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| Form Number<br>LLCF-060 | Issue Date 01/01/11          | Revision Date 06/15/23 | Form Number<br>LLCF-060 |
|                         | Respiratory Protection Guide |                        |                         |

**Minimum Respiratory Protection Requirements\*(See Notes)**

| Hazard **   | Exposure Limit ***                                     | Chronic Health Hazard   | Acute Exposure Symptoms   | Outdoors  | Shop/Indoors   | Confined Spaces  | Ska-packs Required at |
|---|--|---|---|---|--|--|-----------------------|
| <b>Aluminum (Al)</b>                              | Fumes-5 mg/m <sup>3</sup><br>Dust-10 mg/m <sup>3</sup> | Absorbed in the lungs, may cause lung disease                   | Irritation of the skin, eyes, nose and throat                       | Natural ventilation in large open areas                     | Mechanical ventilation respirator may be needed              | Mechanical ventilation respirator may be needed          | Not Determined        |
| <b>Asbestos (Dust)</b>                            | 0.1 fiber/cc   | Known carcinogen, can cause lung disease                        | Respiratory tract and eye irritation                                | Exposure Not Allowed  | Exposure Not Allowed   | Exposure Not Allowed                                     | Exposure Not Allowed  |
| <b>Benzene</b>                                    | 1 ppm  | Known carcinogen  | Eye/lung irritation, dizziness, drowsiness                          | Natural ventilation & APR in open areas                     | APR, local ventilation                                       | APR/supplied air and mechanical ventilation              | 1000ppm               |
| <b>Cadmium (Cd)</b>                               | 0.005 mg/m <sup>3</sup>                                | Suspect Carcinogen Affects Heart, lungs, liver, kidneys, others | Irritation, respiratory distress, dizziness, headache, pain, nausea | Natural ventilation & APR in open areas                     | APR with local exhaust or supplied air without local exhaust | Mechanical ventilation and air line respirators          | 5 mg/m <sup>3</sup>   |
| <b>Carbon Monoxide (CO)</b>                       | 25ppm  | Interferes with the bodies absorption of oxygen                 | Headache, dizziness, loss of consciousness, nausea                  | Natural ventilation in large open areas                     | Mechanical ventilation respirator may be needed              | Mechanical ventilation respirator may be needed          | 1200ppm               |
| <b>Chromium (Cr)</b>                              | 0.05 mg/m <sup>3</sup>                                 | Possible lung cancer blood, liver & kidney disease              | Coughing, congestion, skin ulcers & dermatitis                      | Natural ventilation & APR in open areas                     | APR with local exhaust or supplied air without local exhaust | Mechanical ventilation and air line respirators          | 250 mg/m <sup>3</sup> |
| <b>Cobalt</b>                                     | 0.1 mg/m <sup>3</sup>                                  | Possible lung disease including asthma                          | Cough, shortness of breath, dermatitis                              | Natural ventilation & APR in open areas                     | APR with local exhaust or supplied air without local exhaust | Mechanical ventilation and air line respirators          | 20 mg/m <sup>3</sup>  |
| <b>Copper (Cu)</b>                                | 0.1 mg/m <sup>3</sup>                                  | Irritation, flu-like symptoms                                   | Metallic or sweet taste, nausea                                     | Natural ventilation & APR in open areas                     | APR with local exhaust or supplied air without local exhaust | Mechanical ventilation & APR, supplied air may be needed | 100 mg/m <sup>3</sup> |
| <b>Crystalline Silica Including Ceramic Fiber</b> | 0.05 fiber/cc to 0.1 fiber/cc                          | Possible carcinogen   | Skin, eye & respiratory tract irritation                            | Natural ventilation & APR in open areas                     | APR  | APR or supplied air                                      | 25 mg/m <sup>3</sup>  |
| <b>Hydrogen Fluoride (HF Acid)</b>                | 3ppm   | Produces lung and skin ulcers that are slow healing             | Severe irritant and corrosive to all tissue                         | Full Face APR with acid gas cartridge in low concentrations | Full Face APR with acid gas cartridge in low concentrations  | Supplied air, mechanical ventilation                     | 30ppm                 |

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| <b>Hydrogen Sulfide (H<sub>2</sub>S)</b>                       | 10ppm                  | Digestive tract disturbance, fatigue, insomnia, photosensitive | Headache, dizziness, nausea, eye/nose/throat irritation, collapse, death | Supplied air & natural ventilation      | N/A due to toxicity & flammability                           | Not normally allowed, supplied air w/escape pack & mech. ventilation | 100ppm                 |
| <b>Iron Oxide (Carbon Steel) (Fe<sub>2</sub>O<sub>3</sub>)</b> | 5 mg/m <sup>3</sup>    | Possible lung disease  | Not determined, possibly stomach cramps                                  | Natural ventilation in large open areas | Mechanical ventilation, APR may be needed                    | Mechanical ventilation, APR may be needed                            | 2500 mg/m <sup>3</sup> |
| <b>Lead (Pb)</b>   | 0.05 mg/m <sup>3</sup> | May damage numerous organs & the muscular/skeletal system      | Pain, headache, weakness, nausea, vomiting                               | Natural ventilation & APR in open areas | Exhaust hoods and air line respirators                       | Local ventilation and air line respirators                           | 100 mg/m <sup>3</sup>  |
| <b>Manganese (Mn)</b>  | 1 mg/m <sup>3</sup>    | May cause nervous system damage                                | Irritation, flu-like symptoms, shortness of breath                       | Natural ventilation in large open areas | APR with local exhaust or supplied air without local exhaust | Mechanical ventilation & APR, supplied air may be needed             | 500 mg/m <sup>3</sup>  |
| <b>Molybdenum (Mo)</b>   | 10 mg/m <sup>3</sup>   | Anorexia, diarrhea, liver & kidney damage                      | Irritation to eyes, nose, throat   | Natural ventilation & APR in open areas | APR with local exhaust or supplied air without local exhaust | APR with local exhaust or supplied air without local exhaust         | 5000 mg/m <sup>3</sup> |
| <b>Naphtha (Coal Tar)</b>                                      | 100 ppm                | Possible Carcinogen  | Headache, dizziness, nausea, loss of consciousness                       | Natural ventilation & APR in open areas | Probably N/A due to fire hazard. Local exhaust & APR         | Probably N/A due to fire hazard. Local exhaust & supplied air        | 1000 mg/m <sup>3</sup> |
| <b>Nickel (NI)</b>   | 1 mg/m <sup>3</sup>    | Possible carcinogen  | Rash, headache, dizziness, nausea, weakness                              | Natural ventilation & APR in open areas | APR with local exhaust or supplied air without local exhaust | Supplied air, mechanical ventilation                                 | 10 mg/m <sup>3</sup>   |

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| <b>Niobium (Nb)</b>   | Not established       | Possible kidney & liver damage  | Irritating to skin & eyes  | Natural ventilation & APR in open areas                              | APR with local exhaust or supplied air without local exhaust | Supplied air, mechanical ventilation                          | Not Established       |
| <b>Nitric Acid</b>  | 2ppm                  | Delayed respiratory distress, destroys all tissue it contacts               | Severe irritant, destroys all tissue it contacts                 | Supplied air and natural or mechanical ventilation                   | Supplied air & mechanical ventilation                        | Supplied air & mechanical ventilation                         | 25ppm                 |
| <b>Oxides of Nitrogen (NO, NO<sub>2</sub>, N<sub>2</sub>O, etc.</b> | Various               | Possible chemical pneumonia   | Poor warning properties, respiratory distress & irritation       | Natural ventilation in large open areas, respirators may be required | Exhaust hoods and air line respirators                       | Local ventilation and air line respirators                    | Varies                |
| <b>Ozone (O<sub>3</sub>)</b>  | 0.1ppm (Ceiling)      | Irritating, prolonged exposure may cause respiratory disease                | Headaches, fatigue, shortness of breath                          | Natural ventilation in large open areas                              | Local ventilation or air line respirators                    | Supplied air, mechanical ventilation                          | 5ppm                  |
| <b>Petroleum (Hydrocarbon Vapors)</b>                               | 500ppm (PEL)          | Possible chemical pneumonia with prolonged exposure                         | Headaches, fatigue, nausea, shortness of breath, drowsiness      | Natural ventilation & APR in open areas                              | Probably N/A due to fire hazard. Local exhaust & APR         | Probably N/A due to fire hazard. Mechanical ventilation & APR | 1100ppm               |
| <b>Phosgene (COCl<sub>2</sub>)</b>                                  | 0.1ppm                | May cause delayed pneumonia, dermatitis, O <sub>2</sub> deficiency in blood | Burning skin/throat, chest pain, coughing, vomiting, bluish skin | Supplied air and natural or mechanical ventilation                   | Supplied air & mechanical ventilation                        | Supplied air & mechanical ventilation                         | 2ppm                  |
| <b>Phosphorus (P<sub>4</sub>)</b>                                   | 0.1 mg/m <sup>3</sup> | Eye/respiratory tract irritation, jaundice, anemia                          | Burns to the eyes & skin, abdominal pain, nausea                 | Supplied air and natural or mechanical ventilation                   | Supplied air and natural or mechanical ventilation           | Supplied air and natural or mechanical ventilation            | 5 mg/m <sup>3</sup>   |

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| <b>Sulfuric Acid (H<sub>2</sub>SO<sub>4</sub>)</b> | 1 mg/m <sup>3</sup>                      | Emphysema, bronchitis, dermatitis  | Destructive to all tissue   | Natural ventilation & full face APR in open areas | Full face APR with local exhaust or supplied air without local exhaust | Supplied air & mechanical ventilation     | 15 mg/m <sup>3</sup>   |
| <b>Tantalum (Ta)</b>                               | 5 mg/m <sup>3</sup>                      | None known   | Irritating to eyes & skin   | Natural ventilation in large open areas           | Mechanical ventilation, APR may be needed                              | Mechanical ventilation, APR may be needed | 2500 mg/m <sup>3</sup> |
| <b>Titanium (Ti)</b>                               | 10 mg/m <sup>3</sup>                     | Suspected carcinogen, possible lung fibrosis                                 | Irritating to eyes, nose & throat                                       | Natural ventilation & APR in open areas           | Mechanical ventilation, APR  | Supplied air, mechanical ventilation      | Not Determined         |
| <b>Tungsten (W)</b>                                | (OSHA none)<br>NIOSH 5 mg/m <sup>3</sup> | Possible lung fibrosis, blood changes  | Irritating to eyes, skin & respiratory tract                            | Natural ventilation & APR in open areas           | Mechanical ventilation, APR  | Supplied air, mechanical ventilation      | Not Determined         |
| <b>Vanadium (V)</b>                                | 0.05 mg/m <sup>3</sup>                   | Tongue & skin discoloration, irritation of respiratory tract                 | Sore throat, coughing, bronchitis, shortness of breath                  | Natural ventilation in large open areas           | Mechanical ventilation, APR may be needed                              | Mechanical ventilation, APR may be needed | 35 mg/m <sup>3</sup>   |
| <b>Hexavalent chromium - Cr(VI)</b>                | 0.5 µg/m <sup>3</sup>                    | Asthma, perforated eardrums, kidney damage, liver damage, respiratory cancer | Eye irritation, respiratory irritation, abdominal pain, nose irritation | Natural ventilation in open areas                 | HEPA APR, or mechanical ventilation                                    | Supplied air, or Full Face APR            | 5.0 µg/m <sup>3</sup>  |

\*The above guidelines are the minimum requirements for use against hazards exceeding the PEL/TLV's. Additional requirements may apply. Contact the safety department for additional information

\*\*Fumes unless otherwise noted.

\*\*\*TLV's unless otherwise noted.

APR = Air Purifying Respirator, half face unless otherwise noted, with appropriate cartridges