

How Good is Your Gas?

Revisiting the Risk of CO Contamination

By Robert N. Rossier

A few years back, in this column, we examined the problem of carbon monoxide (CO) contamination in compressed air. At the time, a few unfortunate deaths had occurred as a result of the divers' air being contaminated with CO, a colorless, odorless gas that binds with hemoglobin in the blood, reducing its capacity to transport oxygen.

The main questions on divers' minds seem to revolve around the scope and seriousness of the CO contamination problem, and since a few readers have written recently to express their concerns, we decided to take a look at the issue again.

Digging for Data

The first stop in the data collection process was the Florida Department of Health (DOH), which, since 1999, has been monitoring all Florida air stations. That year the Florida legislature enacted a law requiring all air stations to have air quality checked quarterly by an accredited laboratory. Test results must be posted in a conspicuous location in the dive center and provided to the DOH, which maintains a website listing of all air stations that are in compliance with the law.

According to sources at the Florida DOH, none of the reporting air stations have ever exceeded the CO limit of 10 parts per million (ppm) for CGA (Compressed Gas Association) Grade E air - the standard dictated by Florida law and recognized throughout the diving industry. (Note: Modified Grade E air is required if the air is to be used to make nitrox.) However, DOH officials do concede that the problem is getting the reports in on time.

As we dug a little deeper, we found out what is probably causing the delay in reports getting to the state. According to DOH Press Secretary Bill Parizek, air testing laboratories don't send the test results directly to the DOH unless specifically requested by the air station. If a fill station fails its air quality check, it can correct the problem, run another test and then forward the results to the DOH.

And while it might seem that this is "cheating," the bottom line is that the process does force dive centers to correct problems. So while Florida reports that no stations fail to meet the CO limit, these results are misleading. The question remains as to whether divers are likely to have CO-laced air find its way into their cylinders, even in safety-conscious Florida.

Making Contacts

To get a more representative reading on how frequently air samples from dive centers fail on the CO limit, we contacted some of the major air testing facilities and got a different story. In fact, sources at one major laboratory, TRI Environmental, report that 3 to 5 percent of the air samples tested exceeded the 10-ppm limit. TRI tests between 1,000 and 2,000 air samples monthly.

Another major testing lab, Lawrence Factor, shares similar results. "I probably test about 100 samples a day," reported Bob Laughlin, Director of Laboratory Services at Lawrence Factor. "Of those, about 10 contain CO, and maybe three will be over the limit. And, typically we're not splitting hairs. Those that are over the limit aren't just a little over, they are usually grossly over the limit - maybe 30 to 40 ppm. In fact, I have two right here on my desk today. One is 45 ppm and the other is 50 ppm."

It should be noted that the data on CO-laden air comes not from the testing of individual cylinders, but from periodic testing of the air produced by compressors at air stations around the country. One bad air station could result in untold numbers of individual cylinders contaminated with CO. Most dive centers have their air verified quarterly. For those operating in the state of Florida, it's a legal requirement.

Learning from Failures

A 3 to 5 percent failure rate seems pretty high, and it begs the question of what air stations are doing wrong and whether they are learning from the failures. According to Laughlin, air stations fail to meet the prescribed limits for CO for two primary reasons.

"First is the overuse of the compressor system's inlet filter," says Laughlin. "You can think of the air filter as a big sponge, soaking up the contaminants. If you run with a filter too long, you get what we call 'breakthrough' and it's just like squeezing that sponge. All the contaminants come right out into the compressed air."

"The other problem we see is when the air intake is located where it shouldn't be. Ideally, the intake should be up on the roof somewhere, but we find operators who have them right next to the exhaust, in the shop, or in the back alley where they pick up all kinds of stuff. With portable compressors, the problem comes when the air is calm, and a cloud of exhaust forms around the intake and gets sucked in."

Laughlin says that Lawrence Factor does not charge for a failed test. When a sample fails, a new test kit is sent to the dive center so a new sample can be taken. "We also work with the dive centers to help them find the problem and fix it," notes Laughlin.

As operators experience problems, they probably become smarter, and the likelihood of further problems is reduced. But in the meantime, as dive centers wait for the results of their tests, they may be pumping

contaminated air into scores of cylinders for unwitting divers. And with air quality testing performed only quarterly, an air station could in theory be putting out bad air for nearly three months before the problem is detected.

Taking a Reading

While it's difficult to determine the precise potential for a CO-laden air fill, divers can take steps to limit that risk. The first is to always get your fill from a reputable dive center that fills a lot of cylinders and shares your concern about air quality. To continuously monitor the quality of the compressed air they produce for their customers, some centers have even installed sophisticated electronic CO monitoring systems.

Another way to minimize the risk of CO poisoning is to test your own air. Some manufacturers of CO detectors we reported on a few years back have gone out of business, but others are still readily available. Perhaps the most popular personal CO tester is Lawrence Factor's C-O-Cop(tm). This tester comes in two models: one uses a yoke to attach to the cylinder valve, and the other connects to the fitting for the low-pressure inflator. Both models use the same color-change element to provide a qualitative measure of CO. The element darkens when the CO level of the tested air approaches 50 ppm.

While the vital go/no-go indication provided by the C-O-Cop(tm) is wholly adequate for most purposes, some divers feel a need for a specific reading of the CO level in parts per million. For these, there are the calibrated gas detector tubes manufactured by RAE Systems and by Sensidyne.

Using the same basic color-change technology, a small hand pump pulls a 50-cc air sample through detection tubes, which have a scale ranging 5 ppm to 100 ppm or 10 to 250 ppm. Although these detector tubes provide a quantitative CO reading, taking the measurement is somewhat awkward: air from the cylinder is blown into a plastic bag from which the pump draws a sample.

Bottom Line

The good news is that very few divers suffer exposure to lethal doses of CO when diving. But despite the best efforts of concerned dive centers and the Florida DOH, at least some level of risk of receiving a CO-laden air fill persists. Perhaps most importantly, for those who perceive the risk as unacceptable, available testing can put our minds at ease before we slip below the surface.

References and Resources

[Cole-Parmer Instrument Company](#)

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[Compressed Air Compliance List](#)

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About The Author

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