

“Divers, how clean is your air?”

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All of us as divers by definition must purchase or otherwise obtain compressed air for our operational needs. For ease of use, some dive organizations may decide to create their own compressed air where it is needed (e.g., aquarium dive support or ocean survey vessel work). For those of us that cannot afford such equipment, we must buy air, enriched air, or some such breathing media from a local dive shop. In each case, most divers will agree that clean air is important to their safety.



Figure: SCUBA bottles at an air fill station filled and “ready to dive.” Or are they?

### **What is clean air?**

NOAA defines acceptable air to be that which meets the compressed gas association (CGA) grade E standard or better. The following table is taken from the NOAA Scientific Diving Standards and Safety Manual, section 3.6, August, 2008.

CGA Grade E	
Component Maxim	um
Oxygen 20-22%/v	
Carbon Monoxide	10 ppm/v
Carbon Dioxide	1000 ppm/v
Condensed Hydrocarbons	5 mg/m <sup>3</sup>
Total Hydrocarbons as Methane	25 ppm/v
Water Vapor (ppm)	2
Objectionable Odors	None

OSHA defines clean air for commercial diving as containing less than 20 ppm (parts per million) by volume of carbon monoxide (vs. the CGA standard of 10 ppm), less than 1,000 ppm by volume of carbon dioxide, 5 milligrams per cubic meter of oil mist (except that non-oil-lubricated compressors need not be tested for oil mist), or a pronounced or noxious odor (29 CFR 1910.430(b)).

EPA requires compressed air to meet CGA grade E standards. It probably goes without saying that the risk of impure air, in the worst case, is a diver unconscious under water.

### **How often must compressor air be tested?**

OSHA defines minimum compressor testing frequency for commercial operations as once every 6 months (29 CFR 1910.430(b)). NOAA and EPA also require testing at least every six months for their compressors. PADI “five star” training centers used to require tests for their air on a quarterly basis, but no longer. PADI, while requiring CGA grade E air from their shops, is leaving the testing frequency up to the shop and local governing authorities—ironically in most cases there are no such regulations outside of OSHA requirements for commercial dive operations (Personal communication with Jeff Nadler, PADI 2009)

### **Are all the dive shops you may come across testing their air?**

The short answer is an emphatic “NO.” The EPA Region 10 unit sometimes dives the same locations multiple times, but just as often we travel to a new site; typically this means using a new dive shop that we are unfamiliar with. Dive shops throughout Region 10—Oregon, Idaho, Washington, and Alaska -- like the rest of the U.S., have fallen on hard times due to the economic downturn. Shops are closing right and left, and those that are surviving are making hard choices with their bottom line which can impact your safety.

Here are some quotes in cold-calling separate dive shops that might have been used just during the EPA Region 10 2009 operational window for SCUBA tank air/nitrox fills:

“Yes, we meet CGA grade E air except for the CO<sub>2</sub> reading, which I admit is a little high.”

“I don’t remember when we did our last air test. It was at least a year ago.”

“Our last air test was seven years ago. We would be happy to do another one if you are willing to pay for the cost of testing.”

“We did our air test regularly up to last year when we stopped. We decided that since the results were always the same, there was no reason to continue with the regular testing.”

(Personal communications, EPA Region 10 divers and various dive shops, 2009).

In the case of the shop with the high carbon dioxide reading and all the shops above without a current test, they were still filling SCUBA bottles. Would the high CO<sub>2</sub> have caused DCI-like symptoms - e.g., headache and confused diagnosis following a deep scientific dive? – maybe. In the case of the last quote in the list above, EPA divers noted that the compressor station area had been recently remodeled, the intake moved, and a charcoal grill located near the compressor building, if not the intake itself. This was a dive shop that had emphatically told me that the air used to fill their cylinders was tested regularly. In the end, they were grateful I had asked so that they could ensure that testing occurred in the future. What all of these responses highlight is that you can’t count on an unfamiliar shop testing their air in all instances. This also goes to show that a shop you have used for years might stop air purity testing without informing their customers.

### **Where do we go from here?**

Until more divers and dive organizations start asking for air tests and demanding clean air, I would expect that the next several years will again present a mixed bag of shops “doing the right thing” and those that try more bottom-dollar approaches. There are a lot of shops doing air tests regularly and posting them — and they deserve credit for their hard work and monetary expenditure on behalf of dive safety by virtue of your business. Protect your divers, take nothing for granted, ask for that air test.

*Disclaimer: This article is an illustration of potential hazards from compressed air impurities used during diving and does not represent the official view of the USEPA. Mention of any specific brand or model, instrument, material, or protocol does not constitute endorsement by the USEPA.*