

Particularly Hazardous Substances

The *Minors in Research Laboratories* Policy P616 prohibits Minors aged 14 – 15 years old and restricts 16-18 years old from working with “Particularly Hazardous Substances”. This information and examples will help you determine which chemicals are in the class besides the obvious chemicals such as arsenic and cyanides.

Acutely toxic chemicals are defined as having an LD₅₀ oral ≤ 50 mg/kg or LD₅₀ contact ≤ 200 mg/kg or LC₅₀ inhalation ≤ 200 ppm. New GHS Category: Acute Toxicity, Category 1 and 2; signal word DANGER; symbol Skull & Crossbones.



Carcinogen

Any substance that is regulated by OSHA as a carcinogen, or is listed under the category “known to be carcinogens” in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) or is listed under Group 1 “carcinogenic to humans”, Group 2A or 2B “reasonably anticipated to be carcinogens” by the International Agency for Research on Cancer Monographs (IARC). The current NTP and IARC lists can be found on the NIOSH web page “Occupational Cancer”:

<http://www.cdc.gov/niosh/topics/cancer/>.



Reproductive hazard (mutagen or teratogen)

Reproductive toxicity includes adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on development of the offspring.

The chemical can be considered a *Particularly Hazardous Substance* if it has a:

- NFPA Health Rating of 4 (*Very short exposure could cause death or serious residual injury even though prompt medical attention was given*) or 3 (*Short exposure could cause serious temporary or residual injury even though prompt medical attention was given*).
- Blue stripe on the label (*Health Hazard. Toxic if inhaled, ingested, or absorbed through skin. Store in secure area.*)
- DOT Class of 6.1 (<http://www.phmsa.dot.gov> Title 49 CFR 172.101 Table *List of Hazardous Materials*)
- EPA “P” waste code (<http://www.epa.gov/epawaste/hazard/wastetypes/listed.htm>)



The Material Safety Data Sheet (MSDS) is the best source for finding this information. Always review the MSDS before beginning work with chemicals. Minors must attach a copy of the MSDS with their Risk Assessment/SOP Protocol. These documents can be used to develop the safety protocol:

- [Hazard Assessment and SOP Template](#)
- [Hazard & Risk Evaluation Matrix](#)

Particularly Hazardous Substances

Here are some examples of **Particularly Hazardous Substances**. There are many other chemicals used in laboratories that meet the definition of **Particularly Hazardous Substances**.

Chemical	CAS	LD ₅₀ ¹	GHS Health Classification	Carcinogen	Reproductive Hazard	OSHA 8 hr TWA	DOT	EPA	Storage Code
Acrylamide	79-06-1	Oral (rat): 124 mg/kg Inhalation (rat): 4 h - > 1,500 mg/m ³ Dermal (rat): 400 mg/kg	H301 + H311 Toxic if swallowed or in contact with skin. H315 Causes skin irritation. H317 May cause an allergic skin reaction. H319 Causes serious eye irritation. H332 Harmful if inhaled. H340 May cause genetic defects. H350 May cause cancer. H361 Suspected of damaging fertility or the unborn child.	IARC 2A NTP Reasonably anticipated to be a human carcinogen	Yes	0.3 mg/cu m Skin	6.1	U077	Blue
Acrylonitrile (Vinyl cyanide)	107-13-1	Oral (rat): 78 mg/kg Inhalation (rat): 4 h - 333 ppm Dermal (rabbit): 63 mg/kg	H301 Toxic if swallowed. H310 + H330 Fatal in contact with skin or if inhaled. H315 Causes skin irritation. H318 Causes serious eye damage. H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. H350 May cause cancer. H371 May cause damage to organs.	IARC 2B NTP Reasonably anticipated to be a human carcinogen	Yes	2 ppm	6.1, 3	U009	
Barium chloride	10361-37-2	Oral (rat): 118 mg/kg		No	Yes	0.5 mg/cu m	6.1	D005	Blue

¹ Source: Sigma and Fisher MSDS

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Chemical	CAS	LD ₅₀ ¹	GHS Health Classification	Carcinogen	Reproductive Hazard	OSHA 8 hr TWA	DOT	EPA	Storage Code
Caffeine	58-08-2	Oral (rat): 192 mg/kg	H301 Toxic if swallowed.	No	No	None	6.1		Blue
Capsaicin	404-86-4	Oral (rat) male: 161.2 mg/kg Oral (rat) – female: 148.1 mg/kg Dermal (mouse): > 512 mg/kg	H301 + H311 Toxic if swallowed or in contact with skin. H315 Causes skin irritation. H317 May cause an allergic skin reaction. H318 Causes serious eye damage. H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. H335 May cause respiratory irritation.	No	No data	None	6.1		
Carbon tetrachloride	56-23-5	Oral (rat): 2,350 mg/kg Inhalation (rat): 4 h - 8000 ppm Dermal (rabbit): > 20,000 mg/kg	H301 + H311 Toxic if swallowed or in contact with skin. H316 Causes mild skin irritation. H320 Causes eye irritation. H331 Toxic if inhaled. H351 Suspected of causing cancer. H372 Causes damage to organs through prolonged or repeated exposure if inhaled.	IARC 2B NTP Reasonably anticipated to be a human carcinogen	No data	2 ppm	6.1	U211	

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Chloroform	67-66-3	Oral (rat): 695.0 mg/kg Inhalation (rat): 4 h - 47,702 mg/m ³ Dermal (rabbit): > 20,000 mg/kg	H302 Harmful if swallowed. H315 Causes skin irritation. H319 Causes serious eye irritation. H351 Suspected of causing cancer. H373 May cause damage to organs through prolonged or repeated exposure.	IARC 2B NTP Reasonably anticipated to be a human carcinogen	No data	2 ppm	6.1	U044	Blue
Ethidium bromide	1239-45-8	Oral (rat): 1,503 - 2,177 mg/kg Inhalation (rat): 1 h - 11.8 - 134 mg/l	H302 Harmful if swallowed. H330 Fatal if inhaled. H341 Suspected of causing genetic defects.	No	Yes		6.1		Blue
Formaldehyde	50-00-0	Oral (rat): 500 mg/kg Inhalation (rat): 0.578 mg/L 4 h	H301 + H311 Toxic if swallowed or in contact with skin. H315 Causes skin irritation. H317 May cause an allergic skin reaction. H318 Causes serious eye damage. H331 Toxic if inhaled. H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. H351 Suspected of causing cancer. H370 Causes damage to organs.	IARC 1 NTP Reasonably Anticipated to be a Human Carcinogen OSHA 1910.1048	Yes	0.75 ppm	3, 8	U122	Red (37%) Blue (10%)

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2-Mercaptoethanol	60-24-2	Oral (rat): 244 mg/kg Oral (rat): 98 - 162 mg/kg Inhalation (rat): 4 h - 625 ppm	H301 Toxic if swallowed. H310 + H330 Fatal in contact with skin or if inhaled. H315 Causes skin irritation. H317 May cause an allergic skin reaction. H318 Causes serious eye damage.	No	No data	None	6.1		Blue
Mercuric chloride (Mercury(II) chloride)	7487-94-7	Dermal (rat): 41 mg/kg	H300 + H310 Fatal if swallowed or in contact with skin. H314 Causes severe skin burns and eye damage. H361 Suspected of damaging fertility or the unborn child. H372 Causes damage to organs through prolonged or repeated exposure.	No	Yes		6.1		Blue
Methylene chloride (Dichloromethane)	75-09-2	Oral (rat): 1,600 mg/kg Inhalation (rat): 52,000 mg/m ³	H302 Harmful if swallowed. H315 + H320 Causes skin and eye irritation. H351 Suspected of causing cancer.	IARC 2B NTP Reasonably anticipated to be a human carcinogen OSHA 1910.1052	No data	50 ppm	6.1	U080	Blue
Nicotine	54-11-5	Oral (rat): 50 mg/kg Dermal (rabbit): 50 mg/kg	H300 + H310 Fatal if swallowed or in contact with skin.	No	Yes	0.5 mg/cu m, skin	6.1	P075	Blue

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Chemical	CAS	LD ₅₀ ¹	GHS Health Classification	Carcinogen	Reproductive Hazard	OSHA 8 hr TWA	DOT	EPA	Storage Code
Nicotine tartrate	65-31-6	Oral (rat): 65 mg/kg	H300 + H310 Fatal if swallowed or in contact with skin. H330 Fatal if inhaled.	No	Yes	0.5 mg/cu m, skin	6.1	P075	Blue
Nitric oxide	10102-43-9	Inhalation (rat): 4 h - 1,068 mg/m ³		No	No	25 ppm	2.3	P076	
4-Nitrophenol	100-02-7	Oral (rat): 202.0 mg/kg Dermal (rat): 1,024 mg/kg	H301 Toxic if swallowed. H312 + H332 Harmful in contact with skin or if inhaled.	No	No data		6.1	U170	Blue
Phenol	108-95-2	Oral (rat): 410.0 - 650.0 mg/kg Oral (rat): 317.0 mg/kg Inhalation (rat): 8 h - 900 mg/m ³ Dermal (rabbit): 630.0 mg/kg	H302 Harmful if swallowed. H311 + H331 Toxic in contact with skin or if inhaled. H314 Causes severe skin burns and eye damage. H341 Suspected of causing genetic defects. H371 May cause damage to organs. H373 May cause damage to organs through prolonged or repeated exposure.	No	Yes	5 ppm	6.1	U188	White
Sodium azide	26628-22-8	Oral (rat): 27 mg/kg Inhalation (rat): 37 mg/m ³ Dermal (rabbit): 20 mg/kg	H300 + H310 Fatal if swallowed or in contact with skin.	No	No data	0.1 ppm skin	6.1	P105	Blue