

Breathing Difficulties

When choosing a respirator, straight answers are surprisingly hard to find

BY MATTHEW MILLHAM

When I was in trade school, one of my instructors—a crusty mason I admired for his encyclopedic building knowledge and cheeky humor—was diagnosed with mesothelioma and died soon after. His disease, a condition associated with asbestos exposure, was almost certainly linked to his decades spent on job sites without protective equipment. Since then, I've worn a respirator pretty religiously. But what I hadn't thought about until I started reporting this story is whether that respirator is really protecting me.

It wasn't long after my boss asked me to write a quick guide to respirators that my ignorance caught up with me. I assumed that somewhere, there exists an elegant flowchart or decision tree that would have me in and out of this article in a couple days.

Sad to say, it is not so.

While it's not rocket surgery, a lot more goes into picking respirators than I'd imagined. In a book from the National Safety Council called the *Complete Confined Spaces Handbook*, which is mostly about respiratory hazards and protection, the author notes that choosing a respirator "can be a real nightmare," and then punts on how to do it. If it's too complicated for an industry pro to explain in a "complete" handbook on the subject, it should make Average Joe think twice before grabbing the first



3M 8211
\$23, 10-pack

Disposable half-mask particulate respirators

These are the go-to for many dusty jobs. Starting at about \$2 apiece, they're the least expensive respirator type, and the least versatile. Generally made of clothlike materials, they only filter out dusts, mists, and fumes (airborne particles that come from burning or melting materials).

Assigned Protection Factor (APF) is the industry lingo for how well a respirator performs. There are six different APFs assigned by OSHA: 5, 10, 25, 50, 1000 and 10,000. The higher the number, the higher the level of protection. On a job site, you won't likely see an APF over 1000.

APF

RESPIRATOR ROUNDUP

There are two broad categories of respirators: air purifying and atmosphere supplying. Air-purifying models take the bad air around you and make it breathable. Atmosphere-supplying types provide clean air from a source other than the air around you—for example, from outside via a pump and hose. Various designs within each of these categories offer different levels of protection.

Reusable half-mask air-purifying respirators

At about \$10 to \$30 without filters or cartridges, reusable half-masks offer the same protection factor as disposables, but with far more versatility. These models are made from molded elastomers and accept an assortment of filters and cartridges that protect against many job-site contaminants, including a range of volatile organic compounds and acid gases (up to certain thresholds). The filters available for these reusable masks can last longer than those in disposable masks, so the investment could save you money in the long run.

3M 6500QL
\$17 without
cartridges



10



50

Full-mask air-purifying respirators

These look similar to military gas masks and accept the same range of filters and cartridges as reusable half-masks. They protect against the same stuff as half-masks, but are better at it—as they should be, priced at about \$100 or more for a bare mask.

Honeywell 54001
\$103 without
cartridges

Full-mask powered air-purifying respirators (PAPRs)

With a battery-powered blower motor, full-face, tight-fitting PAPRs are among the most protective air-purifying respirators, though you're not likely to see them on job sites. While half- and full-mask air-purifying respirators rely on inhalation (negative pressure) to suck air through filter and cartridge elements, PAPRs pump clean air to the mask, maintaining positive pressure. This enables them to achieve APFs of up to 1000. PAPR cartridges handle the same contaminants as half-mask and full-mask purifying respirators, but are typically larger, which means longer service lives. Filters for PAPRs are high-efficiency particulate air (HEPA) filters. The least expensive units start at about \$400. There are also hooded PAPRs that don't seal to the face (a good option for guys with beards); APF ratings for these are either 25 or 1000, depending on if they've been tested to demonstrate the higher APF.

25

OR

1000



Survival Air Systems
9800-35
\$905 with ¼-hp pump
and 50-ft. breathing air line

50

OR

1000



3M TR-300-HIK \$1215

Full-mask supplied-air respirators

There are some chemicals that air-purifying respirators can't handle (at least in bulk), like the isocyanate that comes from spray foam or the methylene chloride used in some paint and bathtub strippers. That's when a supplied-air respirator comes in. A pump placed in an uncontaminated space pushes clean air through a hose to a mask or helmet. Protection factors for these depend on the mask or helmet type and the flow mode of the valve (those that provide continuous airflow or positive pressure yield top APFs, while demand valves triggered by negative pressure offer less protection).

RESPIRATORS DEMYSTIFIED PICKING THE RIGHT PROTECTION



KNOW YOUR ENEMY

The first step in picking a respirator is knowing the contaminants and their concentrations in your air. There are no rules of thumb for this; the only way to know is to have the air tested. I know what you're thinking—"That's not happening"—because I thought the same thing. If you don't test the air, then the only way to stay reasonably safe is to shell out a bunch of cash on a supplied-air respirator with a high APF rating. If that sounds unappealing and you're a small to medium-size business, OSHA (and some insurance companies) will test your air for free. Details of the program are available at OSHA's website, OSHA.gov.

OSHA doesn't deal with non-pros, so DIYers have to rely on manufacturers of potentially dangerous materials to recommend what's needed to use their products safely.

CHOOSE YOUR DEFENSE

Once you know what you're dealing with, compare the concentrations of contaminants in your air to OSHA's Permissible Exposure Limit (PEL), available online. If your concentration is below the PEL, you don't need a respirator. If it's above, do some math to determine what type you need.

Divide the contaminant concentrations in your air by their OSHA PELs. The number you come up with is the minimum APF you need for your respirator.

Here's an example: Say you're spraying varnish with an ethyl-benzene solvent. Air testing shows you have 600 parts of ethyl benzene per million of air. OSHA's PEL for ethyl benzene is 100 ppm. The math ($600/100 = 6$) shows that you need a respirator with an APF of at least 6 (and since that doesn't exist, jump right to APF 10).

This formula isn't foolproof. There are cases where an air-purifying respirator will seem to be enough for the job according to the math. But if the concentration of a contaminant is at or above what NIOSH considers "Immediately Dangerous to Life or Health," an air-purifying respirator is unlikely to provide enough protection. If the amount of bad stuff in your air is above the IDLH benchmark, you have to use supplied air.



To see a Tool Tech video about selecting the right type of respirator, visit FineHomebuilding.com/magazine.

mask he sees on the shelf. Because picking the right respirator is critical for at least one major reason: It could mean life or death.

One thing I've learned is that it's hard to say what respirator is right for each job without information—information you won't find on the internet. I talked with experts at the Occupational Safety and Health Administration (OSHA), which writes respiratory-protection rules; the National

Institute for Occupational Safety and Health (NIOSH), which tests and approves respirators; and 3M, one of the world's largest manufacturers of personal protective equipment. While they all had useful information and advice, none had a simple answer to the basic question: What respirator do I need?

When I posed a version of that query to Tom Pouchot, who oversees respirator testing at NIOSH, he told me something he's prob-

ably said a thousand times in his career: "I hate to say there's not an easy solution."

Well, they may not be easy ones, but there are solutions. Figuring out what protection you need is much easier once you know what hazards you're dealing with. □

Matthew Millham is an associate editor. Photos by Rodney Diaz, except where noted.



DID YOU KNOW?

Decode the labels

FILTER RATINGS

There are nine different possible ratings for disposable particulate masks, defined by their resistance to oils and their proficiency at filtering particles out of the air. These ratings apply to filters and prefilters for quarter-mask, half-mask, and full-mask air-purifying respirators. Powered air-purifying respirators use HEPA filters.

- N** Not resistant to oil
- R** Somewhat resistant to oil
- P** Extremely resistant to oil, or "oil-proof."

- 95** The filter media will capture at least 95% of the hardest-to-catch particulates (as well as the easy stuff), including mists and fumes.
- 99** Will capture at least 99% of the hardest-to-catch particulates.
- 100** Will capture at least 99.97% of the hardest-to-catch particulates. This is the same rating as HEPA filters.



CARTRIDGE CLASSIFICATIONS

Air-purifying respirator cartridges and filters come in a rainbow of colors. The colors loosely identify what the cartridge will help protect you against (the specific chemicals a cartridge is good for are listed on the NIOSH-approved cartridges), or the classification of a filter. All manufacturers use the same color-coded system. There are more colors, but some of the big ones for builders are:

Cartridge color

- Black** Organic vapors (common in paints and other finishes)
- White** Acid gas, such as chlorine
- Yellow** Organic vapors and acid gas

Filter color

- Magenta/light purple** P100 protection against particulates

- ✘ If your safety glasses fog up while you're wearing a half-mask respirator, your respirator isn't fitting right. Hot breath should exit through the front, not past the bridge of the nose.
- ✘ Facial hair prevents tight-fitting masks from sealing. Mustaches, goatees, and soul patches are fine if they fit within the seal of the respirator. But even a small amount of beard growth under the seal can drastically affect a respirator's ability to protect you. If the beard is precious, a loose-fitting model of PAPR will work.
- ✘ Most disposable half-mask respirators (the ones that look like dust masks) offer no protection from gases and vapors. The valves on some of these masks help dissipate hot breath more easily, but have nothing to do with filtering contaminants.
- ✘ The more contaminants a cartridge is good for, the shorter its service life. For example, the pink and yellow respirator cartridge and filter assemblies commonly sold in home-improvement stores protect against particulates (denoted by the pink casing) as well as organic vapors and acid gases (denoted by the yellow label). They cover a wide range, but they won't protect against any one thing for very long. A better option is to tailor your filter/cartridge setup to target the specific pollutants in the air.
- ✘ If your disposable respirator is damaged, dirty, or hard to breathe through, it's time to toss it. The same rules apply to the filters on reusable cartridge-style respirators. Different users will tolerate different levels of breathing difficulty, so the right time to dump a disposable can be subjective.
- ✘ Gas and vapor cartridges usually don't have indicators to show when they're kicked. If you know the concentration of contaminants in the air, use a service-life calculator to determine when to change your cartridges (3M has a good one on their website; some other manufacturers have similar online tools). A good rule of thumb: If you can smell the chemicals you're working with through the mask, you're not protected.