

Managing Air Quality to Protect Employees and Customers

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I have a confession to make: I'm a non-shooting former nurse practitioner certified industrial hygienist. I'd like to talk to you about an area that is somewhat glossed over and neglected with regard to shooting range planning, design and maintenance: indoor air quality and control of lead exposure for employees and customers.

From an industrial hygiene standpoint, we've got to talk about how to control employee and shooter exposure to lead. Ideally, you're going to want a laminar flow across your range, a smooth sheet of air to carry contaminants away from the firing line into your ventilation capture system.

You don't want obstructions inhibiting that flow. Shooters, for instance, can create obstructions. I've seen beautifully designed systems that forget that the shooter is a major cause of turbulence. The shooter acts like an air foil. You have a beautiful theoretical design, and you can't understand why the fume and dust are going right into the shooter's breathing zone.

Ideally, and this is subject to modification with a good engineer, the simplest way to control exposure is to have a single pass, HEPA filter system. A HEPA filter is a high-efficiency particulate air filter; 99.9 percent of the tiny little particles are captured.

This isn't a very cost effective way to ventilate, obviously, with large treated areas. When you have expensive treated air, you're going to want to capture and recirculate it, but in order to do that safely, you need some pretty sophisticated engineering features in your system. Finally, I would like to see restrooms and break rooms on a separate system, and that's a real luxury.

Generally, we see single-point supply or no supply, no mechanical ventilation. We see shooters with booths and tables causing obstructions to air flow. We see a simple residential type or simple commercial and/or residential type gross filter that is not capable of screening out dust particles and lead fumes.

We see recirculation where contaminated air spreads over the range many times, and in some situations, the air has a chance to accumulate and concentrate as it's going around. If there are restrooms and break rooms, they're usually on the same air system or no system at all, and because they're passive, air will migrate from the ventilated portion and contaminated air will go into the break rooms and restrooms which are supposed to be clean areas.

I talk with people about air sampling. They're doing "area sampling" or "stationary point sampling." They put the sampling pump at the firing line or down range at the bullet trap, but

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they forget that the exposure to shooters often is different than the exposure they measure in the range itself. So I'm concerned about accurately measuring personal exposure.

In the ideal world, we get rid of lead, arsenic and all toxic components by using non-lead ammunition. A few years ago, that would have been considered pretty ridiculous, but there has been some research in this area. For instance, Metal-jacketed ammo makes a big difference. In copper-jacketed air sampling (personal air sampling on shooters who use jacketed ammunition), lead exposures are very low in comparison with surprisingly high exposures with non-jacketed ammunition.

In reality, we see lead styphnate primer volatilizing into the air. We see lead particles and dust from bullet sheering. We see lead and hot gasses. We see bullet fragmentation at the bullet trap which puts lead into the air. If those particles aren't breathed in at that point, they are relatively heavy and settle. Then they become a resuspension issue when range people clean them up and put them back into the air again. Lead is repeatedly disturbed and put into the air.

How do we access exposure? First of all, why should we? It's required by the Occupational Safety and Health Administration (OSHA). As an employer, you have to show that you measure the exposure of your employees, not your customers, but your employees.

There's also another issue coming to the forefront. As a nurse, I dealt with lead poisoning prevention in children 25 years ago. That's when we thought kids got poisoned by chewing on window sills. We now know that's not true. Children are poisoned by normal hand-to-mouth exposure to lead dust. This has to do primarily with lead paint. I bring it up because it has heightened public awareness of the lead poisoning issue. As soon as there's heightened public awareness, sophisticated consumers look for exposures in many different arenas. Certainly shooting ranges are one.

The second big trend relevant to this issue is that shooting sports are attracting many more women and children, as well as young adults in their reproductive years. These are the people that are vulnerable to the effects of lead. We worry about pregnant women, and we forget that developing embryos are most susceptible to the effects of lead before a woman even knows she's pregnant. We forget that lead affects both male and female reproductive capability; the sperm and egg also are affected. If all of your clients are 60 years old, maybe you don't have issues. If you're trying to attract a younger, mixed-gender population, these lead issues become very important.

How do we look at exposure? Ideally, you get somebody like me to come in every quarter to half year. You pay us a fortune, and I do personal air sampling for your employees and shooters.

Sampling shooters can get dicey, and I won't spend time getting into legalities or public relations issues of sampling shooters. A simpler way of sampling is to have your employees also be your shooters. Sample employees doing maintenance tasks and at the firing line. You want to do some area sampling and compare the two sets of information. You also want to do some wipe sampling, which is inexpensive and provides useful information.

Finally, OSHA requires that you test employee blood lead levels and zinc protoporphin levels. If their airborne exposures are at a certain level, consider testing the blood lead at least

annually as a failsafe spot check. It's an inexpensive way to get an index of whether lead poisoning is occurring at your range.

In the real world, you would call me. I would visit your range once, and we could have phone conversations after that. Frankly, this is a cost effective way to use someone like me. I can teach business owners to do sampling. Running collection pumps is no big deal. Devising sampling strategy and interpreting data take professional expertise, and I can do that by telecommuting. Look for a consultant who's willing to work with you, rather than swooping in once a quarter or every six months to do the work.

Secondly, you may want to confine your sampling to a one-time sampling at the firing line, and if your results are okay, then you're probably okay unless your range use changes. Smallbore is different from other kinds of weapons. Pistols are different. There are many variables in terms of lead and arsenic emissions. A one-shot deal may not do it, but there are ways to limit your sampling if you're on a tight budget.

How do we do air sampling? Personal sampling involves hanging a pump on a person, and you attempt to assess their breathing zone. In area sampling, you put the pump elsewhere in the range. Then you try to compare those two levels. Again, it takes professional judgement to analyze the numbers.

Whether you do the sampling or hire a consultant, make sure that you use a validated and recognized method. The National Institute of Occupational Safety and Health (NIOSH) has a manual of approved methods for analyzing samples. You want to make sure samples are taken to an accredited lab. Having samples analyzed by non-accredited labs is the easiest way to invalidate data in terms of credibility. If you're paying to have it analyzed, get the right lab.

You want to make sure that sampling is done for all representative work and activities. I've talked before about the importance of sampling shooters at the firing line, but maintenance activities are important. Vacuuming the range is different than cleaning the bullet trap or recycling. You want to know what those different tasks involve in terms of exposure.

The OSHA action level limit is 30 micrograms per cubic meter of air, averaged over an eight-hour period. Thirty micrograms is not a lot of lead. Think about it. A microgram is a thousandth of a milligram. When the action level is reached, OSHA says you have to do a number of things, such as more air sampling, employee training and so forth. If you are above the permissible exposure limit, OSHA requires that you put your employees in respirators and work on your engineering controls to reduce that level.

Let's talk about assessing exposure. I mentioned wipe sampling earlier. We're interested in looking at surface contact hazards or dust being resuspended. The stuff is in the air and it settles. It can be kicked up again or people can get it onto their hands and into their mouths. Wipe sampling is easy. You take a baby wipe and you wipe a square foot surface in a prescribed way. You stick the wipe in a tube and you send it to the lab. That's all there is to it. Interpreting it also is relatively inexpensive. You can get it analyzed for about \$7 or \$8. It's a good do-it-yourself method, but you then need some idea how to use the information.

There are ways to prevent lead dust from being an issue to begin with. We talked about proper ventilation. Housekeeping is essential. We don't want dry sweeping on the range—if you

find a broom on the range, you've got problems. We want you using a HEPA vacuum. HEPA vacuum manufacturers are very in tune to the needs of ranges, and they have heavy-duty, high-volume machines that will pick up shell casings and gross debris and separate it out for recycling. The machines are not cheap, but they're certainly available.

You want an annual professional cleaning. Rafters and remote areas need to be cleaned. Hopefully your concrete floor has been sealed and you've paid attention to seam design. You don't have cracks, nooks, crannies and crevices, and you can clean it by wet mopping.

Another issue is tacky mats and shoe cleaners. We borrow some of this technology from the clean room industry. How many of you have been at a range where there are tacky mats? They're fly paper doormats that you can put at strategic places in the range to help prevent tracking of lead dust out of the range. I recently saw mechanical boot cleaners in the steel industry. It's an automated brush in enclosed housing with a vacuum on it. The shoes are literally brushed and the dust is sucked into a receptacle where it can be captured appropriately. I'm not sure why that wouldn't work on a range, especially if you were building a modern, high-tech, attractive range. This could be a real selling point. Obviously, there is a cost/benefit ratio involved.

If you're recycling your waste for economic reasons, I strongly suggest that you work with your waste contractor for frequent pickup to minimize lead handling by your employees. You will minimize their exposures, and you're paying somebody else to do it anyway. If you time your pickups with that in mind, you can save yourself a lot of grief.

You need convenient facilities for hand and face washing. By convenient, I also mean attractive. Nobody wants to go into a filthy bathroom. Especially from a woman's standpoint, hygiene is a major issue. You know that the way to attract women is to have the place look nice. From a lead exposure standpoint, it's also extremely important.

Ideally, you'd like to have changing rooms and showers for your employees—which I realize is "pie-in-the-sky." In the lead industries, however, that's exactly what they have. It makes a huge difference in exposure levels of employees. At the very least, employees should wear disposable coveralls or shoe covers when cleaning. Break areas should be separately ventilated.

You want an extremely strict policy regarding eating, drinking and smoking on the range. Lead can be eaten very easily, making it very important to enforce this policy.

Last, and probably most importantly, you have to train your employees. In addition, I would strongly suggest that, in this day of increased litigation, disclosure to customers is the name of the game. Tell your customers up front what they're dealing with in a way that is tactful and does not raise hysteria. If you're going to err, err on the side of telling them too much, because it's not a big secret. The more you tell, the better off you'll be if an issue comes up.

Your training and public relations efforts should focus on people at risk. Pay attention to young men and women in their reproductive years, pregnant women and children. Children under the age of six are the most vulnerable, but certainly at ages seven and eight, they're still very vulnerable.

What kind of training is ideal? You want annual professional training. There are some useful videos on the market about preventing exposure in indoor ranges. Consider an interactive video presentation on exposure issues for your customers. Use creative signage encouraging people to wash their hands and faces when they're done shooting.

What subjects are you supposed to go over when you're training? Once again, stress that lead is an inhalable poison, but it's also a poison that you eat. Review health effects and who is most vulnerable. Discuss air sampling, wipe sampling, blood lead testing, the importance of hand/face washing, and the fact that eating, drinking and smoking are absolute no-nos in lead areas. Stress the use of coveralls and foot protection to avoid taking lead home. By all means and any means, avoid taking lead home!