Respirator Selection Requirement of Substance Specific Requirements – Quick Tips

The Occupational Safety and Health Administration (OSHA) issued its final rule for assigned protection factors (APFs) and maximum use concentrations (MUCs) in the Federal Register on August 24, 2006. This document focuses on the mandatory selection provisions of APFs, MUCs and the APF Table, and their roles in the Substance Specific standards

The APF is the workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program.

MUC is the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator, and is determined by the assigned protection factor of the respirator or class of respirators and the exposure limit of the hazardous substance. The MUC is the upper limit at which the class of respirator is expected to provide protection. Whenever exposures approach the MUC, the next higher class of respirators should be selected. Employers must not apply MUCs to conditions that are immediately dangerous to life or health (IDLH).

The MUC for respirators can be determined by multiplying the APF specified for the respirator by the OSHA permissible exposure limit (PEL), short-term exposure limit (STEL) or ceiling limit. When no OSHA exposure limit is available for a hazardous substance, the MUC must be determined on the basis of relevant available information and informed professional judgment.

Employers must use the APFs and MUCs to select the appropriate type of respirator that meets or exceeds the required level of employee protection. Selection is based on the airborne contaminant level found in the workplace and the maximum concentration of the contaminant in which a particular type of respirator can be used.

29 Code of Federal Regulations (CFR) 1910.134(d)(3)(i)(A)

Table 1 Assigned Protection Factors [5]

Type of respirator [1,2]	Quarter mask	Half mask	Full facepiece	Helmet/ hood	Loose-fitting facepiece
Air-purifying respirator	5	10 [3]	50	-	-
Powered air-purifying respirator (PAPR)	-	50	1,000	25 [4] / 1000	25
Supplied-air respirator (SAR) or airline respirator • Demand mode	-	10	50	-	-
Supplied-air respirator (SAR) or airline respirator • Continuous flow mode	-	50	1,000	25 [4] / 1000	25
Supplied-air respirator (SAR) or airline respirator • Pressure-demand or positive-pressure mode	-	50	1,000	-	-
Self-contained breathing apparatus (SCBA) • Demand Mode	-	10	50	50	-
Self-contained breathing apparatus (SCBA) • Pressure-demand or other positive-pressure mode	-	-	10,000	10,000	-

Notes:
[1] Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.
[2] The assigned protection factors in Table 1 are only effective when the employer implements a continuing, effective respirator program as required by this section (29 CFR 1910.134), including training, fit testing, maintenance and use requirements.
[3] This APF category includes filtering facepieces, and half masks with elastomeric facepieces.
[4] The employer must have evidence provided by the respirator manufacturer that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000. This level of performance can best be demonstrated by performing a workplace protection factor (WPF) or simulated workplace protection factor (SWPF) study or equivalent testing. Absent such testing, all other PAPRs and SARs with helmets/hoods are to be treated as loose-fitting facepiece

respirators and receive an APF of 25.
[5] These APFs do not apply to respirators used solely for escape. For escape respirators used in association with specific substances covered by 29 CFR 1910 subpart Z, employers must refer to the appropriate substance-specific standards in that subpart. Escape respirators for other IDLH atmospheres are specified by 29 CFR 1910.134 (d)(2)(ii).

Common Subpart Z Toxic and Hazardous Substances:

Chemical	Respirator Selection Requirements
Asbestos	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1001(g)(3)(i)** 2. Provide high-efficiency particulate air (HEPA) filters for powered and non-powered air-purifying respirators. 1910.1001(g)(3)(ii) 3. Cannot use filtering facepiece (disposable) respirators. **1910.1001(g)(3)(i)**
Coal tar pitch	None noted. **1910.1002**
4-nitrobiphenyl and 13 carcinogens	None noted. **1910.1003 -1910.1016**
Vinyl chloride	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1017(g)(3)(i)(A)** 2. Provide an organic vapor cartridge that has a service life of a least one hour when using a chemical cartridge respirator for vinyl chloride concentrations up to 10 parts per million (ppm). **1910.1017(g)(3)(i)(B)** 3. Select a canister that has a service life of at least four hours when using a PAPR having a hood, helmet, or full or half facepiece, or a gas mask with a front or back mounted canister, at concentrations up to 25 ppm. **1910.1017(g)(3)(i)(C)** 4. When air-purifying respirators are used, the canisters or cartridges must be replaced prior to the expiration of their service life or the end of the shift in which they are first used, whichever occurs first. **1910.1017(g)(3)(ii) and 1910.1017(g)(3)(ii)(A)**

Inorganic arsenic	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1018(h)(3)(i)(A)** 2. Cannot use half-mask respirators for protection against arsenic trichloride because it is rapidly absorbed through the skin. **1910.1018(h)(3)(i)(B)** 3. Provide HEPA filters for powered and non-powered air-purifying respirators. **1910.1018(h)(3)(i)(C)** 4. Select air-purifying respirators that have a combination HEPA filter with an appropriate gas-sorbent cartridge or canister when the employee's exposure exceeds the PEL for inorganic arsenic and the relevant limit for other gases. **1910.1018(h)(3)(i)(D)(1)** 5. Select front- or back-mounted gas masks equipped with HEPA filters and acid gas canisters or any full facepiece SARs when the inorganic arsenic concentration is at or below 500 milligrams per cubic meter of air (mg/m^3), and half mask air-purifying respirators equipped with HEPA filters and acid gas cartridges when the inorganic arsenic concentration is at or below 100 ($\mu g/m^3$). **1910.1018(h)(3)(i)(D)(2)**
Lead	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1025(f)(3)(i)(A)** 2. Must use full facepiece respirators only for protection against lead aerosols that cause eye or skin irritation at the use concentrations. **1910.1025(f)(3)(i)(B)** 3. Provide HEPA filters for powered and non-powered air purifying respirators. **1910.1025(f)(3)(i)(C)**
Cadmium	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1027(g)(3)(i)(A)** 2. Must use full facepiece respirators when employee experiences eye irritation. **1910.1027(g)(3)(i)(B)**

	3. Provide HEPA filters for powered and non-powered air purifying respirators. **1910.1027(g)(3)(i)(C)**
Benzene	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1028(g)(3)(i)** 2. Use organic vapor cartridge or canister with powered and non-powered air-purifying respirators, and a chin-style canister with full facepiece gas masks. **1910.1028(g)(3)(i)(C)** 3. Ensure that canisters used with non-powered air-purifying respirators have a minimum service life of four hours when tested at 150 ppm benzene at a flow rate of 64 liters per minute (LPM), a temperature of 25°C and relative humidity of 85%. For cartridges used on PAPRs, the flow rates for testing must be 115 LPM for tight fitting and 170 LPM for loose fitting. **1910.1028(g)(3)(i)(D)**
Coke ovens	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1029(g)(3)** 2. Employers may use a filtering facepiece respirator only when it functions as a filter respirator for coke oven emissions particulates. **1910.1029(g)(3)**
Cotton dust	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. 1910.1043(f)(3)(i)(A) 2. Employers must not select or use filtering facepiece respirators at concentrations greater than five times the PEL. **1910.1043(f)(3)(i)(A)** 3. Provide HEPA filters for powered and non-powered air-purifying respirators for concentrations greater than 10 X PEL. **1910.1043(f)(3)(i)(B)**

1,2-dibromo-3-(DBCP)	1. Select atmosphere-supplying respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs.**1910.1044(h)(3)(i)** 2. For entry into or escape from, unknown DBCP concentrations, provide employees with either a combination respirator that includes a SAR with a full facepiece operated in a pressure-demand or other positive-pressure or continuous-flow mode, as well as an auxiliary SCBA operated in a pressure-demand or positive-pressure mode ochloropropaner a SCBA with a full facepiece operated in a pressure-demand or other positive-pressure mode. **1910.100(h)(3)(ii)(A)** and **1910.100(h)(3)(ii)(B)**
Acrylonitrile	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1045(h)(3)(i)** 2. For escape, provide employees with any organic vapor respirator or any SCBA permitted for use under **1910.134(d)(3)(i)(A)**. **1910.1045(h)(3)(ii)**
Ethylene oxide (ETO)	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1047(g)(3)(i)** 2. Employers cannot use half masks of any type due to eye irritation or injury. **1910.1047(g)(3)(i)** 3. Equip each air-purifying, full-facepiece with a front-or back-mounted canister approved for protection against ETO. **1910.1047(g)(3)(ii)**
Formaldehyde	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1048(g)(3)(i)(A)** 2. Equip each air-purifying, full-facepiece respirator with a canister or cartridge approved for protection against formaldehyde. **1910.1048(g)(3)(i)(B)**

	facepiece respirator having a chin-style or a front-or back-mounted industrial-size, canister or cartridge approved for protection against formaldehyde. **1910.1048(g)(3)(i)(C)** 4. Half facepiece respirators can only be used if worn with gas-proof goggles. **1910.1048(g)(3)(ii)**
Methylenedianiline (MDA)	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1050(h)(3)(i)(A)** 2. HEPA filters are used unless MDA is in liquid form or used as part of a process requiring heat. In these two cases a combination organic vapor/HEPA combination canister or cartridge must be used. **1910.1050(h)(3)(i)(B)** and **1910.1050(h)(3)(i)(D)** 3. For escape, provide employees with either a SCBA with a full facepiece or hood operated in the positive-pressure or continuous-flow mode; or a full facepiece air-purifying respirator. **1910.1050(h)(3)(i)(C)**
1,3-butadiene (BD)	1. Employers must select appropriate respirators from Table 1 – Minimum Requirements for Respiratory Protection for Airborne BD. **1910.1051(h)(3)(i)** 2. Air-purifying respirators must have filter elements approved by the National Institute for Occupational Safety and Health for organic vapors or BD. **1910.1051(h)(3)(ii)**
Methylene chloride (MC)	1. Select respirators specified in 1910.134(d)(3)(i)(A) - Table 1 – APFs. **1910.1052(g(3)(i)** 2. Cannot use or select half facepiece of any type because MC may cause eye irritation or damage. **1910.1052(g)(3)(i)** 3. For emergency escape, provide employees with either a SCBA operated in the continuous-flow or pressure-demand mode; or a gas mask with an organic vapor canister. **1910.1052(g)(3)(ii)**

Commonly Asked Questions

Q: What is IDLH?

A: Immediately dangerous to life or health (IDLH) is an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Q: How are cartridge/canister change out schedules calculated?

A: In the absence of an end of service life indicator (ESLI), a cartridge/canister change out schedule is required for gas-and vapor-removing respirators and should be based on objective information or data that will ensure that the canisters and cartridges are changed before the end of their service life. Usually, manufacturers have software to estimate a change out schedule for their cartridges or canisters. Change out schedules are not the same from one manufacturer's cartridges or canisters

to that of another manufacturer. This is because the volume and type of adsorbent varies between manufacturers. Additionally, OSHA has mandatory change out schedules for cartridges for certain substances.

Q: Are arrows required in addition to marking pipes?

A: Yes. ASME A13.1-2015 states that arrows shall be used on either end or both ends of the label to show the direction of flow. Arrows should be placed every 50 feet on straight runs, on both sides of wall, floor or ceiling penetrations, and near valves, flanges and changes in pipe direction, and at any line entry or re-entry point.

Source: Grainger Know How – https://www.grainger.com/know-how