; component in shell collections; in conservation as alkaline reserve in paper; geological specimens	OSHA PEL: TWA 15 mg/m³ (total); TWA 5 mg/m³ (resp)
Calcium chloride CaCl <sub>2</sub> White hygroscopic powder	Calcium (II) chloride; Calcium dichloride; E 509	Antifreeze solution; ice melting agent; fire extinguishers; fireproofing solutions; wood preservatives; medicinal uses; additive in plastic; fabric softener; beverage electrolyte; pickeling; production of Brie; gelling agent for starch sizing; desiccant. Until 1973, was used to speed up curing rate in mortar, shotcrete (gunite) and dry mix concrete but was replaced due to corrosion of steel reinforcements	TLV not established
Calcium chloride hypochlorite CaCl(OCl) Fine white powder	Chlorinated lime; bleaching powder	Strong oxidizing bleach	TLV not established

Calcium fluoride 7789-75-5 CaF <sub>2</sub> White powder	Calcium difluoride; Fluorspar; Derbyshire spar Mineral: Fluorite	Metal surface treatments; soldering agents; welding agents; abrasives; pyrotechnics; ceramic glazes; enamels; glass	TLV: 2.5 mg/m <sup>3</sup> (as F)
Calcium fluorosilicate CaSiF <sub>6</sub> White powder	Calcium fluorite; Calcium hexafluorosilicate; Calcium silicofluoride	Insecticides; ceramics; enamels; glass	TLV: 2.5 mg/m <sup>3</sup> (as F)
Calcium hydroxide Ca(OH) <sub>2</sub> White, odorless powde.	Calcium dihydroxide; Calcium hydrate; Hydrated lime; Slaked lime; Caustic lime; Milk of lime; Lime water (aqueous solution)	Used for detection of carbon dioxide; water softener; mortar; cement; stucco; glass; white wash; putty; leather tanning; papermaking; in conservation for washing and prep for alkaline deposits and buffering of paper	OSHA PEL: TWA 15 mg/m³ (total) 5 mg/m³ (resp)
Calcium oxide 1305-78-8 CaO White or gray, odorless lumps or granular powder	Burned lime; Burnt lime; Calcia; Caustic lime; Hot lime; Hydrated lime; Hydraulic lime; Lime; Pebble lime; Quick lime; Unslaked lime	Used for detection of carbon dioxide; water softener; mortar; cement; stucco; glass; white wash; putty; leather tanning; insecticide; fertilizer; papermaking; in conservation for washing and prep for alkaline deposits and buffering of paper	OSHA PEL: TWA 15 mg/m³ (total); 5 mg/m³ (resp)
Calcium sulfate CaSO <sub>4</sub> Odorless white powder or colorless crystals; may have a blue, gray or reddish tinge; can be brick red  Calcium sulfate dehydrate CaSO <sub>4*</sub> 2H <sub>2</sub> O Odorless, white powder or colorless, crystalline solid; may have blue, gray, or reddish tinge	Anhydrous calcium sulfate; Anhydrous gypsum; Anhydrous sulfate of lime; Blue marble; Calcium salt of sulfuric acid  Note: Gypsum is the dihydrate form; Plaster of Paris is the hemihydrate form.  Mineral: Anhydrite	Plaster structures; composition and fills in ceramics, figurines; filler in polychrome sculpture; filler in gesso grosso ground layer; filler in paper, paints and plastic; chalkboard chalk	OSHA PEL: TWA 15 mg/m³ (total); 5.0 mg/m³ (resp)
CHROMIUM (Cd) 7440-47-3 Steel grey lustrous brittle, hard, odorless solid metal.  Trivalent chromium Cr (III) is an essential metal [6]  Hexavalent chromium Cr (VI) compounds are considered to be the most toxic [6]  Chromium metal is a Cr (VI) compound [5]	Chrome; Chrome plate Minerals: Chromite; Crocoite; Eskolaite; Phoenicochoroite; Uvarovite	Cr (VI) compounds are principle substance of all chromium chemicals used in production of stainless steel and magnetic tapes; anti-corrosive in cooking systems; boilers; oil-drilling muds; hip replacements; gasoline additive; electrical conductors; catalyst; glass production; chrome salts for tanning leather; fixative in specimen preparation; weighted silks; textile mordents; wood preservatives; varnishes; artificial patinas; inks; pigments; geological specimens; synthetic rubies	OSHA PEL: TWA 1.0 mg/m³; TLV: 0.05 mg/m³ (Cr VI compounds); TLV: 0.5 mg/m³ (Cr III compounds) Major toxic metal; Cr (III) is essential metal with potential for toxicity [6]  *Known/Probable carcinogen; possible
Chromic acetate 1066-30-4 Cr(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>3</sub> ·H <sub>2</sub> O Grayish granular powder	Chromium acetate	Catalyst; hardener for photographic emulsions; leather tanning; mordant in dyeing and printing textiles	mutagen [5]  OSHA PEL: TWA 1.0 mg/m³; TLV: 0.05 mg/m³ (Cr VI compounds) 2.0
Chromic chloride 10025-73-7 CrCl <sub>3</sub> Shiny, violet plate-like crystals	Chromium chloride; Chromium trichloride; Chromium sesquichloride	Vapor plating chromium; corrosion inhibitor; leather tanning; mordant for textile dyes	TLV (as TWA) 0.5 mg/m <sup>3</sup> (as Cr), A4 (ACGIH 1998)

Chromic fluoride CrF <sub>3</sub> Dark green needle-like crystals	7788-97-8	Chromium (III) fluoride; Chromium trifluoride	Mothproofing; metal polish; marble hardener; printing and dyeing wool fabrics	OSHA PEL: TWA 0.5 mg/m³ (as Cr); TWA 2.5 mg/m³ (as F)
Chromic sulfate Cr <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> Several hydrated forms: Anhydrous: Violet-red powder	10101-53-8	Chromium sulfate	Metal plating solutions; hardener in photographic emulsions; leather tanning; ceramic glazes; mordents in dyeing and printing textiles; varnishes; inks	OSHA PEL: TWA 0.5 mg/m³ for Cr (III) compounds (as Cr)
Hydrated: green powder				
Chromium dioxide CrO <sub>2</sub> Black powder	12018-01-8		Semi conductors; active material in recording tapes; magnetic strips on credit cards	TLV not established
Chromium III oxide Cr <sub>2</sub> O <sub>3</sub> Anhydrous oxide of chromium Dull, opaque green crystals  Hydrous oxide of chromium Cr <sub>2</sub> O <sub>3</sub> . 2H <sub>2</sub> O Transparent bright green crystals	1308-38-9	Chromium oxide; Chromic oxide; Chromium sesquioxide  Mineral: Chromite; Eskolaite  Pigment: Chromium oxide green, opaque; Chrome green; Institutional green  Chromium hydroxide  Pigments: Viridian; vert emeraude (also see Emerald green for same name but different compound; Emerald chromium oxide is the old name for Viridian); Guignet's green; Chromium oxide green, transparent; Pigment green 17	Molds for firing of bricks (chromite); abrasives; green rouge metal polish; leather tanning, camouflage coatings for military; deck paints; pigments; geological specimens  Pigment; printing ink	OSHA PEL: TWA 0.5 mg/m <sup>3</sup> for Cr (III) compounds (as Cr)
Chromium potassium sulfate CrK(SO <sub>4</sub> ) <sub>2</sub> ·12H <sub>2</sub> O Dark violet crystals	10141-00-1	Chrome alum; Chrome potash alum; Potassium chrome alum; Potassium chromium sulfate	Hardener in photographic processing solutions; leather tanning; mordant for textile dyeing	OSHA PEL: TWA 0.5 mg/m³ for Cr (III) compounds (as Cr)
Chromium trioxide CrO <sub>3</sub> Dark, violet-red deliquescent crystals	1333-82-0	Chromic acid; Chromic anhydride; Chromium (VI) oxide	Chrome plating baths; engraving etchings; leather tanning; colorant in ceramics and glass	TLV: 0.05 mg/m³ (as Cr) (ACGIH 1993- 1994)
Strontium chromate SrCrO <sub>4</sub> Yellow crystalline powder (a Cr (VI) compound [5])	7789-06-2	Chromic Acid Strontium Salt; Green cinnabar; Citron yellow Pigments: Deep lemon yellow; Strontium Yellow; C.I. pigment Yellow 32; C.I. 77839	Pyrotechnics; anti-corrosive coating; pigments	TLV: ppm; 0.0005 mg/m³ (as Cr), A2: (ACGIH 1998)
COBALT (Co) Odorless, silver-gray powder	7440-48-4	Metal dust and fume  Trade names: Aquacat; Super cobalt; cobalt-59; C.I.77320; NCI-C60311  Minerals: Bieberite; Chloanthite; Cobaltite; Erythrite; Glaucodot; Linnaetile; Skutterudite; Smaltite; Spherococbaltite	High-temperature alloys; permanent magnets; drying agent for paints, varnishes, inks; catalyst for petroleum industry; catalyst in manufacture of many pigments; colorant in glass production; ground coats for porcelain enamels; pigments (cobalt blue and cobalt green); geological specimens	OSHA PEL: TWA 0.1 mg/m³; TLV: 0.05 mg/m³  Essential metal with potential for toxicity [6]  *Probable Carcinogen

Anhydrous cobalt phosphate Co <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub> or Anhydrous cobalt arsenate	Pigment: Cobalt violet	Pigment	TLV: 0.02 mg/m <sup>3</sup> (as TWA) (as Co), A3 (ACGIH 1997);
Co <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> or a mixture of the two. Transparent red-violet crystals			OSHA PEL: [1910.1018] TWA 0.01 mg /m <sup>3</sup> (as As)
Cobalt aluminate CoO · Al <sub>2</sub> O <sub>3</sub> Blue crystals	Cobalt (II) oxide-aluminum oxide  Pigments: Azure blue; C.I. 77346; Cobalt blue; Cobalt ultramarine; Dresden blue; Hungary blue; King's blue; Leyden blue; Olympia blue; Pigment blue 28; Thénard's blue (also made with cobalt phosphate and aluminum); Vienna blue; Vienna ultramarine	Cobalt blue filter in ophthalmoscopes; ceramic glazes; colorant for glass, enamels; pigments; 19 <sup>th</sup> century replacement pigment for smalt and ultramarine	OSHA PEL: TWA 0.1 mg/m³; TLV: 0.05 mg/m³ (as Co)
Cobalt (II) chloride 7646-79-9 CoCl <sub>2</sub> Pale-blue, hygroscopic powder, turns pink on exposure to moist air	Cobalt dichloride; Cobalt muriate; Cobaltous chloride; Cobaltous Dihydrate; Cobaltous Hexahydrate	Pale blue leaflets that turn pink upon exposure to moist air; added to Silica gel as an indicator of effectiveness as a desiccant due to color change	OSHA PEL: TWA 0.1 mg/m³; TLV: 0.05 mg/m³ (as Co)
Cobalt (III) oxide 1308-04-9 Co <sub>2</sub> O <sub>3</sub> Black-gray crystalline powder	Dicobalt trioxide; Cobalt sesquioxide; Cobalt trioxide; Cobaltic oxide; Cobaltous oxide Pigment: Smalt (early pigment in glass) Trade name: C.I. 77323	Glass; background for gold lettering on signs; pigment (frequently found on old paintings)	TLV: 0.02 mg/m³ (as TWA) (as Co), A3 (ACGIH 1997)
Cobalt oxide (CoO) and Zinc oxide (ZnO) Semi-transparent blue-green crystals	Pigment: Cobalt green (Zinc green, Rinmann's green)	Colorant in ceramic glazes and (cobalt) glass, enamels; pigments	TLV: 0.02 mg/m³ (as TWA) (as Co), A3 (ACGIH 1997) OSHA PEL: TWA 5.0 mg/m³ (fume); TWA 15 mg/m³ (total dust); TWA 5 mg/m³ (resp dust) (as Zn)
Cobaltous ammonium sulfate CoSO <sub>4</sub> -(NH <sub>4</sub> )SO <sub>4</sub> -6H <sub>2</sub> O Ruby red crystals		Cobalt plating; colorant in enamels, ceramic glazes and glass	TLV: 0.02 mg/m <sup>3</sup> (as TWA) (as Co), A3 (ACGIH 1997
Cobaltous stannate CoO · nSnO <sub>2</sub> Blue-green crystals	Cobalt (II) stannate; Cobalt stannate; Cobalt tin oxide; Pigment blue 35  Pigment: Cerulean Blue; C.I. 77346; C.I. 77368; Coeruleum	Drier for oil paints; pigments	TLV: 0.02 mg/m³ (as TWA) (as Co), A3 (ACGIH 1997)
	Cobalt potassium nitrate Pigment: Cobalt yellow; Aureolin; Fisher's salt	Oil-based glazes; colorant in glass; watercolor and tempera paints; pigments	TLV: 0.02 mg/m <sup>3</sup> (as TWA) (as Co), A3 (ACGIH 1997)
COPPER (Cu) 7440-50-8  Metal; Red powder, turns green on exposure to moist air.	Mineral: Chalcopyrite (primary ore); Native copper	Metal alloys; solder; ammunition; construction; shipbuilding; roofing; plumbing pipes; water pipes; household fixtures; metal nails; electrical wiring; heat conductor; electromagnets;	OSHA PEL: TWA: 1.0 mg/m³. The PEL applies to other copper compounds (as Cu)
Cu/CuO fume 1317-38-0	Cu fume: Copper fume CuO: Copper monoxide fume; Copper (III) oxide fume;	generators, and transformers; electrical relays and switches; integrated circuits; vacuum tubes; cathode	except copper fume.  Fume: TWA 0.1 mg/m <sup>3</sup>

COPPER (Cu) Metal; Red powder, turns green on e moist air. Cu/CuO fume	7440-50-8 exposure to 1317-38-0	Mineral: Chalcopyrite (primary ore); Native copper  Cu fume: Copper fume CuO: Copper monoxide fume; Copper (III) oxide fume; Cupric oxide fume; Black copper oxide fume; Copper oxide, Red  Copper oxide, Black: Black copper oxide fume Copper oxide, Red: Cuprous oxide; Cuprite	Metal alloys; solder; ammunition; construction; shipbuilding; roofing; plumbing pipes; water pipes; household fixtures; metal nails; electrical wiring; heat conductor; electromagnetic motors; electromagnets; generators, and transformers; electrical relays and switches; integrated circuits; vacuum tubes; cathode ray tubes; extinguishing powder in Class D fire extinguishers; magnetrons in microwave ovens; cooking utensils; medical purposes; germicidal; musical instruments; jewelry; ornaments; sculpture; bronze and brass powders used for imitation gold; copper leaf; colorant in glass production; pigments; geological specimens	OSHA PEL: TWA: 1.0 mg/m³. The PEL applies to other copper compounds (as Cu) except copper fume. Fume: TWA 0.1 mg/m³  Essential metal with potential for toxicity [6]. Inhalation of fume may cause metal fume fever.
Copper acetate Cu(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>2</sub> ·H <sub>2</sub> O Dark green crystalline powder	142-71-2	Cupric acetate; Crystals of Venus; Verdet; Verdiris	Fungicide; pesticide; textile dye; pigment for ceramics, inks and paints	OSHA PEL: TWA 1.0 mg/m <sup>3</sup> as copper dusts and mists
Copper acetate, dibasic $Cu(C_2H_3O_2)_2 \cdot 2Cu \text{ (OH)}_2$ Blue-green crystals or powder	52503-64-7	Basic copper acetate; Copper subacetate; Cupric acetate, basic  Pigment: Blue Verdigris; Common Verdigris; French Verdigris; Green Verdigris; Van Eyck green; vert de Grece	Pigment used in early oil paintings was fugitive and can turn dark brown; used on parchment to illuminate books between 15 <sup>th</sup> and 19 <sup>th</sup> century; fungicide; pesticide; textile dye; pigment for ceramics and paints	OSHA PEL: TWA 1.0 mg/m <sup>3</sup> as copper dusts and mists
Copper acetoarsenite  C <sub>4</sub> H <sub>6</sub> As <sub>6</sub> Cu <sub>4</sub> O <sub>16</sub> White solid tinted bright green	12002-03-8	Copper acetate arsenite; Copper aceto-arsenite Cupric acetoarenite; (Aceto) Trimetaarsenitodicopper;  Trade names (insecticides): Ortho P-G Bait; Sowbug Cutworm Control; other  Pigments:: Emerald green; French green; Paris green; Schweinfurt green; Mitis green; C.I.Pigment Green 21; Imperial green; King's green; Meadow green; Mineral green; Moss green; Parrot green; other	Insecticide for agricultural, horticultural use; imitation bronze patina; antifouling agent in marine paints; pigments	OSHA PEL: [1910.1018] TWA 0.01 mg/m³ (as As) *Potential carcinogen [28]
Copper arsenate As <sub>2</sub> Cu <sub>3</sub> H <sub>8</sub> O <sub>12</sub> /Cu <sub>3</sub> (AsO <sub>4</sub> ) <sub>2</sub> · 4H <sub>2</sub> O Blue or bluish-green powder	10103-61-4	Copper (II) orthoarsenate; Arsenic acid, copper salt	Insecticide; wood preservative	TLV: ppm; 0.2 mg/m <sup>3</sup> (as As), ACGIH 1992-1993)
Copper (II) arsenite CuAsHO <sub>3</sub> Yellowish-green powder	10290-12-7	Copper orthoarsenite; Acid copper arsenite; Cupric arsenite; Arsenious acid, copper (II) salt  Trade names: Copper Orthoarsenite; Air-Flo Green  Pigment: Scheele's green; Swedish green; Cupric green	Fungicide; insecticide; rodenticide; wood preservative; pigments	TLV: ppm; 0.01 mg/m <sup>3</sup> (as As), A1 (ACGIH 1998)
Copper (II) carbonate CuCO <sub>3</sub> - Cu(OH) <sub>2</sub> Green crystals	1184-64-1 12069-69-1	Basic copper carbonate; Cupric carbonate  Mineral and Pigment: Malachite; Mountain green Artificial: Green Verditer	Corrosion product of copper, copper alloys; fungicide; fireworks; pigments; occasionally found in tempera paints prior to and after 16 <sup>th</sup> century; used in distemper and oil based paints in 19 <sup>th</sup> century; geological specimens; gemstones	OSHA PEL: TWA 1.0 mg/m <sup>3</sup> as copper dusts and mists
Copper (II) carbonate 2CuCO <sub>3</sub> -Cu(OH) <sub>2</sub> Blue crystals	1184-64-1 12069-69-1	Basic copper carbonate; Cupric carbonate  Mineral and Pigment: Azurite (Mountain blue)  Pigments: Artificial pigment: Blue Verditer; Ashes blue; Blue bice (greenish-blue color); Bremen blue	Corrosion product of copper, copper alloys; fungicide; fireworks; pigments; geological specimens; gemstones	OSHA PEL: TWA 1.0 mg/m <sup>3</sup> as copper dusts and mists

Copper chromated arsenate Formula varies Green tint	CCA; Chromated copper arsenate  Trade name: Tanalith	Wood preservative for pressure treated wood (certain products canceled 2003)	OSHA PEL: TWA: 1.0 mg/m³; TLV: 0.05 mg/m³ (Cr VI compounds); TLV: 0.5 mg/m³ (Cr III compounds);
			OSHA PEL: [1910.1018] TWA 0.01 mg /m <sup>3</sup> (as As)
			OSHA PEL: TWA: 1.0 mg/m³. The PEL applies to other copper compounds (as Cu) except copper fume. Fume: TWA 0.1 mg/m³
Copper naphthenate 1338-02-9 Green liquid with petroleum-like odor	Copper salt of naphthenic acid; Paint drier <b>Trade names:</b> Cuprinol; Cuprinol Green; Redycoat; Shakelast; Wittox-C	Used in solution with mineral spirits or oils; fungicide; insecticide; wood preservative; antifouling paints	OSHA PEL: TWA: 1.0 mg/m³ (as Cu)
Copper nitrate 3521-23-8 Ca(NO <sub>3</sub> ) <sub>2</sub> Green-blue deliquescent crystals	Cupric nitrate	Fungicide; wood preservative; mordant and oxidizing agent for textile dyeing; colorant for metals; pigment for ceramic, enamels, and glass	OSHA PEL: TWA 1.0 mg/m³ as copper dusts and mists
Copper sulfate (anhydrous) 7758-98-7 CuSO <sub>4</sub> White hygroscopic or pale green crystals Pentahydrate form is bright blue crystals	Cupric sulphate, Sulfuric acid, copper(2+) salt(11); Copper (II) sulfate; Blue vitriol; Bluestone Anhydrous Mineral: Chalcocyanite Pentahydrate Mineral: Chalcanthite	Analytical agent in certain chemical tests including Fehling's solution, Benedict's solution, and Biuret reagent; hardener for cattle hooves; used to grow crystal (laboratory); hair dyes; agent in certain fungicides, herbicides and pesticides; colorant for glass	OSHA PEL: TWA 1.0 mg/m³ as copper dusts and mists
HAFNIUM (POWDER) (Hf) 7440-58-6 Gray powder Metal is highly lustrous, ductile, grayish solid; Often associated with Uranium, Yttrium, and Zirconium in natural minerals	Celtium; Elemental hafnium; Hafnium metal Minerals: Found in Zircon, Cyrtolite, Alvite, Malacon	Neutron absorbing material in nuclear reactors; filament in light bulbs; cathode in x-ray tubes; oxygen and nitrogen scavenger; glass; geological specimens	OSHA PEL: TWA 0.5 mg/m³. The PEL applies to other hafnium compounds (as Hf).
IRON (OXIDE dust and fume) Fe <sub>2</sub> O <sub>3</sub> Reddish-brown solid	Ferric oxide; Iron(III) oxide; Crocus powder Mineral: Hematite in many varieties (red or black); Magnetite; Kamacite and Taenite (iron-nickel meteorites) Pigments: Iron oxide red; Hematite; Red ochre; English red; Indian red (from India); Light Red; Pozzuoli red (volcanic origin from Pozzuoli near Naples); Venetian red	Construction; machinery; tools; weapons; corrosion product (rust); jeweler's rouge; magnets; colorant in glass production; pigments; geological specimens	OSHA PEL: TWA 10 mg/m³; 5 mg/m³ (resp); TLV: 1 mg/m³ (soluble salts)  Fe metal is an essential metal with potential for toxicity [6].
Ferric ammonium sulfate FeNH <sub>4</sub> (SO <sub>4</sub> ) <sub>2</sub> ·12H <sub>2</sub> O Pale lilac crystals; effloresce in air Also light green crystalline solid	Ferric alum; Iron ammonium sulfate; Ammonium ferrous sulfate; Ammonium iron sulfate; Diammonium iron disulfate  Trade Name: Mohr's Salt	Metallurgy; chemical analysis; medicine; toning solutions for black and white photography; mordant in textile dying	TLV: 1.0 mg/m <sup>3</sup> TWA as soluble iron salt (as Fe) (ACGIH)

Ferric arsenite 63989-69-5 As <sub>2</sub> Fe <sub>2</sub> O <sub>6</sub> •Fe <sub>2</sub> O <sub>3</sub> • 5H <sub>2</sub> O Brown powder	Iron (iii)-o-arsenite, pentahydrate	Antidote for arsenical poisoning; co-precipitate of arsenic reduction/removal from water and mines	OSHA PEL: [1910.1018] TWA 0.01 mg /m <sup>3</sup> (as As) *Carcinogen [23]
LEAD (Pb) 7439-92-1 Bluish-white or silvery-grey solid in various forms. turns tarnished on exposure to air	Lead metal; Plumbum  Minerals: Anglesite; Boleite; Boulangerite; Bournite; Bournonite; Cerussite; Curite; Descloizite; Finnemanite; Fiedlerite; Galena; Georgiadesite; Heliophyllite; Jamesonite; Kasolite; Linarite; Mimetite; Pentfieldite; Phoenicochroite; Phosgenite; Pyromorphite; Schultenite; Vanadinite; Wulfenite	Environmental excess exposure due to vehicle exhaust and industrial uses; metal alloys; solder; construction; brass pipe fittings; bearings; tools; metal chain ballast; gaskets gasoline additives; pesticides; lead labels on specimens; ear liners on taxidermy mounts; sculptures; older toys (paint and major component e.g. lead figurines); ceramic clay bodies and glazes; glass production; enamel in cloisonné materials; metal coatings; foil; lead-acid batteries; battery clamps; cables; radiation shields; ammunition; fireworks; counter-weights; sash weights; plastics; glass (including beads); cames for stain glass panels; linotype printing blocks; lead inlay such as on Asian lacquer pieces; microchemical tests; Oddy test; mordant in textiles; weighted silks; salts used to speed curing time of drying oils; old house paint; paints; pigments; geological specimens	OSHA PEL: 1910.1025 TWA 0.05 mg/m³. The PEL applies to other Pb compounds. Major toxic metal [6].  *Human mutagen; birth defects; retardation; some compounds are probable carcinogens
	Acetic acid lead salt; Lead (II) acetate; Lead diacetate; Lead dibasic acetate; Neutral lead acetate; Plumbous acetate, Salt of Saturn; Sugar of lead	Insecticides; hair dyes; sweetener for food and wine (imported); dyes; antifouling paints; manufacture of black colors for japanning	OSHA PEL: 1910.1025 TWA 0.05 mg/m³ (as Pb)
<b>Lead antimonite</b> Pb <sub>2</sub> Sb <sub>2</sub> O <sub>7</sub> Lemon yellow with variants of greenish, pinkish orange, or reddish tinged powder	Antimonite of lead  Pigment (synthetic): Naples yellow; Antimony yellow;  Pigment yellow 41	Colorant for ceramic tiles; glass; pottery glazes; paints; pigments	OSHA PEL: TWA 0.05 mg/m³ (as Pb) OSHA PEL: TWA 0.5 mg/m³ (as Sb)
Lead arsenate 7784-40-9 PbHAsO <sub>4</sub> Odorless white heavy powder	Arsenic acid, lead salt; Acid lead arsenate; Dibasic lead arsenate; Plumbous arsenate; Lead hydrogen arsenate; Acid Orthoarsenate  Trade name: Lead arsenate; Gypsine; Soprabel; NU Rexform; Security; Talbot Mineral: Schultenite	Hardener in lead-antimony alloys; cable sheathing; insecticide; taxidermy; pigment; geological specimen	TLV (as TWA) 0.15 mg/m³ as Pb³(AsO <sub>4</sub> ) <sub>2</sub> (ACGIH 1997)
Lead arsenite As <sub>2</sub> O <sub>4</sub> Pb White powder	Lead (II) arsenite; Lead metaarsenite; Arsenious acid lead (2) salt	Insecticide	TLV (as Pb): ppm; 0.05 mg/m³, A3, (ACGIH 1999). TLV (as As): ppm; 0.01 mg/m^3, A1, (ACGIH 1999) *Carcinogen; Reproductive toxicity [23]
Lead carbonate 598-63-0 PbCO <sub>3</sub> Colorless to grayish-white crystals	Carbonic acid, lead(2+) salt; Lead(2+) carbonate  Mineral: Cerussite  Pigment: Basic carbonate of lead: White lead; Cremnitz white; Kremnitz white; Flake white	Synthetic mother of pearl; pigments; geological specimens	OSHA PEL: 1910.1025 TWA 0.05 mg/m³ (as Pb)

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Lead carbonate, basic 1319-46-6 2PbCO <sub>3</sub> ·Pb(OH) <sub>2</sub> White amorphous powder	Basic white lead; Lead subcarbonate; Hydrocerussite; Lead flake Mineral: Hydrocerussite Pigments: Lead white; cremnitz white; Krems white; Silver white; Dutch white lead; French white; Vienna white; Flemish white; London white; Roman white; Pigment white No. 1	Ceramic glazes; used in drying oils; primary white pigment for oil paint and ceramic glazes prior to 20 <sup>th</sup> century; found in egg tempera, glue tempera, gum tempera; exterior paints; interior paints until restricted in 1950's and prohibited since 1978	OSHA PEL: 1910.1025 TWA 0.05 mg/m³ (as Pb)
Lead chromate (VI) 7758-97-6 PbCrO <sub>4</sub> Yellow to orange-yellow crystalline powder	Plumbous Chromate; Chromic Acid, Lead (II) Salt (11); Minerals: Crocoite, Phoenicochroite.  Pigments: Chrome Yellow; Cologne yellow; King's yellow (also see Orpiment for same name but different compound); Leipzig yellow; Paris yellow; C.I. Pigment yellow 34' C.I. 77600. Note: Chrome green ( mixed lead chromate and Prussian blue; also called Cinnabar green or Zinnober green).	Pyrotechnics; pigments; geological specimens	TLV: 0.05 mg/m³ (as Pb); 0.012 mg/m³ (as Cr); NIOSH REL: 0.001 012 mg/m³ (as Cr VI)  *Carcinogen [5]
Basic lead chromate PbCrO <sub>4</sub> · Pb(OH) <sub>2</sub> Brick-red crystalline powder	Pigment: Chrome red; Chinese red	Pigment	
<b>Lead iodide</b> PbI <sub>2</sub> Bright yellow powder (from reaction of lead acetate and potassium iodide)	Lead (II) iodide	Cloud seeding; photography; bronzing; gold pencils; ormolu; printing	OSHA PEL: 1910.1025 TWA 0.05 mg/m³ (as Pb)
Lead molybdenum Pb (MoO <sub>4</sub> ) Yellow, orange, brown, gray, whitish crystalline solid	Mineral: Wulfenite	Geological specimens	OSHA PEL: 1910.1025 TWA 0.05 mg/m³ (as Pb)
Lead naphthenate C <sub>7</sub> H <sub>12</sub> O <sub>2</sub> - xPb Yellow semi-transparent paste	Naphthenic acid, lead salt; Cyclohexanecarboxylic acid, lead salt  Trade name: Nuodex	Insecticide; wood preservative; drier in oil paints and varnishes to speed polymerization and oxidation processes	TLV not established; OSHA PEL: 1910.1025 TWA 0.05 mg/m³ (as Pb)
Lead nitrate 10099-74-8 Pb(NO <sub>3</sub> ) <sub>2</sub> White or colorless crystals	Lead (II) nitrate; Lead dinitrate; Plumbous nitrate	Oxidizing agent; engraving and lithographic processes; photography; stain for mother-of-pearl; mordant in dyeing and printing calico	OSHA PEL: 1910.1025 TWA 0.05 mg/m³ (as Pb)
Lead (II) oxide PbO Odorless grey to yellow-green to red-brown crystalline solid	Lead monoxide; Plumbous oxide; Lead protoxide Mineral: Massicot Pigment: Massicot, yellow (made by gentle roasting of white lead); lead oxide yellow Litharge: Flake litharge, yellow-orange (formed from direct oxidation of molten metallic lead)	Batteries; lead crystal; flint glass; rubber vulcanizer; ceramics; dryer in paints and varnishes; important as intermediate step in preparation of red lead; pigments; geological specimens	TLV: ppm; 0.15 mg/m <sup>3</sup> as TWA (as Pb) (ACGIH 1992-1993)
Lead sulfide1314-87-0PbSBlack to silvery powder or crystalline solid	Galena; Leaded bisilicate ash; Plumbous sulfide Mineral: Galena (main source of lead)	Semi-conductors; infrared detectors as photon detectors; ceramic glazes; Medieval pottery; 17 <sup>th</sup> century slipware; geological specimens	OSHA PEL: 1910.1025 TWA 0.05 mg/m³ (as Pb)

PbS Black to silvery powder or crystalline solid	Galena; Leaded bisilicate ash; Plumbous sulfide Mineral: Galena (main source of lead)	Semi-conductors; infrared detectors as photon detectors; ceramic glazes; Medieval pottery; 17 <sup>th</sup> century slipware; geological specimens	OSHA PEL: 1910.1025 TWA 0.05 mg/m³ (as Pb)  *Suspect carcinogen [31]
Lead tetroxide 1314-41-6 Pb <sub>3</sub> O <sub>4</sub> Red or orange crystals or powder	Triplumbic tetroxide; Lead orthoplumbate  Mineral: Minium  Pigments: C.I. Pigment Red 105; Lead oxide; Mineral red; Minium; Orange mineral; Paris red; Red lead; Saturn red	Older plumbing fixtures; batteries; amateur pyrotechnics; lead glass manufacture; enamels; ceramic glazes; flux in porcelain paints; rust proof paint; pigments; illuminated manuscripts	OSHA PEL: TWA 0.05 mg/m <sup>3</sup> (as Pb)
		Motor fuel antiknock compound	OSHA PEL: TWA 0.075 mg/m <sup>3</sup> skin
Tetramethyl lead Pb(CH <sub>3</sub> ) <sub>4</sub> / C <sub>4</sub> H <sub>12</sub> Pb Colorless liquid with characteristic odor		Motor fuel antiknock compound	OSHA PEL: TWA 0.075 mg/m <sup>3</sup> skin
MAGNESIUM (Mg) 7439-95-4  Magnesium (Oxide fume) 1309-48-4  MgO  Hygroscopic, fine, white powder	Magnesia; Magnesia fume; Calcined brucite; Calcined magnesia; Magnesium earth  Minerals: Carnallite; Dolomite; Epsomite; Kieserite; Magnesite; Periclase  Trade Names: Bookkeeper; Magcal, Maglite, Magox, Akro-Mag, Animag, Granmag, Magchem 100, Marmag	Light-weight metallic alloys; production of carbon dioxide; magnesia cement; medicinal purposes; fireworks; flashbulbs; optical mirrors; fillers in paper, ceramics, glass, and paint; ceramic glazes; glass production; non-alkalization agent for paper in conservation	OSHA PEL: TWA 15 mg/m³; TLV: 10 mg/m³ (fumes)  Inhalation may cause metal fume fever. Mg metal is an essential metal with potential for toxicity [6]
$\label{eq:chrysotile} \begin{array}{c} \text{Chrysotile} & \text{12001-29-5} \\ \text{Mg}_3 \text{Si}_2 \text{H}_4 \text{O}_6  /  \text{Mg}_3 (\text{Si}_2 \text{O}_5) (\text{OH})_4 \\ \text{White, grey, green or yellowish curly fibrous solid} \end{array}$	Asbestos chrysotile; White asbestos; Serpentine chrysotile Mineral: Chrysotile (from serpentine rocks)	Building construction (in U.S. chrysotile accounts for 95% of asbestos use) e.g. corrugated cement roof sheets, flat sheets for ceilings, floors, walls; floor tiles; pipe insulation; joint compound; fireproof spun fabric; fire-protective cloth behind fuses; rope seals to boilers	TLV: 0.1 fibers/cc (as TWA) A1 (ACGIH 1998. For fibers longer than 5 um with an aspect ratio equal to or greater than: 3:1 as determined by the membrane filter method at 400-450X magnification (4-mm objective) phase contrast elimination)
Magnesium carbonate MgCO <sub>3</sub> White powder  Magnesium bicarbonate Mg(HCO <sub>3</sub> ) <sub>2</sub>	Carbonic acid, magnesium salt  Mineral: Magnesite  Trade names: Gold Star; Hydromagnesite; Kimboshi;  Magnesia	Production of carbon dioxide; absorbent for natural history specimens; paper washing; alkaline reserve for paper	OSHA PEL: TWA 15 mg/m³ (total); TWA 5 mg/m³ (resp) (as Mg)
Magnesium hydroxide 1309-42-8	Magnesium hydrate; Magnesia Magma	Manufacture of paper pulp; production of aqueous	OSHA PEL: TWA

$\begin{array}{ll} \textbf{Magnesium silicate hydrous} & \textbf{14807-96-6} \\ Mg_3(OH)_2Si_4O_{10} & \\ White powder & \end{array}$	Hydrated magnesium silicate; Talc; Asbestine; French chalk; Steatite; Soapstone	Abrasives; fireproofing agent; fillers in paints, paper and crayons	TLV: 2 mg/m³ (resp, no asbestos) (as Mg)
Magnesium sulfate 7487-88-9 MgSO <sub>4</sub> White crystals or powder	Magnesium sulphate Trade names: Epsom salts (as heptahydrate form) Minerals: Epsomite	Soil additive for plants; maintains magnesium balance in marine aquaria; medicinal uses including treatment of asthma, first aid for barium poisoning, anti-inflammatory, as a laxative; bath salts; flotation therapy; additive in some bottled water; coagulant in tofu production; desiccant in organic synthesis; lava lamp repairs; geological specimens	TLV not established
Methoxy magnesium methyl carbonate 3CH <sub>3</sub> OMgOCO <sub>2</sub> CH <sub>3</sub> ·CO <sub>2</sub> Non-aqueous solution	Methyl magnesium carbonate; MMC; MMMC Trade name: Wei T'o <sup>TM</sup> #2	Paper deacidification	Not available
MANGANESE (Mn) 7439-96-5 Gray-white powder; lustrous, brittle, silvery solid.	Manganese metal: Colloidal manganese; Manganese-55 Minerals: Babingtonite; Bixbyite; Braunite; Eosphorite; Ferberite; Franklinite; Hausmannite; Hauerite; Heubnerite; Johanssenite; Manganite; Manganosite; Phosphophyllite; Purpurite; Pyrolusite; Rhodochrosite; Rhodonite; Romanechite; Psilomelane; nodules on ocean floor Pigments: Manganese Blue (barium manganese-barium sulphate); Manganese Violet (manganese ammonium phosphate)	Metal alloy; welding alloys; deoxidizing agent; colorant in glass to produce pink tones; ceramic glazes	OSHA PEL*: 5.0 mg/m³ CEILING; NIOSH REL: 1.0 mg/m³. Essential metal with potential for toxicity [6]. Mn dust is pyrophoric; ignites in chlorine
Manganese dioxide 1313-13-9 MnO <sub>2</sub> Black to brown powder	Manganese (IV) oxide; Manganese peroxide; Black oxide of manganese; C.I. 77728; Battery manganese Mineral: Pyrolusite Pigment: Manganese Black; Manganese brown (synthetic); Pigment black 14	Dry cell batteries (alkaline and zinc-carbon batteries); oxidizing agent; analytical catalyst; water treatments; glass production; colorant in mortar; drier for oil paints; pigments; geological specimens	TLV: 5.0 (dust) or 1.0 (fume) mg/m <sup>3</sup> ; RET as STEL: 3 mg/m <sup>3</sup> (fume) (as Mn) (ACGIH 1994-1995)
$\begin{tabular}{ll} Manganese oxide & 1317-35-7 \\ Mn_3O_4 & Brown to black crystalline powder & \\ \end{tabular}$	Trimanganese tetraoxide; Manganese tetroxide; Manganomanganic oxide Mineral: Hausmannite	Analytical catalyst in several chemical reactions; lithium batteries; geological specimens	TLV: 0.2 mg/m³ (as Mn) (ACGIH 2001)
MERCURY (Hg) 7439-97-6 Odorless, heavy and mobile silvery liquid metal Hg <sup>0</sup> found in metallic or vapor form.	Quicksilver; Liquid silver; Colloidal mercury; Metallic mercury  Mineral: Native metal; Cinnabar ore; Calomel;  Montroydite	Mercury vapor is natural in atmosphere from degassing of earth's crust; extraction of gold; coal; manufacture of industrial chemicals; scientific instruments; thermometers; barometers; blood pressure monitors; light bulbs; mercury vapor lamps; some neon signs; contemporary compact fluorescent bulbs; electrical relay systems; silent light; switches; medicinal purposes (e.g. Mercurochrome, Calomel); antiseptics; laxatives; antidepressants; additive in inoculations; antisyphilitics; preservative in vaccines (Thimerosal); tattoo inks; early manufacture of felt, fur and wool; fungicides; herbicides; pesticides; photography; metal amalgams e.g gold gilding, silver; amalgam silvered mirrors; dental amalgam fillings; fixative in specimen preparation; blue neon gas; toys and toy paint; interior wall paint; pigments; geological specimens	OSHA PEL: 0.1 mg/m³ CEILING; TLV: 0.05 mg/m³ (skin; inorganic) Major toxic metal; vapor is most toxic form [6]  *Central Nervous System damage  *Probable developmental toxicant [5]

Mercuric arsenate HgHAsO <sub>4</sub> Yellow powder	C.I. 77762	Anti-fouling and waterproof paints	OSHA PEL: [1910.1018] TWA: 0.01 mg/m³ (as As); OSHA PEL: 0.1 mg/m³ (as Hg) CEILING; TLV: 0.05 mg/m³ (skin; inorganic) (as Hg)
Mercuric chloride 7487-94-7 HgCl <sub>2</sub> White crystals or powder	Mercury dichloride; Mercury (II) chloride; Bichloride of mercury; Corrosive sublimate Trade names: Calochlor; Abavit B; Fungchex; Sulem; TL898; NCI-C60173	Antiseptic; disinfectant; tissue cell preservative; taxidermy; fungicide; herbicide; insecticide; pesticide; beetles, roaches, termites; on herbaria collections (still used in third world countries); photography; leather tanning; used to separate gold from lead; paint preservative	TLV: 0.025 mg/m³ (skin, A4) (as Hg) (ACGIH 1999).  *Most toxic Hg compound; ingestion of 0.5 grams can be fatal [5]
Mercuric nitrate 10045-94-0 Hg(NO <sub>3</sub> ) <sub>2</sub> White crystalline powder; colorless deliquescent crystals	Mercury (II) nitrate; Mercury Dinitrate; Mercury nitrate monohydrate  Trade names: Citrine ointment; Millon's Reagent	Analytical chemical; medicinal purposes; used in former carroting process in manufacture of felt, fur, wool until 1941 in U.S. (may still be present in objects made from recycled material); used in aqueous solutions for gilding	TLV: 0.025 mg/m <sup>3</sup> (skin) A4 (as Hg) (ACGIH 1999)
Mercuric oxide HgO Yellow or orange-yellow, or red heavy crystalline powder; yellow when finely powdered	Mercury (II) oxide; Red mercuric oxide; Yellow mercuric oxide; mercury monoxide  Trade names: Santar; Santar M; Natural Montroydite	Analytical reagent; chemical intermediate for mercury salts, organic mercury compounds, and chlorine monoxide; dry cell batteries; abrasives; glass modifier; preservative in cosmetics; antiseptic; fungicide; pigment modifier; pigment; formerly used in antifouling/marine paints	TLV: 0.025 mg/m <sup>3</sup> A4 (skin) (as Hg) (ACGIH 2000)
Mercuric sulfate 7783-35-9 HgSO <sub>4</sub> Odorless, white crystalline powder	Mercury(II) sulfate; Mercuric bisulfate	Gold and silver extraction; analytical chemical used to make other mercury compounds; medicinal purposes	TLV: ppm; 0.025 mg/m³ (skin, A4) (as Hg) (ACGIH 1999)
Mercuric sulfide HgS Odorless red-orange or black powder	Mercury sulfide; Mercury (II) sulfide; Red mercury sulfide; mercuric sulfide, black; mercuric sulfide, red; Ethiops mineral, black  Pigment: Cinnabar (natural); Artificial cinnabar; English vermilion; Chinese vermilion; Chinese red; Minium (as used by early Greeks and Romans; modern term refers to artificial red lead); Orange vermilion; Scarlet vermilion; Vermilion; C.I. Pigment Red 106  Mineral: Cinnabar	Pigments; red ink as used by early (at least Hans) Chinese on cartouches, and stamp seals; geological specimens	OSHA PEL: 0.1 mg/m <sup>3</sup> CEILING; TLV: 0.05 mg/m <sup>3</sup> (skin; inorganic) (as Hg)
	Dimercury dichloride; Calomel; Mercury subchloride; mild mercury chloride <b>Trade names</b> : Cyclosan, M-C Turf fungicide	Medicinal purposes; teething powder; pesticide	TLV: 0.025 mg/m <sup>3</sup> (skin) A4 (as Hg) (ACGIH 1999)
Mercury bromide 7789-47-1 HgBr <sub>2</sub> White crystalline powder	Mercury (II) bromide; mercuric bromide; mercuric dibromide; mercury dibromide; Dibromomercury	Chemical reagent in Koenigs-Knorr reaction with carbohydrates; reagent in a chemical test for presence of arsenic	OSHA PEL: 0.1 mg/m <sup>3</sup> CEILING; TLV: 0.05 mg/m <sup>3</sup> (skin; inorganic) (as Hg)

MOLYBDENUM (Mo) 7439-98-7 Dark gray or black powder with a metallic luster; silvery-white solid	Molybdenum metal  Mineral: Molybdenite (MoS <sub>2</sub> ); Wulfenite  Pigment: Molybdate orange	Found naturally in the soil; fertilizers; production of certain catalysts; high-temperature resistant steel alloys used in gas turbines and jet aircraft engines; propeller shafts; tools; boiler plates; rifle barrels; x-ray tubes; electrical contacts; filaments; glass to metal seals; lubricants, dyes; pigments; geological specimens	OSHA PEL: TWA 15 mg/m³ for insoluble Mo compounds. OSHA PEL: TWA 5 mg/m³ for soluble Mo compounds.  Essential metal with potential for toxicity [6]
Molybdate orange (mixed compound of lead chromate, lead sulphate, lead molybdate		Pigment	TLV: 0.05 mg/m³ (as Pb); 0.012 mg/m³ (as Cr); NIOSH REL: 0.001 mg/m³ (as Cr VI)
NICKEL (Ni) 7440-02-0 Silvery metallic solid in various forms; magnetic	Nickel metal: Elemental nickel; Nickel catalyst; White copper  Mineral: Bunsenite; Garnierite; Niccolite (NiAs), also called Kupfernickel; Nickeline; Nitrobarite; Pentlandite; Pyrrhotite; Retgersite; Kamacite and Taenite (ironnickel meteorites)	Metal alloys; stainless steels; magnets; electroplating; coins; chemical apparatus; analytical catalyst; cooking utensils; substitute for decorative silver; clothing fasteners; jewelry; green colorant in glass production; geological specimens	OSHA PEL: TWA 1.0 mg/m³. The PEL does not apply to Nickel carbonyl; NIOSH REL: 0.015 mg/m³  Major toxic metal [6]  *Carcinogen  Combustible Solid
OSMIUM (Os) 7440-04-2 Bluish-white solid	Mineral: Osmiridium; Iridosmine; trace element in all platinum ores	Manufacture of platinum alloys; analytical catalyst; electric light filaments. As an alloy with iridium: fountain pen points; surgical needles; phonograph needles; compass points; instrument pivots	Not available
Osmium tetroxide OsO <sub>4</sub> Colorless, crystalline solid or pale-yellow mass with an unpleasant, acrid, chlorine-like odor; turns to liquid above 105°F	Osmium (IV) oxide; Osmic acid anhydride; Osmium oxide; Tetraoxosmium  Trade name: Milas' Reagent	Platinum group alloy; oxidizing agent; staining agent in Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM); staining agent for fatty tissue; intermediate in osmium ore refining; surgical implants such as pacemaker and replacement pulmonary valves; filament in Oslamp; forensic residue on archival material (osmium/ruthenium tetoxide); fingerprint detection	OSHA PEL: TWA 0.002 mg/m³ *Extremely toxic
PLATINUM (Pt) 7440-06-4 Silvery, whitish-gray, malleable, ductile metal. * Platinum group metals include ruthenium, rhodium, palladium, osmium, and iridium [6]	Platinum black; Platinum metal; Platinum sponge	Laboratory equipment; electrical contacts; catalytic converter; catalyst in fuel cells; bullion; electrolysis; photography; watch-making; jewelry; medical purposes; chemotherapeutic drugs; dentistry; surgical instruments; resistance thermometers; pen points; silvery color leaf; metal inlay in Egyptian boxes; used as simulated silver for decorative purposes	OSHA PEL: TWA 0.002 mg/m³; TLV 0.002 mg/m³ (soluble salts); TLV: 1.0 mg/m³ (metal)
RHODIUM (Rh) 7440-16-6 Metal: white with bluish-grey luster; hard, ductile. Powder: grey to black	Rhodium metal: Elemental rhodium  Minerals: Rhodite; Sperrylite; Iridosmine; all Platinum ores	Alloying agent; electrodes for aircraft spark plugs; lab crucibles; optical instruments; coating on sterling silver; catalyst in catalytic converter systems; filter in	OSHA PEL: TWA 0.1 mg/m <sup>3</sup> for <i>insoluble</i> Rh compounds. OSHA

		mammography; pen surfaces; target element in some hand-held XRF instruments; high-reflectivity mirror surfaces on searchlights, optical instruments and cinema projectors; jewelry	PEL: TWA 0.001 mg/m³ for <i>soluble</i> Rh compounds
SELENIUM (Se) 7782-49-2 Odorless solid in various forms. dark red-brown to bluish-black amorphous solid or red transparent crystals or metallic grey to black crystals *Metalloid; semi-metal	Elemental selenium, Selenium alloy; occurs as an impurity in most sulfide ores  Mineral: Selenolite	Metal alloys; replacement (with bismuth) in brasses to replace lead rubber compounds; electronics; television screens; photocopiers; photocells; light meters; cameras; toners in photography; industrial radiography; solar cells; medical purposes; xeroradiography; red and pink colorant for ceramic glazes and glass; pigment manufacture	OSHA PEL: TWA 0.2 mg/m³. The PEL applies to other selenium compounds (as Se) except Selenium hexafluoride.  Essential metal with potential for toxicity [6]  *Mutagen [5]
Hydrogen selenide 7783-07-5 H <sub>2</sub> Se Colorless compressed liquefied gas with characteristic odor	Selenium hydride; Dihydrogen monoselenide  Trade name: Selane	Production of semi-conductors; synthesis of Se compounds	OSHA PEL: C: 20 ppm, 50 ppm, 10-minute maximum peak
SILVER (Ag) 7440-22-4 White metal, turns dark on exposure to ozone, hydrogen sulfide or sulfur	Argentium Pigment/gilding: Silver leaf; Silver powder, C.I. 77820	Metal alloys; amalgams; mirrors; electrical contacts; medical purposes; photographic plates; jewelry; coins; eating utensils; food and drink containers; silver foil; gilding; paint; pigment; geological specimens	OSHA PEL: TWA 0.01 mg/m³  Minor toxic metal [6].  Can cause permanent blue-black stain on skin [5]
Silver nitrate 7761-88-8 AgNO <sub>3</sub> Odorless, colorless transparent or white crystals	Nitric acid, silver (I) salt; Silver (I) nitrate; Silver mononitrate; Lunar caustic; Lapis infernalis	Organic synthesis; reagent in chemical spot test for chlorides; silver staining for proteins and nucleic acids; stain in SEM; photography; high refractive index glass for camera lenses; antiseptic; cauterizing agent; treatment of oral ulcers; silver mirrors; silver plating; hair dyeing; indelible inks; colorant for glass and porcelain	OSHA PEL: TWA 0.01 mg/m <sup>3</sup>
TANTALUM (Ta) 7440-25-7 Steel-blue to gray solid or black, odorless powder	Tantalum metal; Tantalum-181; Tantalum oxide; Tantalum pentoxide; Tantalum acid anhydride  Minerals: Found with Niobium in Columbite, Tantalite, Microlite, others	Alloys especially for carbide tools and jet engines; chemical process equipment; nuclear reactors; missile parts; electronic capacitors and resistors; pen nibs; surgical instruments; surgical implants; sutures and pins (bones); glass for telescopes and camera lenses; fine wire; filament	OSHA PEL: TWA 5.0 mg/m <sup>3</sup> Powder ignites SPONTANEOUSLY in air
TELLURIUM (Te) 13494-80-9  Dark gray to brown amorphous powder, with metal characteristics or silvery-white, lustrous crystalline solid.  *Metalloid; semi-metal  Part of sulfur and selenium family [6]	Aurum paradoxum; Metallum problematum  Minerals: Avicennite; Paratellurite; occurs as Telluride in gold, silver, copper, lead, and nickel ores	Produced as a by-product of metal refineries; used in refining of copper; manufacture of rubber; vapor is used in "daylight" lamps; a catalyst in certain metal alloys; used as a semi-conductor; production of solar cells; infrared detectors; thermoelectric generators; food packaging found in condiments, dairy products, nuts, fish; some plants such as garlic; colorant in	OSHA PEL: TWA 0.1 mg/m³. The PEL applies to other Te compounds except Tellurium hexafluoride and Bismuth telluride

		ceramic glazes and glass	Minor toxic metal [6]
THALLIUM (TI) 7440-28-0 Bluish-white, very soft metal. turns grey on exposure to air	Ramor; Thallium (metal)  Minerals: Carlinite; Crookesite; Hutchinsonite; Lorandite; Pierrotite; Routherite	A by-product of refining cadmium, iron, zinc; catalyst in certain alloys and chemicals; nuclear medicine; optical lenses; glass windows; jewelry; infrared detectors; relays; switches; production of photo cells; low-temperature thermometers; semiconductors; scintillation counters; green pyrotechnics dyes; rat poison; ant killer; insecticides; production of artificial diamonds; pigments	OSHA PEL: TWA 0.1 mg/m³ skin  Minor toxic metal; some compounds are highly toxic [6]  *Possible toxicity to human reproduction or development
	Trade Name: Ratox	Rodenticide, ants	TLV (as Tl): 0.1 mg/m <sup>3</sup> (as TWA) (skin) (ACGIH 1999)
TIN (Sn) 7440-31-5 Gray to almost silver-white, ductile, malleable, lustrous solid	Bright tin; Metallic tin; Tin flake; Tin metal; Tin plate; Tin powder; Silver mat powder  Mineral: Cassiterite  Trade names: C.I. Metal 5; Tin paste 62-1177; Wang	Manufacture of tin-plate; roof construction; solder; alloy in bronze and brass; pewter; decorative items; toys; plating for iron toys; glass production; medical purposes; food packaging; bactericides; fungicides; slimicides; stabilizers in plastics; textile mordents; gilding as tin leaf	OSHA PEL:TWA 2.0 mg/m³. Note: The PEL applies to other inorganic Sn except tin oxides. OSHA PEL: TWA 0.1 mg/m³ for organic Sn compounds  Minor toxic metal; some organic compounds are highly toxic [6]
	Tin (IV) oxide; Stannic anhydride; Tin dioxide; Flowers of tin; Polishing powder; Putty powder; Tin ash Mineral: Cassiterite	Polishing abrasive	OSHA PEL:TWA 2.0 mg/m³ (as Sn)
Stannic sulfide 1315-01-1 SnS <sub>2</sub> Bronze yellow scaly crystalline powder	Tin IV sulfide; Tin disulfide; Artificial tin; Mosaic gold (also Purpurino); Bronze powder  Trade name: Suvarnavanga (Indian Ayurvedic medicine)	Previous medical treatment for nervousness; pigment in bronzing and gilding	OSHA PEL: TWA 0.1 mg/m³ for <i>organic</i> Sn compounds
TITANIUM (dioxide) 13463-67-7 TiO <sub>2</sub> Colorless to white crystalline powder; dense white opaque powder	Titanium oxide; Titanium peroxide; Titania; Titanic anhydride; Titanic acid anhydride  Minerals: Anatase; Brookite; Ilmenite (menachanite); Rutile  Pigment: Titanium white; Pigment white 6  Trade names: Titanox (for pigment); C.I. 77891	Whitener in cosmetics, food, paper, plastics, toothpastes, gessoes; cement; textiles; leather ink; ceramic glazes; pigment; geological specimens; gemstones; imitation diamonds in paste jewelry	OSHA PEL: TWA 15 mg/m³  Ti metal is a Minor toxic metal [6] *Potential Carcinogen
URANIUM (U) 7440-61-1 Silver-white, malleable, ductile, lustrous solid; weakly radioactive	Uranium I Minerals: Autunite; Bequerelite; Betafite; Carnotite; Curite; Descloizite; Kasolite; Pitchblende; Samarskite; Thorianite; Torbernite; Uraninite; Uranite Often associated with Hafnium and Yttrium  Pigment: Kawai's yellow	Uranium: Fuel in nuclear reactors; nuclear weapons; armor plating; stains in TEM; radiometric dating of earth; radioactive specimens; vertebrate fossils; x-ray targets; toners in photography; lamp filaments; eyeglass lenses; dentures; smoke detectors cloisonné jewelry; colorant in uranium glass (Vaseline glass), ceramic glaze (Fiesta ware); textile mordents; stains	OSHA PEL: TWA 0.25 mg/m³ (insoluble compounds); 0.05 mg/m³ (soluble compounds)  Minor toxic metal [6].

Radon is derived from the radioactive duranium to radium (226) then to radon g	ecay of	Uranium I  Minerals: Autunite; Bequerelite; Betafite; Carnotite; Curite; Descloizite; Kasolite; Pitchblende; Samarskite; Thorianite; Torbernite; Uraninite; Uranite Often associated with Hafnium and Yttrium  Pigment: Kawai's yellow	Uranium: Fuel in nuclear reactors; nuclear weapons; armor plating; stains in TEM; radiometric dating of earth; radioactive specimens; vertebrate fossils; x-ray targets; toners in photography; lamp filaments; eyeglass lenses; dentures; smoke detectors cloisonné jewelry; colorant in uranium glass (Vaseline glass), ceramic glaze (Fiesta ware); textile mordents; stains and dyes for leather and wood; pigments in paints.  Depleted uranium: ammunition; shielding material; inertial guidance devices; gyroscopic compasses.  Radium 226: glow-in-the-dark, luminous objects may still be radioactive even if no longer fluoresce: paints, clock and watch hands, compasses, doorknobs, altimeter, instrument panels, light switches, religious statuary, chamber pot lids; specific spa waters; bottles of health medicines or health cures with RAD or RADI in title [32, 34].  Radon gas: emitted from fossil and rock specimens; house foundations (e.g. basements) [32]; cancer treatment	OSHA PEL: TWA 0.25 mg/m³ (insoluble compounds); 0.05 mg/m³ (soluble compounds)  Minor toxic metal [6].  *Probable carcinogen  Uranium is considered mildly radioactive; Radium is considered extremely radioactive.  Rn: TLV not established
Metallic gray rod /chunks		Mineral: Anadinite; Carnotite; Karelianite; Shcherbinaite; Vanadinite; Volborthite  Divanadium pentoxide dust or fume; Vanadic anhydride dust or fume; Vanadium oxide dust or fume; Vanadium pentaoxide dust or fume; Vanadium(V)oxide	Vanadium is a by-product of petroleum refining; nuclear applications; hardener for steel; surgical instruments; tools; axles; crankshifts; gears; photography; insecticides; target material for x-rays; UV absorbers; increases rust-wear resistance in steel; lacrosse shafts; food additive e.g. milk, seafood, cereals, vegetables; medical implants; simulated alexandrite jewelry; yellow and red colorants in ceramic glazes and glass; colorant for red phosphor in color television tubes; textile mordant  Vanadium pentoxide is used as a catalyst in various chemicals including sulfuric acid	OSHA PEL: 0.5 mg V <sub>2</sub> O <sub>5</sub> /m <sup>3</sup> (resp dust) CEILING OSHA PEL: C: 0.1 mg V <sub>2</sub> O <sub>5</sub> /m <sup>3</sup> fume Minor toxic metal [6].
YTTRIUM (Y) Dark-grey to black, odorless solid	7440-65-5	Yttrium metal  Minerals: Fergusonite; Gadolinite; Yttrialite; Xenotime; found in almost all rare earth minerals.  Often associated with hafnium, uranium and zirconium	Component in cathode ray tube display of television or LED; production of electrodes, electrolytes, electronic filters, lasers, superconductors; medical applications; analytical catalyst; gas mantle for propane lanterns; production of magnets; geological specimens	OSHA PEL: TWA 1.0 mg/m³. The PEL applies to other Y compounds.
Odorless grey to blue powder	7440-66-6	Zinc metal, fume or dust; Zinc powder; Blue powder  Trade name: Merrillite; Ascarco L 15; ECKA 4; Rheinzink  Minerals: Hemimorphite; Smithonite – both previously referred to as Calamine  Arsenic acid, zinc salt; Zinc orthoarsenate	Nuclear technology; coating on high temperature alloys; metal alloys; plating; solder; batteries; contemporary pipe organs; microwave band pass filters in communication networks; lasers; production of artificial diamonds; medicinal purposes; skin rash treatments (e.g. Calamine); deodorant; anti-corrosion product; glass production; pesticide; wood preservative; plastic lubricant; reagent in chemical spot tests (e.g. arsenic spot test); pigments including zinc sulfide in luminescent pigments; geological specimens  Herbicide; insecticide; rodenticide	TLV: 5.0 mg/m³ (fumes)  Essential metal with potential for toxicity [6]  *Metal fume fever is a concern.

Zinc chromate ZnCrO <sub>4</sub> Yellow crystalline powder. (a Cr (VI) compound [5])	13530-65-9	Chromium zinc oxide; Zinc Chromate (VI) hydroxide; Zinc tetraoxychromate; Chromic acid, zinc salt (11); zinc chromate is also used to refer to a wide range of commercial zinc and zinc potassium chromates <b>Pigments</b> : Zinc yellow; Pigment Yellow 36; Buttercup Yellow	Pigments.	TLV: 0.01 mg/m <sup>3</sup> (as Cr)
Zinc hexafluorosilicate Zn(SiF <sub>6</sub> ) White crystalline solid	16871-71-9	Zinc fluorosilicate; Zinc silicofluoride  Trade Names: Berlou; Arko Moth Proof	Insecticide; mothproofer; hardener for concrete; fixative for acid dyes	TLV: 2.5 mg/m <sup>3</sup> (as F)
Zinc oxide ZnO Odorless white powder or crystals	1314-13-2	Zinc white; Zinc monoxide; Zinc peroxide  Pigments: C.I. Pigment white 4; Chinese white; Zinc white	Rubber industry; semi-conductors; light emitting diodes; sunburn and windburn skin protection ointment; diaper rash ointment; Calamine lotion; throat lozenges; cosmetics; dentistry; food additive; pharmaceuticals; UV absorber; ceramic glazes; printing inks; colorant for glass; pigments	OSHA PEL: TWA 5.0 mg/m³ (fume); TWA 15 mg/m³ (total dust); TWA 5 mg/m³ (resp dust) (as Zn)  *Metal fume fever is a concern
Zinc phosphide P <sub>2</sub> Zn <sub>3</sub> Black to gray powder or paste	1314-84-7	Trizinc diphosphide  Trade Name: Arrex; Phosvin; Ridall-Zinc; Ridall-Z; Zinc-Tox	Pesticide; rodenticide	TLV not established
Zinc sulfate heptahydrate ZnSO <sub>4</sub> • 7H <sub>2</sub> O Granules or crystalline powder	7446-20-0	Mineral: Goslarite; White vitriol	Medicinal purposes; astringent; emetic; coagulation baths for rayon; electrolytes; skin and leather preservative; textile mordant	TLV not established
Zirconium (Zr) Lustrous grey-white metal	7440-67-7	Zirconium element; Zirconium metal (liquid, suspension); Zirconium suspended in flammable liquid <b>Mineral:</b> Baddeleyite; Eudialyte; Malacon; Zircon (Zr silicate); Zirkelite; some rare earth minerals	Nuclear reactors; weapons; space vehicles; explosive primers; vacuum tube getters; surgical appliances; filaments; light bulbs; abrasives; grinding wheels; sandpaper; modern pigments; geological specimens; gem stones	OSHA PEL: TWA 5.0 mg/m³ (as Zr compounds)
Zirconium oxide ZrO <sub>2</sub> White powder	1314-23-4	Zirconia; Zirconium dioxide; Zirconium (IV) oxide; Zirconic anhydride Trade names: C.I. Pigment white 12; Zirconium white; Zirox 180 Mineral: Baddeleyite	Thermal barrier coating in jet turbine and diesel engines; refractory material; insulation; fiber insulation; oxygen sensors; fuel cell membranes; elctroceramics; limelight; casing in some mobile devices; radio transparency; abrasives; enamels; ceramic glazes; pigments; simulated diamonds; geological specimens; gemstones	OSHA PEL: TWA 5.0 mg/m³ (as Zr)