

[Lesson Learned - Researcher Smells Toxic Fluorine Gas When Changing Out Gas Cylinder](#)

What happened?

Two researchers were changing out a gas cylinder containing a low concentration of fluorine used in an eximer laser. After reconnecting the regulator, researchers opened the cylinder valve, heard a hissing sound, and smelled a pungent odor. They quickly turned off the cylinder valve and reported the incident to their department safety coordinator (DSC). Fluorine is a very toxic and reactive gas, but fortunately, the concentration was dilute, less than 0.1% fluorine. The DSC contacted EH&S and was advised that researchers involved should be medically evaluated because of the possible effects of exposure to fluorine.

The researchers were medically evaluated and cleared at the Occupational Health Clinic at University Health Services.

What was the cause?

1. There is a **special lead washer** that must be used to attach regulators to fluorine cylinders. The researchers forgot to use this special washer the first time they attached the regulator. When the lead washer was properly inserted and tightened properly, there was a good seal, and no leak.
2. In this case, the vented gas cabinet was not used properly. The gas cabinet door was fully open when the gas to the cylinder was turned ON. With the door fully open there was inadequate ventilation of the leaking gas. Had the door had been closed and the smaller access window been opened to turn on the gas, there may have been no exposure outside of the gas cabinet. Fortunately, this gas cabinet did have more than the required airflow that prevented additional exposure in the room.



Smaller access door (shown above) should be used to turn on gas cylinder valve rather than the larger door which was opened.

Lessons Learned

How can incidents like this be prevented?

- All toxic gas use must be evaluated and approved by EH&S prior to purchase and use. The evaluations are to protect gas users and other building occupants from exposure to toxic gases used in research. In the evaluation process, "conditions of use" are prepared and must be followed. The use of this gas had been reviewed by EH&S, but some of the conditions of use had not been fully implemented.
- Special hazardous operations should be explained in the laboratory chemical hygiene plan. The procedure of changing out a toxic gas cylinder is a hazardous operation that should be documented. Training on the use of the special lead washer should be documented and provided prior to conducting change outs of cylinders containing toxic gas.
- Purge the gas lines fully before changing out a cylinder of toxic gas. This normally means exhausting and refilling with non-hazardous purge gas, a number of times, before opening the system.
- Use a low concentration of hazardous materials whenever possible. Use good exhaust ventilation to control exposure. Minimize the opening of gas cabinets and fume hoods to provide exhaust ventilation containment.
- If there is an exposure to a toxic gas, the exposed individuals should be trained to seek out immediate medical attention.

Bottom line: because of the low concentration and good ventilation control there were no adverse effects from the brief exposure to fluorine to the individuals changing the gas cylinder. Immediate medical attention was received and the lab is retraining applicable personnel.