3M

Technical Data Bulletin

OH&ESD

#129, May 1997

Selection Guide for 42 CFR 84 Filters

The purposes of this bulletin are to provide a:

1. Selection logic for 42 CFR 84 filters,
2. Chemical/substance list with the minimum 42 CFR 84 approved filter recommendations. The list consists of those substances from the 1997 3M Respirator Selection Guide that may require **particulate** filters,
3. Selection guide for OSHA substance specific standards for the interim period until OSHA addresses the issue in the 1910.134 rulemaking activity.

General Respirator Selection Decision Logic

The following selection guidelines were used in making the 42 CFR 84 particulate filter recommendations listed in this bulletin. These guidelines were used only for the selection of the filter. If both vapor and particulate hazards are present, respirator users can still use the following method for selecting the correct particulate filter. When a gas or vapor cartridge may be required, the guidelines in the 3M Respirator Selection Guide should be followed.

The following selection steps are for atmospheres known or thought to contain aerosols (particles suspended in air).

Step 1. Identify the aerosol contaminants (name) and form (oil or non-oil) regardless of concentration. The Material safety data sheet (MSDS) can be helpful with this step. If the form is unknown, consider it as an oil.

Step 2. Determine concentrations of air contaminants. If any of the following situations exist, do not use these guidelines. These situations are:

- unknown contaminant concentration(s),

3M Occupational Health and Environmental Safety Division

3M Center, Building 275-6W-01
P.O. Box 33275
St. Paul, MN 55133-3275

- contaminant concentration(s) ≥ the immediately dangerous to life or health (IDLH) levels,
- oxygen concentration <19.5% or the potential exists for the oxygen concentration to fall below 19.5%.

If none of these situations exist, proceed to Step 3.

Step 3. Determine the hazard ratio (HR) for all substances. The HR is the ratio of the hazard air concentration / occupational exposure limit.

- If the highest HR is ≤10, use either a half or full facepiece respirator.
- If the highest HR is ≤50 (*i.e.*, 10<HR≤50), use a full facepiece.
- If the HR >50, another type of respirator must be selected. For more information see the selection guidelines in the 3M Respirator Selection Guide.

Step 4. Determine filter efficiency required. Use a Class 100 (99.97% efficiency) filter if required by a specific regulation or regulatory policy. If no such regulation or policy exists, a Class 95 (95% efficiency) filter may be used.

These guidelines allow a Class 95 filter to be used with a full facepiece up to 50 times the occupational exposure limit. NIOSH stated in the *Federal Register* that the filters certified under 42 CFR 84 (Class 95, 99 or 100) can be selected without regard to particle size.[1] NIOSH states all filters under these new procedures will be effective against any size aerosol. Since the filter efficiency concern no longer exists, the current assigned protection factors would be appropriate.

Step 5. Determine the filter series needed. If no oil is present (<0.1 mg/m^3), an N-, R-, or P- series filter may be selected for the respirators selected in Step 3. If oil is present, either an R- or P-series filter must be selected. R-series filters must be changed after 8 hours use or after the respirator is loaded with (exposed to) 200 mg of aerosol.[2]

The presence of oil may be an important point in the selection of the new filters, however, no guidance has been given by any regulatory agency regarding how to decide if enough oil is present to affect filter efficiency. While virtually all atmospheres probably contain oil, it is unlikely that small amounts of will adversely affect filter efficiency.

The detection limit of NIOSH analytical method 5026 (0.1 mg/m^3) was used as the criterion to determine whether or not oil is present in a given atmosphere.[3] This conservative value was chosen for two reasons:

1. If the oil mist levels are below the detection limit, it is not possible to know if oil is present.

2. It is felt that filters used in atmospheres with this small amount of oil are worn to protect against other (non-oil) particulate hazards. Atmospheres with both oil and non-oil aerosols are likely to result in filter caking from the non-oil aerosol, rather than the oil wetting the filter fibers. Filter caking results in increased efficiency and increased breathing resistance, indicating when the filter should be changed.

Where oil is suspected, but air samples have not been taken to determine its presence, an R- or P- series filter should be selected.

Step 6. Once a specific filter class is identified (e.g., N95) that meets the regulatory needs, workplace and respirator characteristics should be identified in order to select the most appropriate respirator within the class. In fact with the new filters, these other characteristics or features may be more important to selection than the approval. These characteristics include:

- Respirator maintenance capabilities (reusable versus filtering facepiece),
- Respirator fit as indicated by an appropriate fit test,
- Respirator compatibility with other personal protective equipment (e.g., welding helmet, safety glasses, goggles),
- Heat and spark resistance such as in welding operations,
- Respirator/filter durability,
- Potential for excessive filter loading, such as in spray painting,
- Breathing resistance/wearer acceptance,
- Capability for removal of nuisance level organic vapors or acid gases.

Paint Spray

Since the new certification requirements eliminated the “paint spray respirator”, respirator selection for spray painting operations is now based on the specific hazards present. Because of the nature of the paint spray aerosol, an N95 filter is sufficient in most cases. The relatively large particle size indicates aerosol capture by mechanical means such as impaction and interception. The consistency of the paint aerosol is such that when the paint particle contacts the fiber it is not going to move or “wet” the fiber. These same reasons indicate that N95 filters designed specifically for paint spray will be the most appropriate selections. Filters **not** designed specifically for paint spray may load faster and become more difficult to breathe through in a shorter time period resulting in greater worker stress and discomfort and increased filter costs.

After the filter has been selected, use of a chemical cartridge must be considered. Most spray painting operations do not generate solvent vapor concentrations above the TLV. In these situations, a chemical cartridge appropriate for the vapors present is generally recommended to minimize worker exposures and nuisance odor complaints. If vapor concentrations exceed the

TLV, use of the appropriate chemical cartridge is required. (Exception: if the solvent has poor warning properties, a supplied air respirator must be used).

While the "paint spray respirator' always used an organic vapor cartridge, there may be situations in which a different chemical cartridge is more appropriate. This can be determined by a thorough evaluation of the paint constituents, their airborne levels and consideration of the effectiveness of the various chemical cartridges available. Some paint spray operations (*e.g.*, some latex paints) may not require a chemical cartridge.

Pesticides

The pesticide respirator category of an organic vapor cartridge and a pesticide prefilter was also eliminated with 42 CFR 84. Respirators for pesticides must be selected on the basis of the respiratory hazards. In some cases, chemical cartridges other than organic vapor may be more appropriate. In other cases only a particulate filter may be required for pesticides with very low vapor pressures. One example may be dinitro-*o*-cresol with a vapor pressure of 0.00005 mm Hg at 20^{o}C where only an N95 filter would be required.[2]

Chemical List (Table 1)

The chemical list in Table 1 contains substances for which a particulate filter recommendation was made in the 1997 3M Respirator Selection Guide. Based on the physical description of the substance, a 42 CFR 84 particulate filter is suggested. The filter identified is the minimum filter recommendation with regards to series (N-,R-, and P-series) and filter efficiency [95, 99 and 99.97 (100) %]. When the nature of the substance was not clear, it was considered an oil (e.g., coke oven emissions often contain some amount of oil. It may still load on a filter as a dust, but due to the uncertainty, R- or P- Series is recommended.). The recommendation may be substituted with any filter providing a wider range of aerosol applications or higher filter efficiency.

The minimum respirator for concentrations up to 10 X TLV is listed in Table 1. The Class 100 filters are recommended when a specific regulation specifies a HEPA filter as the minimum. Since Class 95 filters are more efficient than the Class of dust/mist and dust/mist/fume filters, the Class 95 filters are generally the minimum filter efficiency level required. When an N-series filter is listed, either N-, R-, or P-series filters may be used. Where an oil aerosol is present, either R-, or P-series filters may be used. Time use restrictions may apply to R-Series filters. Where a gas or vapor chemical cartridge is selected, the guidelines in the 3M Respirator Selection Guide were used and the filter combined with the appropriate cartridge. A full facepiece is recommended when the potential for eye irritation exists in this concentration range. For concentrations not to exceed ten times (10X) the occupational exposure limit, half facepiece respirators with equivalent filters may be suitable if appropriate eye protection is provided.

The list identifies (as does the selection guide) those substances that may exist in both particle and vapor phase. Where the substance is also found to exist in the particle phase, a chemical cartridge is recommended for vapor concentrations below the TLV. A supplied air respirator (SA) is recommended if the vapor concentration exceeds the TLV since the odor threshold is not known for most of these compounds. Where the material is expected to occur primarily in the vapor phase, but it may exist in the particle phase, a particulate filter in addition to the chemical cartridge is recommended. These recommendations are based on work by Perez and Soderholm.[4] Where this method could not be used and a vapor/particle removing respirator is listed, the recommendation is based on workplace experience.

Table 1. 42 CFR 84 Filter Recommendations for 3M Respirator Selection Guide Substance List

Chemical Name	*Physical State*	*Respirator**	*Comments*
Acetylsalicylic acid	solid	N95	
Acrylamide	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
a-alumina	solid	N95	
Aluminium (as Al) - Metal and oxide dusts	solid	N95	
Aluminium (as Al) Soluble salts	solid	N95	
Aluminium (as Al) welding fume	solid	N95	
p-Aminobenzoic acid	solid	N95	
Ammonium chloride (Liquids)	liquid, non-oil	AM/N95	
Ammonium chloride (Solids)	solid	N95	
Ammonium perfluorooctanoate	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Anisidine (o-,p-, isomers)	liquid, oil based	OV/R or P95	Mixture of both isomers
ortho-Anisidine	liquid, oil based	OV/R or P95	
para-Anisidine	solid	OV/N95	
Antimony and compounds dust and mists (as Sb)	solid	N95	
Antimony metal fume (as Sb)	solid	N95	
Arsenic elemental and inorganic compounds, except arsine (as As)	solid	N100	
Asbestos	solid	N100	
Asphalt petroleum fumes	solid, oil based	OV/R or P95[A]	R or P filters alone may be suitable for some applications.
Barium soluble compounds (as Ba)	solid	N95	
Barium sulfate	solid	N95	

Chemical Name	Physical State	Respirator	Comments

Benzophenone	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Benzoyl peroxide	solid	OVN95	If vapor concentration alone exceeds the TLV, use SA.
Benzyl chloride	liquid, non-oil	(F)OV/AG	Add N95 prefilter if particulate phase present.
Beryllium and compounds (as Be)	solid	N95	
Biphenyl	solid	OV/N95	
Bismuth telluride	solid	N95	
Bismuth telluride (Se-doped)	solid	N95	
Borates, tetra, sodium salts: Anhydrous & Pentahydrate	solid	N95	
Borates, tetra, sodium salts: Decahydrates	solid	N95	
Boron oxide	solid	N95	
4-tert-Butylcatechol	solid	(F)N95	
tert-Butyl chromate (as $Cr0_3$)	liquid, non-oil	N95	
o-sec-Butylphenol	liquid, oil based	OV/R or P95	
Cadmium dust and salts (as Cd)	solid	N100	
Cadmium fume (as Cd)	solid	N100	
Calcium arsenate (as As)	solid	N100	
Calcium carbonate	solid	N95	
Calcium chromate (as Cr)	solid	N95	
Calcium cyanamide	solid	N95	
Calcium fluoride (as F)	solid	N95	
Calcium hydroxide	solid	N95	
Calcium oxide	solid	N95	
Calcium silicate	solid	N95	
Camphor	solid	(F)OV/N95	
Caprolactam - vapor	solid	OV/N95	
Caprolactam - Dust & Mist	solid	OV/N95	
Carbon black	solid	N95	
Catechol	solid	OV/N95	
Cellulose	solid	N95	
Cesium fluoride	solid	N95	
Cesium hydroxide	solid	N95	
Chloramphenicol	solid	N95	
Chlorinated diphenyl oxide	solid, oil based	SA	OV/R or P95 may be acceptable if no heat involved.
a-Chloroacetophenone	solid	(F)OV/N95	
Chlorobenzene	liquid, non-oil	OV/N95	
o-Chlorobenzylidene malononitrile	solid	OV/N95	
Chlorodiphenyl (42% Chlorine)	liquid, oil based	(F)OV/R or P95	If vapor concentration alone exceeds the TLV, use SA.
Chlorodiphenyl (54% Chlorine)	liquid, oil based	(F)OV/R or P95	If vapor concentration alone exceeds the TLV, use SA.

Chemical Name	Physical State	Respirator	Comments
Chlorosulfonic acid	liquid, non-oil	(F)AG/N95	

Chromic acid and chromates (as $Cr0_3$)	solid	N95	
Chromium (II) and chromium (III) compounds (as Cr) - dust & mist	solid	N95	
Chromium (II) and chromium (III) compounds (as Cr) - fume	solid	N95	
Chromium (VI) compounds, water soluble (as Cr) - dusts and mists	solid	N95	
Chromium (VI) compounds, water soluble (as Cr) - fumes	solid	N95	
Chromium (VI) compounds, certain water insoluble (as Cr)	solid	N95	
Chromium metal dusts (as Cr)	solid	N95	
Chromium metal fume (as Cr)	solid	N95	
Coal dust	solid	N95	
Coal tar pitch volatiles (as Benzene solubles)	liquid, oil based solid, oil based	R or P95 [A]	R or P filters with activated carbon are specifically recommended.
Cobalt metal dust and fume (as Co)	solid	N95	
Coke oven emissions	liquid, oil based solid, oil based	R or P95 [A]	R or P filters with activated carbon are specifically recommended.
Copper dust and mist (as Cu)	solid	N95	
Copper fume (as Cu)	solid	N95	
Cotton dust (raw)	solid	N95	
Cresol (all isomers)	liquid, oil based	OV/R or P95	
Cryolite (as F)	solid	N95	
Cyanamide	solid,	N95	
Cyclonite	solid	N95	
Decabromodiphenyl oxide	solid	N95	
Diatomaceous earth (uncalcined)	solid	N95	
Dibutyl phenyl phosphate	liquid, oil based	R or P95	OV/R or P95 may be preferable if heat involved.
Dibutyl phosphate	liquid, oil based	OV/R or P95	
Dibutyl phthalate	liquid, oil based	OV/R or P95	If vapor concentration alone exceeds the TLV, use SA.
1,3-Dichloro-5,5-di-methylhydantoin	solid	OV/N95	
Dicyclopentadiene	solid	OV/N95	
Dicyclopentadienyl iron	solid	N95	
Diethylene glycol - aerosol and vapor	liquid, oil based	OV/R or P95 [B]	If vapor concentration alone exceeds the TLV, use SA.
Chemical Name	**Physical State**	**Respirator**	**Comments**
Diethylene glycol - aerosol only	liquid, oil based	R or P95 [B]	

Diethyl phthalate	liquid, oil based	R or P95	
Dimethylphthalate	liquid, oil based	OV/R or P95	If vapor concentration alone exceeds the TLV, use SA.
Dimethylterephthalate	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Dinitrobenzene	solid	OV/N95	
3,5-Dinitro-o-toluamide	solid	N95	
Dinitrotoluene	solid	OV/N95	If substance is in liquid form, use R- or P-series filter instead of N-series. If vapor concentration alone exceeds the TLV, use SA.
Diphenylamine	solid	N/95	OV/N95 may be preferable when odor is a problem.
Di-sec-octyl phthalate	liquid, oil based	R or P95	
2,6-Di-tert-butyl-p-cresol	solid	N95	
Emery	solid	N95	
Erythromycin	solid	N95	
Ethylene glycol	liquid, oil based	OV/R or P95 [B]	If vapor concentration alone exceeds the TLV, use SA.
Ferrovanadium dust	solid	N95	
Fibrous glass, dust	solid	N95	
Fluorides (as F)	solid	N95	
Glycerin, mist	liquid, oil based	R or P95	
Grain dust (oats, wheat, barley)	solid	N95	
Graphite (natural)	solid	N95	
Graphite (synthetic)	solid	N95	
Gypsum	solid	N95	
Hafnium and compounds dust and mists (as Hf)	solid	N95	
Hexachlorobenzene	solid	N95	
Hexachloroethane	solid	OV/N95	
Hexachloronaphthalene	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Hexamethylenediamine	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Hexanediol diacrylate	liquid, oil based	OV/R or P95	If vapor concentration alone exceeds the TLV, use SA.
Hydrogenated terphenyls	liquid, oil based	R or P95	
Hydroquinone	solid	(F)OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Indium dusts	solid	N95	
Iron oxide fume	solid	N95	
Iron salts, soluble (as Fe)	solids	N95	
Isocyanuric acid	solid	N95	AM/N95 may be preferable if wet.
Isophthalic acid	solid	N95	
Kaolin	solid	N95	
Lead - metal and inorganic compounds (as Pb)	solid	N100	
Lead arsenate (as As)	solid	N100	
Lead chromate (as Cr)	solid	N100	
Chemical Name	**Physical State**	**Respirator**	**Comments**
Limestone	solid	N95	
Lithium fluoride (as F)	solid	N95	

Lithium hydride	solid	N95	
Lithium hydroxide	solid	N95	
Lithium oxide	solid	N95	
Magnesite	solid	N95	
Magnesium oxide fume	solid	N95	
Maleic anhydride	solid	(F)OV/N95	
Manganese, dust and compounds (as Mn)	solid	N95	
Manganese, metal fume	solid	N95	
Manganese oxide fume	solid	N95	
Manganese tetroxide	solid	N95	
Mercury - inorganic compounds (as Hg)		N95	Dusts with essentially no vapor pressure only.
Mercury, alkyl compounds (as Hg)	liquids, solids	N95	Hg/N95 for volatile liquids.
Mercury, aryl compounds (as Hg)		N95	Dusts with essentially no vapor pressure only.
Methoxyphenol	solid	N95	
2-Methylcyclopentadienyl manganese tricarbonyl (as Mn)	liquid, non-oil	OV/N95	SA preferable if heat involved.
4,4'-Methylene dianiline	solid	N100	OV/N100 if heat involved.
Methyl trichlorosilane	liquid, non-oil	AG/N95	
Mica	solid	N95	
Mineral (rock), wool fiber	solid	N95	
Molybdenum - soluble compounds (as Mo)	solid	N95	
Molybdenum - insoluble compounds (as Mo)	solid	N95	
Molybdenum metal fume (as Mo)	solid	N95	
Monochloroacetic acid	solid	(F)OV/N95	
Naphthalene	solid	OV	Add N95 prefilter if particulate phase present.
Nickel metal dust (as Ni)	solid	N95	
Nickel metal fume (as Ni)	solid	N95	
Nickel - soluble compounds (as Ni)	solid	N95	
Nickel - sulfide roasting - fume and dust (as Ni)	solid	N95	
Nicotine	liquid, oil based	OV/R or P95	If vapor concentration alone exceeds the TLV, use SA.
p-Nitroaniline	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Nitrotoluene	liquid, non-oil	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Nuisance particulates			
Inhalable particulate	generally solids	N95	This category includes many materials. For oils an R or P95 filter is recommended.
Respirable particulate	solid	N95	This category includes many materials. For oils an R or P95 filter is recommended.

Octachloronaphthalene	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Oil mist (mineral)	liquid, oil based	R or P95	
Oxalic acid	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Paraffin wax fume	solid	N95	
Pentachloronaphthalene	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Pentaerythritol	solid	N95	
Pentaerythritol triacrylate	liquid, oil based	OV/R or P95	If vapor concentration alone exceeds the TLV, use SA.
Perlite	solid	N95	
Persulfates			
Ammonium	solid	N95	
Potassium	solid	(F)N95	
Sodium	solid	(F)N95	
Phenol	solid	OV/N95	
m-Phenylenediamine	solid	OV/N95	SA preferable if heat involved.
o-Phenylenediamine	solid	OV/N95	SA preferable if heat involved.
p-Phenylenediamine	solid	OVN95	SA preferable if heat involved.
Phosphoric acid	liquid, non-oil	(F)N95	
Phosphorus (yellow)	solid	SA	If no phosphorous vapor or phosphine gas present, N95.
Phosphorus pentasulfide	solid	N95	
Phthalic anhydride	solid	OV/N95	
m-Phthalodinitrile	solid	N95	
Picric acid	solid	N95	
Piperazine dihydrochloride	solid	N95	
Plaster of Paris	solid	N95	
Platinum metal - dusts and mists (as Pt)	solid	N95	
Platinum metal-fume (as Pt)	solid	N95	
Platinum-soluble salts (as Pt)	solid	N95	
Polyethylene glycols	liquids, oil based	R or P95 [B]	
Polypropylene glycols	liquids, oil based	R or P95 [B]	
Portland cement	solid	N95	
Potassium bromate	solid	N95	
Potassium hydroxide	solid	N95	
Propylene glycol - aerosol only	liquids, oil based	R or P95 [B]	
Propylene glycol - vapor and aerosol	liquids, oil based	OV/R or P95 [B]	
Quinone	solid	(F)OV/N95	
Resorcinol	solid	N95	OV/N95 may be preferable if heat is involved.
Rhodium - metal and insoluble compounds - dusts and mists (as Rh)	solid	N95	

Chemical Name	Physical State	Respirator	Comments
Rhodium metal, fume (as Rh)	solid	N95	

Rhodium, soluble compounds (as Rh)	solid	N95	
Rouge	solid	N95	
Selenium & compounds - dusts and mists (as Se)	solid	N95	
Selenium & compounds - fumes (as Se)	solid	N95	
Silica amorphous			
Diatomaceous earth inhalable	solid	N95	
Diatomaceous earth respirable	solid	N95	
Precipitated silica	solid	N95	
Silica gel	solid	N95	
Silica, fume	solid	N95	
Silica, fused	solid	N95	
Silica crystalline			
Cristobalite	solid	N95	
Quartz	solid	N95	
Tridymite	solid	N95	
Tripoli	solid	N95	
Silicon	solid	N95	
Silicon carbide	solid	N95	
Silver, metal & soluble compounds (as Ag)	solid	N95	
Soapstone	solid	N95	
Sodium bisulfite	solid	AG/N95	N95 alone suitable if irritation eliminated.
Sodium fluoroacetate	solid	N95	
Sodium hydroxide	solid	N95	
Sodium hypochlorite	solid	N95	
Sodium metabisulfite	solid	AG/N95	N95 alone suitable if irritation eliminated.
Starch	solid	N95	
Stearates	solids	N95	
Strontium chromate (as Cr)	solids	N95	
Strychnine	solid	N95	
Subtilisins	solid	SA	Difficult to measure 10 X TLV. N95 acceptable with suitable air sampling data.
Sucrose	solid	N95	
Sulfuric acid	liquid, non-oil	(F)N95	N95 with appropriate eye protection acceptable if irritation prevented.
Talc (containing no asbestos fibers)	solid	N95	
Tantalum - metal and oxide - dusts and mists	solid	N95	
Tantalum, metal fume	solid	N95	
Tellurium compounds - dusts and mists (as Te)	solid	N95	
Chemical Name	**Physical State**	**Respirator**	**Comments**
Terephthalic Acid	solid	N95	
Terphenyls	solid	N95	OV/N95 may be preferable if heat involved.

Tetrachloronaphthalene	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Tetraethylene glycol diacrylate	liquid, oil based	OV/R or P95	If vapor concentration alone exceeds the TLV, use SA.
Tetrasodium pyrophosphate	solid	N95	
Tetryl	solid	N95	
Thallium - soluble compounds (as Tl)	solid	N95	
4,4'-Thiobis(6-tert-butyl-m-cresol)	solid	N95	
Tin - inorganic compounds and metal oxides (as Sn) (except SnH_4)	solid	N95	
Tin, metal fume	solid	N95	
Tin - organic compounds (as Sn)	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Titanium dioxide	solid	N95	
Titanium tetrachloride		AG/N95	
p-Toluenesulfonyl chloride	solid	(F)OV/AG/N95	If vapor concentration alone exceeds the TLV, use SA.
Tributyl phosphate	liquid, oil based	OV/R or P95	
Trichloronaphthalene	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Triethylene glycol diacrylate	liquid, oil based	OV/R or P95	
Trimellitic anhydride	solid	OV/N95	
Trimethylolpropane triacrylate	liquid, oil based	OV/R or P95	
Trimethylolpropane trimethacrylate	liquid, oil based	OV/R or P95	
2,4,6-Trinitrotoluene	solid	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Triorthocresyl phosphate	liquid, oil based	R or P95	
Triphenyl amine	solid	N95	
Triphenyl phosphate	solid	N95	OV/N95 preferable if heat involved.
Trisodium phosphate	solid	(F)N95	
Tungsten - Insoluble compounds (as W)	solid	N95	
Tungsten - Soluble compounds (as W)	solid	N95	
Tungsten - Metal fume	solid	N95	
Uranium (natural), insoluble compounds (as U)	solid	P100 [C]	
Uranium, soluble compounds (as U)	solid	P100 [C]	AG/P100 for uranium halides.
Urea	solid	N95	AM/N95 may be preferable if heat involved.

Chemical Name	Physical State	Respirator	Comments
Vanadium pentoxide, dust (as V_2O_5)	solid	N95	
Vanadium pentoxide, fume (as V_2O_5)	solid	N95	

Vegetable oil, mists	liquid, oil based	R or P95	
Welding fumes (not otherwise classified)	solid	N95	
Wood dust (Certain hard woods eg. western red cedar, beech, oak)	solid	N95	
Wood dust (Soft wood)	solid	N95	
m-Xylene a,a'-diamine	liquid, non-oil	OV/N95	If vapor concentration alone exceeds the TLV, use SA.
Yttrium - metal and compounds - dusts and mists (as Y)	solid	N95	
Yttrium metal, fume (as Y)	solid	N95	
Zinc chloride, fume	solid	N95	
Zinc chromate (as Cr)	solid	N95	
Zinc oxide, dust	solid	N95	
Zinc oxide, fume	solid	N95	
Zinc stearate	solid	N95	
Zirconium compounds - dusts and mists (as Zr)	solid	N95	
Zirconium compounds - fume (as Zr)	solid	N95	

*N95 means any 42 CFR 84 N-, R-, or P-series filter is acceptable. R or P95 means any R- or P-series filter may be used. R-series filters may have time use limitation. See discussion for more details.

[A] It is believed that an N-series filter is sufficient since these materials will not coat the filter fibers, but since this material may contain oil aerosols an R or P-series filter is recommended until further research or a regulatory agency takes a specific position.

[B] R or P-series filters have been recommended pending more research as to how these materials affect the filter fibers.

[C] At this point in time it is unclear as to the regulatory position for selection of filters for radionuclides. While any 100 class filter should satisfy the requirement for a high efficiency filter for these compounds, it is unclear as to whether the Nuclear Regulatory Agency requires the 100 filters to be colored magenta. For this reason P-100 particulate filters have been recommended.

Abbreviations Used in Table 1

Abbreviations	Respirator Description
N95	Half facepiece with N95 Particulate Filter
(F)95	Full facepiece with N95 Particulate Filter
N100	Half facepiece with N100 Particulate Filter
R or P95	Half facepiece with either R95 or P95 Particulate Filter
(F)R or P95	Full facepiece with either R 95 or P95 Particulate Filter
P100	Half facepiece with P100 Particulate Filter
OV	Half facepiece with Organic Vapor cartridges

Abbreviations	Respirator Description
OV/N95	Half facepiece with Organic Vapor cartridges and N95 Particulate Filters
OV/N100	Half facepiece with Organic Vapor cartridges and N100 Particulate Filters
OV/R or P95	Half facepiece with Organic Vapor cartridges and either R95 or P95 Particulate Filters
(F)OV	Full facepiece with Organic Vapor cartridges

(F)OV/N95	Full facepiece with Organic Vapor cartridges and N95 Particulate Filters
(F)OV/R or P95	Full facepiece with Organic Vapor cartridges and either R95 or P95 Particulate Filters
AG/N95	Half facepiece with Acid Gas cartridges and N95 Particulate Filters
AG/P100	Half facepiece with Acid Gas cartridges and P100 Particulate Filters
(F)AG/N95	Full facepiece with Acid Gas cartridges and N95 Particulate Filters
(F)OV/AG	Full facepiece with Organic Vapor/Acid Gas cartridges
(F)OV/AG/N95	Full facepiece with Organic Vapor/Acid Gas cartridges and N95 Particulate Filters
AM/N95	Half facepiece with Ammonia cartridges and N95 Particulate Filters
Hg/N95	Half facepiece with Mercury cartridges and N95 Particulate Filters
SA	Supplied Air respirator with any type of respiratory inlet covering
TLV	Threshold Limit Value®

OSHA Substance Specific Standards (Table 2)

Table 2 lists OSHA particulate substance specific standards with 42 CFR 84 filter recommendations. It identifies the interim 42 CFR 84 respirator requirements under OSHA's current substance specific standards. The 42 CFR 84 recommendations were made in accordance with an OSHA memorandum dated September 3, 1996.[6] The N100, R100 and P100 filters are certified at the 99.97% efficiency level and are identified as HEPA (High Efficiency Particulate Air) filter respirators. If oil particles are present, N-series filters cannot be used. This is only an interim recommendation since OSHA is addressing respirator requirements of substance specific standards in the 29 CFR 1910.134 Respiratory Protection rulemaking. These requirements may change with the promulgation of this revised regulation.

References

1. "Respiratory Protective Devices," *Federal Register 60*:110 (June 8,1995) pp.30339 & 30352.
2. **National Institute for Occupational Safety and Health**: NIOSH Guide to the Selection and Use of Particulate Respirators Certified Under 42 CFR 84 [DHHS (NIOSH) Pub. No. 96-101]. Cincinnati, OH: National Institute for Occupational Safety and Health, 1996.
3. **National Institute for Occupational Safety and Health**: NIOSH Manual of Analytical Methods, 4th edition, by P. M. Eller. (Method 5026, Oil mist, Mineral) Cincinnati, OH: National Institute for Occupational Safety and Health, 1994.
4. **Perez, C. and S.C. Soderholm**: Some Chemicals Requiring Special Consideration when Deciding Whether to Sample the Particle, Vapor, or Both Phases of an Atmosphere. *Appl. Occup. Environ. Hyg. 6(10):* 859-864 (1991).
5. **Industrial Safety Equipment Association**: Use and Selection Guide for Non-Powered Air Purifying Particulate Respirators. Arlington, VA: Industrial Safety Equipment Association, 1996.

6. Occupational Safety and Health Administration: “Particulate Respirators Certified under 42 CFR Part 84.” by J.B. Miles, Jr. Washing ton DC, September 3, 1996. [Memo]

Table 2. Interim Respirator Requirements for OSHA Specific Particulate Substance Standards

Adapted from ISEA Use and Selection Guide.[5]

Standard Number (29 CFR)	Substance	Permissible Exposure Limit	30 CFR 11 Required Respirators	42 CFR 84 Required Respirators	Comments
1910.1001 & 1915.1101 & 1926.1101	Asbestos	0.1 fiber/cc	H. R*. ≤10 Half Mask with HEPA filter H. R. ≤50 Full Facepiece with HEPA filter	H. R. ≤10 Half Mask with any 100 filter** H. R. ≤50 Full Facepiece with any 100 filter	Disposables are not allowed
1910.1003	4-Nitrobiphenyl alpha-Naphthylamine 3,3'-Dichlorobenzidine and its salts beta-Naphthylamine Benzidine 4-Aminodiphenyl 2-Acetylaminofluorene 4-Dimethylaminoazo benzene	none assigned	Handling Operations Half Mask with Dust, Fume and Mist filters	Handling Operations Half Mask with any filter***	Do not use particulate filters for the following substances also listed in this OSHA standard; methyl chloromethyl ether, bis chloromethyl ether, ethyleneimine, beta-propiolactone, and n-nitrosodimethylamine as these substances have significant vapor pressure and present a vapor hazard.
1910.1018	Inorganic Arsenic	10 μg/m³	H. R. ≤10 Half Mask with HEPA filter H. R. ≤50 Full Facepiece with HEPA filter	H. R. ≤10 Half Mask with any 100 filter H. R. ≤50 Full Facepiece with any 100 filter	
1910.1025 &1926.62	Lead	50 μg/m³	H. R. ≤10 Half Mask with HEPA filter H. R. ≤50 Full Facepiece with HEPA filter	H. R. ≤10 Half Mask with any 100 filter H. R. ≤50 Full Facepiece with any 100 filter	
1910.1027 & 1926.1127	Cadmium	5 μg/m³	H. R. ≤10 Half Mask with HEPA filter H. R. ≤50 Full Facepiece with HEPA filter	H. R. ≤10 Half Mask with any 100 filter H. R. ≤50 Full Facepiece with any 100 filter	
1910.1029	Coke Oven Emissions	150 μg/m³	H. R. ≤10 Half Mask with Dust/Mist filter	H. R. ≤10 Half Mask with any filter	An organic vapor cartridge may be used with the filter
1910.1043	Cotton Dust	Yarn mfg. & washing 200 μg/m³. Mill wastes or Yarn mfg. from lower grade washed cotton 500 μg/m³. Slashing & weaving operations 750 μg/m³.	H. R. ≤5 Half Mask (including disposable) with particulate filter H. R. ≤10 Half Mask (excluding disposable) with particulate filter H. R. ≤100 Full Facepiece with HEPA filter	H. R. ≤5 Half Mask (including disposable) with any filter. H. R. ≤10 Half Mask (excluding disposable) with any filter H. R. <100 Full Facepiece with any 100 filter.	Atmosphere may contain oil greater than 0.1mg/m³ in which case use only an R or P filter
1910.1050 &1926.60	4,4'-MDA	10 ppb	H. R. ≤10 Half Mask with HEPA filter H. R. ≤50 Full Facepiece with HEPA filter.	H. R. ≤10 Half Mask with any 100 filter. H. R. ≤50 Full Facepiece with any 100 filter.	Whenever MDA used in a process with heat, use an organic vapor cartridge

* H.R. = Hazard Ratio ** Any N100, R100, or P100 filter *** Any N-, R-, or P- filter of any efficiency (95, 99, 100)