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Introduction

The *NIOSH Pocket Guide to Chemical Hazards* is intended as a source of general industrial hygiene information for workers, employers, and occupational health professionals. The *Pocket Guide* presents key information and data in abbreviated tabular form for 677 chemicals or substance groupings (e.g., manganese compounds, tellurium compounds, inorganic tin compounds, etc.) that are found in the work environment. The industrial hygiene information found in the *Pocket Guide* should help users recognize and control occupational chemical hazards. The chemicals or substances contained in this revision include all substances for which the National Institute for Occupational Safety and Health (NIOSH) has recommended exposure limits (RELs) and those with permissible exposure limits (PELs) as found in the Occupational Safety and Health Administration (OSHA) General Industry Air Contaminants Standard (29 CFR 1910.1000).

Background

In 1974, NIOSH (which is responsible for recommending health and safety standards) joined OSHA (whose jurisdictions include promulgation and enforcement activities) in developing a series of occupational health standards for substances with existing PELs. This joint effort was labeled the Standards Completion Program and involved the cooperative efforts of several contractors and personnel from various divisions within NIOSH and OSHA. The Standards Completion Program developed 380

substance-specific draft standards with supporting documentation that contained technical information and recommendations needed for the promulgation of new occupational health regulations. The *Pocket Guide* was developed to make the technical information in those draft standards more conveniently available to workers, employers, and occupational health professionals. The *Pocket Guide* is updated periodically to reflect new data regarding the toxicity of various substances and any changes in exposure standards or recommendations.

Data Collection and Application

The data were collected from a variety of sources, including NIOSH policy documents such as criteria documents and Current Intelligence Bulletins (CIBs), and recognized references in the fields of industrial hygiene, occupational medicine, toxicology, and analytical chemistry.

NIOSH Recommendations

Acting under the authority of the Occupational Safety and Health Act of 1970 (29 USC Chapter 15) and the Federal Mine Safety and Health Act of 1977 (30 USC Chapter 22), NIOSH develops and periodically revises recommended exposure limits (RELs) for hazardous substances or conditions in the workplace. NIOSH also recommends appropriate preventive measures to reduce or eliminate the adverse health and safety effects of these hazards. To formulate these recommendations, NIOSH evaluates all known and available medical, biological, engineering, chemical, trade, and other information relevant to the hazard. These recommendations are then published and transmitted to OSHA and the Mine Safety and Health Administration (MSHA) for use in promulgating legal standards.

NIOSH recommendations are published in a variety of documents. Criteria documents recommend workplace exposure limits and appropriate preventive measures to reduce or eliminate adverse health effects and accidental injuries.

Current Intelligence Bulletins (CIBs) are issued to disseminate new scientific information about occupational hazards. A CIB may draw attention to a formerly unrecognized hazard, report new data on a known hazard, or present information on hazard control.

Alerts, Special Hazard Reviews, Occupational Hazard Assessments, and Technical Guidelines support and complement the other standards development activities of the Institute. Their purpose is to assess the safety and health problems associated with a given agent or hazard (e.g., the potential for injury or for carcinogenic, mutagenic, or teratogenic effects) and to recommend appropriate control and surveillance methods. Although these documents are not intended to supplant the more comprehensive criteria documents, they are prepared to assist OSHA and MSHA in the formulation of regulations.

In addition to these publications, NIOSH periodically presents testimony before various Congressional committees and at OSHA and MSHA rulemaking hearings.

Recommendations made through 1992 are available in a single compendium entitled *NIOSH Recommendations for Occupational Safety and Health: Compendium of Policy Documents and Statements* (/niosh/92-100.html) [DHHS (NIOSH) Publication No. 92-100]. Copies of the Compendium may be ordered from the NIOSH Publications office (800-232-6348).

How to Use This Pocket Guide

The *Pocket Guide* has been designed to provide chemical-specific data to supplement general industrial hygiene knowledge. To maximize the amount of data provided in this limited space, abbreviations and codes have been used extensively. These abbreviations and codes, which have been designed to permit rapid comprehension by the regular user, are discussed for each column in the following subsections.

The chemical name found in the OSHA General

Industry Air Contaminants Standard (29 CFR 1910.1000) is listed in the top left portion of each chemical table.

Chemical Name

The chemical name found in the OSHA General Industry Air Contaminants Standard (29 CFR 1910.1000) is listed in the top left portion of each chemical table.

Structure/Formula

The chemical structure or formula is listed under the chemical name in each chemical table. Carbon-carbon double bonds (-C=C-) have been indicated where applicable.

CAS Number

This Chemical Abstracts Service (CAS) registry number is provided in the top right portion of the chemical tables. The CAS number, in the format xxx-xx-x, is unique for each chemical and allows efficient searching on computerized data bases. The CAS number index (npgdcas.html) can be used to find a chemical based on the CAS number.

RTECS Number

This section lists the Registry of Toxic Effects of Chemical Substances (RTECS®) number, in the format ABxxxxxxx. RTECS® may be useful for obtaining additional toxicologic information on a specific substance. The RTECS number index (npgdrtec.html) can be used to find a chemical based on the RTECS® number.

RTECS® is a compendium of data extracted from the open scientific literature. On December 18, 2001, CDC's Technology Transfer Office, on behalf of NIOSH, successfully completed negotiating a "PHS Trademark Licensing Agreement" for RTECS®. This non-exclusive licensing agreement provides for the transfer and continued development of the "RTECS® Database and its Trademark" to MDL Information Systems, Inc. ("MDL"), a wholly owned subsidiary of Elsevier Science, Inc. Under this agreement, MDL took on the responsibility for updating, licensing, and marketing and distributing RTECS®. This agreement was

assigned to Symyx Technologies, Inc. in 2007, when MDL became part of Symyx. For more information visit the Symyx web site. (http://www.symyx.com/products/databases/bioactivity/rtecs/index.jsp) (http://www.cdc.gov/Other/disclaimer.html)

DOT ID and Guide Numbers

This section lists the U.S. Department of Transportation (DOT) Identification numbers and the corresponding Guide numbers. Their format is xxxx yyy. The Identification (ID) number (xxxx) indicates that the chemical is regulated by DOT. The Guide number (yyy) refers to actions to be taken to stabilize an emergency situation; this information can be found in the *2008 Emergency Response Guidebook* (http://phmsa.dot.gov/hazmat/library/erg) (http://www.cdc.gov/Other/disclaimer.html) (Pipeline and Hazardous Materials Safety Adminstration, U.S. Department of Transportation, East Building, 2nd Floor, 1200 New Jersey Avenue, SE, Washington, D.C. 20590). Please note however, that many DOT numbers are **not** unique for a specific substance.

Synonyms and Trade Names

This section of each chemical table contains an alphabetical list of common synonyms and trade names for each chemical. The Chemical Name, Synonym and Trade Name Index (npgsyn-a.html) can be used to search for chemical pages. This index also includes the primary chemical names for all of the chemicals in the *Pocket Guide*.

Conversion Factors

This section lists factors for the conversion of ppm (parts of vapor or gas per million parts of contaminated air by volume) to mg/m^3 (milligrams of vapor or gas per cubic meter of contaminated air) at 25°C and 1 atmosphere for chemicals with exposure limits expressed in ppm.

Exposure Limits

The NIOSH recommended exposure limits (**REL**s) are listed first in this section. For NIOSH RELs, "**TWA**" indicates a time-weighted average concentration for up to a 10-hour workday during a 40-hour workweek. A

short-term exposure limit (STEL) is designated by "**ST**" preceding the value; unless noted otherwise, the STEL is a 15-minute TWA exposure that should not be exceeded at any time during a workday. A ceiling REL is designated by "**C**" preceding the value; unless noted otherwise, the ceiling value should not be exceeded at any time. Any substance that NIOSH considers to be a potential occupational carcinogen is designated by the notation "**Ca**" (see Appendix A (/niosh/npg/nengapdxa.html) , which contains a brief discussion of potential occupational carcinogens).

The OSHA permissible exposure limits (**PEL**s), as found in Tables Z-1, Z-2, and Z-3 of the OSHA General Industry Air Contaminants Standard (29 CFR 1910.1000), that were effective on July 1, 1993* and which are currently enforced by OSHA are listed next.

*In July 1992, the 11th Circuit Court of Appeals in its decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992) vacated more protective PELs set by OSHA in 1989 for 212 substances, moving them back to PELs established in 1971. The appeals court also vacated new PELs for 164 substances that were not previously regulated. Enforcement of the court decision began on June 30, 1993. Although OSHA is currently enforcing exposure limits in Tables Z-1, Z-2, and Z-3 of 29 CFR 1910.1000 which were in effect before 1989, violations of the "general duty clause" as contained in Section 5(a) (1) of the Occupational Safety and Health Act may be considered when worker exposures exceed the 1989 PELs for the 164 substances that were not previously regulated. The substances for which OSHA PELs were vacated on June 30, 1993 are indicated by the symbol "**†**" following OSHA in this section and previous values (the PELs that were vacated) are listed in Appendix G (/niosh/npg/nengapdxg.html)

TWA concentrations for OSHA **PEL**s must not be exceeded during any 8-hour workshift of a 40-hour workweek. A STEL is designated by "**ST**" preceding the value and is measured over a 15-minute period unless noted otherwise. OSHA ceiling concentrations (designated by "**C**" preceding the value) must not be exceeded during any part of the workday; if instantaneous monitoring is not feasible, the ceiling must be assessed as a 15-minute TWA exposure. In

addition, there are a number of substances from Table Z-2 (e.g., beryllium, ethylene dibromide) that have PEL ceiling values that must not be exceeded except for specified excursions. For example, a "5-minute maximum peak in any 2 hours" means that a 5-minute exposure above the ceiling value, but never above the maximum peak, is allowed in any 2 hours during an 8-hour workday. Appendix B (/niosh/npg/nengapdxb.html) contains a brief discussion of substances regulated as carcinogens by OSHA.

Concentrations are given in ppm, mg/m^3, mppcf (millions of particles per cubic foot of air as determined from counting an impinger sample), or fibers/cm^3(fibers per cubic centimeter). The "**[skin]**" designation indicates the potential for dermal absorption; skin exposure should be prevented as necessary through the use of good work practices, gloves, coveralls, goggles, and other appropriate equipment. The "**(total)**" designation indicates that the REL or PEL listed is for "total particulate" versus the "**(resp)**" designation which refers to the "respirable fraction" of the airborne particulate.

Appendix C (/niosh/npg/nengapdxc.html) contains more detailed discussions of the specific exposure limits for certain low-molecular-weight aldehydes, asbestos, various dyes (benzidine-, o-tolidine-, and o-dianisidine-based), carbon black, chloroethanes, the various chromium compounds (chromic acid and chromates, chromium(II) and chromium(III) compounds, and chromium metal), coal tar pitch volatiles, coke oven emissions, cotton dust, lead, mineral dusts, NIAX® Catalyst ESN, trichloroethylene, and tungsten carbide (cemented). Appendix D (/niosh/npg/nengapdxd.html) contains a brief discussion of substances included in the *Pocket Guide* with no established RELs at this time. Appendix F (/niosh/npg/nengapdxf.html) contains miscellaneous notes regarding the OSHA PEL for benzene and the IDLHs for four chloronaphthalene compounds, and Appendix G (/niosh/npg/nengapdxg.html) lists the OSHA PELS that were vacated on June 30, 1993.

Immediately Dangerous to Life and Health (IDLH)

This section lists the immediately dangerous to life or health concentrations (IDLHs). For the June 1994 Edition of the *Pocket Guide*, NIOSH reviewed and in many cases revised the IDLH values. The criteria utilized to determine the adequacy of the original IDLH values were a combination of those used during the Standards Completion Program and a newer methodology developed by NIOSH. These criteria formed a tiered approach, preferentially using acute human toxicity data, followed by acute animal inhalation toxicity data, and then by acute animal oral toxicity data to determine a preliminary updated IDLH value. When relevant acute toxicity data were insufficient or unavailable, NIOSH also considered using chronic toxicity data or an analogy to a chemically similar substance. NIOSH then compared these preliminary values with the following criteria to determine the updated IDLH value: 10% of lower explosive limit (LEL); acute animal respiratory irritation data (RD50); other short-term exposure guidelines; and the *NIOSH Respirator Selection Logic* (/niosh/docs/2005-100/) (DHHS [NIOSH] Publication No. 2005-100) The *Documentation for Immediately Dangerous to Life or Health Concentrations* (/niosh/idlh/intridl4.html) (NTIS Publication Number PB-94-195047) further describes these criteria and provides information sources for both the original and revised IDLH values. NIOSH currently is assessing the various uses of IDLHs, whether the criteria used to derive the IDLH values are valid, and if other information or criteria should be utilized.

The purpose for establishing an IDLH value in the Standards Completion Program was to determine the airborne concentration from which a worker could escape without injury or irreversible health effects from an IDLH exposure in the event of the failure of respiratory protection equipment. The IDLH was considered a maximum concentration above which only a highly reliable breathing apparatus providing maximum worker protection should be permitted. In determining IDLH values, NIOSH considered the ability of a worker to escape without loss of life or irreversible health effects along with certain transient effects, such as severe eye or respiratory irritation, disorientation, and incoordination, which could

prevent escape. As a safety margin, IDLH values are based on effects that might occur as a consequence of a 30-minute exposure. However, the 30-minute period was NOT meant to imply that workers should stay in the work environment any longer than necessary; in fact, EVERY EFFORT SHOULD BE MADE TO EXIT IMMEDIATELY!

NIOSH Respirator Selection Logic (/niosh/docs/2005-100/) defines IDLH exposure conditions as "conditions that pose an immediate threat to life or health, or conditions that pose an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse cumulative or delayed effects on health." The purpose of establishing an IDLH exposure concentration is to ensure that the worker can escape from a given contaminated environment in the event of failure of the respiratory protection equipment. The *NIOSH Respirator Selection Logic* (/niosh/docs/2005-100/) uses IDLH values as one of several respirator selection criteria. Under the *NIOSH Respirator Selection Logic* (/niosh/docs/2005-100/), the most protective respirators (e.g., a self-contained breathing apparatus equipped with a full facepiece and operated in a pressure-demand or other positive-pressure mode) would be selected for firefighting, exposure to carcinogens, entry into oxygen-deficient atmospheres, in emergency situations, during entry into an atmosphere that contains a substance at a concentration greater than 2,000 times the NIOSH REL or OSHA PEL, and for entry into IDLH atmospheres. IDLH values are listed in the *Pocket Guide* for over 380 substances.

The notation "**Ca**" appears in the IDLH field for all substances that NIOSH considers potential occupational carcinogens. However, IDLH values that were originally determined in the Standards Completion Program or were subsequently revised are shown in brackets following the "**Ca**" designations. "**10%LEL**" indicates that the IDLH was based on 10% of the lower explosive limit for safety considerations even though the relevant toxicological data indicated that irreversible health effects or impairment of escape existed only at higher concentrations. "**N.D.**" indicates that an IDLH value has not been determined for that substance. Appendix F (/niosh/npg/nengapdxf.html)

contains an explanation of the "Effective" IDLHs used for four chloronaphthalene compounds.

Physical Description

This entry provides a brief description of the appearance and odor of each substance. Notations are made as to whether a substance can be shipped as a liquefied compressed gas or whether it has major use as a pesticide.

Chemical and Physical Properties

The following abbreviations are used for the chemical and physical properties given for each substance. "NA" indicates that a property is not applicable, and a question mark (?) indicates that it is unknown.

MW	Molecular weight
BP	Boiling point at 1 atmosphere, °F
Sol	Solubility in water at 68 °F (unless a different temperature is noted), % by weight (i.e., g/100 ml)
Fl.P	Flash point (i.e., the temperature at which the liquid phase gives off enough vapor to flash when exposed to an external ignition source), closed cup (unless annotated "(oc)" for open cup), °F
IP	Ionization potential, eV (electron volts) [Ionization potentials are given as a guideline for the selection of photoionization detector lamps used in some direct-reading instruments.]
VP	Vapor pressure at 68 °F (unless a different temperature is noted), mm Hg; "approx" indicates approximately
MLT	Melting point for solids, °F
FRZ	Freezing point for liquids and gases, °F
UEL	Upper explosive (flammable) limit in air, % by volume (at room temperature unless otherwise noted)
LEL	Lower explosive (flammable) limit in air, % by volume (at room temperature unless otherwise noted)

MEC	Minimum explosive concentration, g/m^3 (when available)
Sp.Gr	Specific gravity at 68 °F (unless a different temperature is noted) referenced to water at 39.2 °F (4 °C)
RGasD	Relative density of gases referenced to air = 1 (indicates how many times a gas is heavier than air at the same temperature)

When available, the flammability/combustibility of a substance is listed at the bottom of the chemical and physical properties section. The following OSHA criteria (29 CFR 1910.106) were used to classify flammable or combustible liquids:

Class IA flammable liquid	Fl.P. below 73 °F and BP below 100 °F.
Class IB flammable liquid	Fl.P. below 73 °F and BP at or above 100 °F.
Class IC flammable liquid	Fl.P. at or above 73 °F and below 100 °F.
Class II combustible liquid	Fl.P. at or above 100 °F and below 140 °F.
Class IIIA combustible liquid	Fl.P. at or above 140 °F and below 200 °F.
Class IIIB combustible liquid	Fl.P. at or above 200 °F.

Incompatibilities and Reactivities

This entry lists important hazardous incompatibilities or reactivities for each substance.

Measurement Methods

The section provides a source (NIOSH or OSHA) and the corresponding method number for measurement methods which can be used to determine the exposure for the chemical or substance. Unless otherwise noted, the NIOSH methods are from the 4th edition of the *NIOSH Manual of Analytical Methods* (/niosh/nmam/) (DHHS [NIOSH] Publication No. 94-113 and supplements. If a different edition of the *NIOSH Manual of Analytical Methods* (/niosh/nmam/) is cited,

the appropriate edition and, where applicable, the volume number are noted [e.g., II-4 (2nd edition, volume 4)]. The OSHA methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html) are from the OSHA Web site ("http://www.osha.gov/dts/sltc/methods/index.html".) (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html) "None available" means that no method is available from NIOSH or OSHA.

Each method listed is the recommended method for the analysis of the compound of interest. However, the method may not have been fully optimized to meet the specific sampling situation. Note that some methods are only partially evaluated and have been used in very limited sampling situations. Review the details of the method and consult with the laboratory performing the analysis regarding the applicability of the method and the need for further modifications to the method in order to adjust for the particular conditions.

Personal Protection and Sanitation Recommendations

This section presents a summary of recommended practices (protect.html) for each substance. These recommendations supplement general work practices (e.g., no eating, drinking, or smoking where chemicals are used) and should be followed if additional controls are needed after using all feasible process, equipment, and task controls. Each category is described as follows:

SKIN:	Recommends the need for personal protective clothing.
EYES:	Recommends the need for eye protection.
WASH SKIN:	Recommends when workers should wash the spilled chemical from the body in addition to normal washing (e.g., before eating).
REMOVE:	Advises workers when to remove clothing that has accidentally become wet or significantly contaminated.

CHANGE:	Recommends whether the routine changing of clothing is needed.
PROVIDE:	Recommends the need for eyewash fountains and/or quick drench facilities.

First Aid

This entry lists emergency procedures (firstaid.html) for eye and skin contact, inhalation, and ingestion of the toxic substance.

Respirator Selection Recommendations

This section provides a condensed table of allowable respirators to be used for those substances for which IDLH values have been determined, or for which NIOSH has previously provided respirator recommendations (e.g., in criteria documents or Current Intelligence Bulletins) for certain chemicals. There are, however, 186 chemicals listed in the *Pocket Guide* for which IDLH values have yet to be determined. Since the IDLH value is a critical component for completing the *NIOSH Respirator Selection Logic* (/niosh/docs/2005-100/) for a given chemical, the *Pocket Guide* does not provide respiratory recommendations for those 186 chemicals without IDLH values. As new or revised IDLH values are developed for those and other chemicals, NIOSH will provide appropriate respirator recommendations. [Appendix F (/niosh/npg/nengapdxf.html) contains an explanation of the "Effective" IDLHs used for four chloronaphthalene compounds.]

In 1995, NIOSH developed a new set of regulations in 42 CFR 84 (/niosh/pt84abs2.html) [PDF] (also referred to as "Part 84") for testing and certifying non-powered, air-purifying, particulate-filter respirators. The new Part 84 respirators have passed a more demanding certification test than the old respirators (e.g., dust; dust and mist; dust, mist, and fume; spray paint; pesticide) certified under 30 CFR 11 (also referred to as "Part 11"). Recommendations for non-powered, air-purifying particulate respirators have been updated from previous editions of the *Pocket Guide* to incorporate Part 84 respirators; Part 11 terminology has been removed. For more information concerning

the selection of N-, R-, or P-series (Part 84) particulate respirators click here (#nrp) .

In January 1998, OSHA revised its respiratory protection standard (29 CFR 1910.134). (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716) (http://www.cdc.gov/Other/disclaimer.html) Among the provisions in the revised standard is the requirement for an end-of-service-life indicator (ESLI) or a change schedule (http://www.osha-slc.gov/SLTC/etools/respiratory/change_schedule.html) (http://www.cdc.gov/Other/disclaimer.html) when air-purifying respirators with chemical cartridges or canisters are used for protection against gases and vapors [29 CFR 1910.134(d)(3)(iii)]. (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716) (http://www.cdc.gov/Other/disclaimer.html) requirement.) In the *Pocket Guide*, air-purifying respirators (without ESLIs) for protection against gases and vapors are recommended only for chemicals with adequate warning properties, but now these respirators may be selected regardless of the warning properties. Respirator recommendations in the *Pocket Guide* have not been revised in this edition to reflect the OSHA requirements for ESLIs or change schedules.

Appendix A (/niosh/npg/nengapdxa.html) lists the NIOSH carcinogen policy. Respirator recommendations for carcinogens in the *Pocket Guide* have not been revised to reflect this policy; these recommendations will be revised in future editions.

The first line in the entry indicates whether the "NIOSH" or the "OSHA" exposure limit is used on which to base the respirator recommendations. The more protective limit between the NIOSH REL or the OSHA PEL is always used. "NIOSH/OSHA" indicates that the limits are equivalent.

Each subsequent line lists a maximum use concentration (MUC) followed by the classes of respirators, with their Assigned Protection Factors (APFs), that are acceptable for use up to the MUC. Individual respirator classes are separated by diagonal lines (/). More protective respirators may be worn.

"**Emergency or planned entry into unknown concentrations or entry into IDLH conditions**" is followed by the classes of respirators acceptable for these conditions. "**Escape**" indicates that the respirators are to be used only for escape purposes. For each MUC or condition, this entry lists only those respirators with the required APF and other use restrictions based on the *NIOSH Respirator Selection Logic* (/niosh/docs/2005-100/) .

In certain cases, the recommended respirators are annotated with the following symbols as additional information:

*	Substance reported to cause eye irritation or damage; may require eye protection
£	Substance causes eye irritation or damage; eye protection needed
¿	Only nonoxidizable sorbents allowed (not charcoal)
†	End of service life indicator (ESLI) required

All respirators selected must be approved by NIOSH under the provisions of 42 CFR 84. (/niosh/pt84abs2.html) The current listing of NIOSH/MSHA certified respirators can be found in the NIOSH Certified Equipment List (/niosh/npptl/topics/respirators/cel/) .

A complete respiratory protection program must be implemented and must fulfill all requirements of 29 CFR 1910.134. (http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716) (http://www.cdc.gov/Other/disclaimer.html) respiratory protection program must include a written standard operating procedure covering regular training, fit-testing, fit-checking, periodic environmental monitoring, maintenance, medical monitoring, inspection, cleaning, storage and periodic program evaluation. Selection of a specific respirator within a given class of recommended respirators depends on the particular situation; this choice should be made only by a knowledgeable person. **REMEMBER:** Air-purifying respirators will not protect users against oxygen-deficient atmospheres, and they are **not to be used in IDLH conditions.** The only respirators

recommended for firefighting are self-contained breathing apparatuses that have full facepieces and are operated in a pressure-demand or other positive-pressure mode. Additional information on the selection and use of respirators can be found in the *NIOSH Respirator Selection Logic* (/niosh/docs/2005-100/) (DHHS [NIOSH] Publication No. 2005-100) and the *NIOSH Guide to Industrial Respiratory Protection* (/niosh/87-116.html) (DHHS [NIOSH] Publication No. 87-116).

Exposure Route, Symptoms, Target Organs

Exposure Route

This section lists the toxicologically important routes of entry for each substance and whether contact with the skin or eyes is potentially hazardous.

Symptoms

This entry lists the potential symptoms of exposure and whether NIOSH considers the substance a potential occupational carcinogen.

Target Organs

This entry lists the organs that are affected by exposure to each substance. For carcinogens, the type(s) of cancer are listed in brackets. Information in this section reflects human data unless otherwise noted.

Selection of N-, R-, or P- Series Particulate Respirators

1. The selection of N-, R-, and P-series filters depends on the presence of oil particles as follows:

- If no oil particles are present in the work environment, use a filter of any series (i.e., N-, R-, or P-series).
- If oil particles (e.g., lubricants, cutting fluids, glycerine) are present, use an R- or P-series filter. **Note: N-series filters cannot be used if oil particles are present.**
- If oil particles are present and the filter is to be used for more than one work shift, use only a P-series filter.

Note: To help you remember the filter series, use the following guide:

N for **N**ot resistant to oil,

R for **R**esistant to oil,

P for oil **P**roof.

2. Selection of filter efficiency (i.e., 95%, 99%, or 99.97%) depends on how much filter leakage can be accepted. Higher filter efficiency means lower filter leakage.

3.The choice of facepiece depends on the level of protection needed - that is, the assigned protection factor (APF) needed.

See Recommendations for Respirator Selection for more information. (#mustread)

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