

UW - Madison Safety Department Chemical and Radiation Protection
30 N. Murray St. 262-8769 <http://www.fpm.wisc.edu/safety>

Help Line 265-5518

Calibration -- How Important is it?

By Ronald R. Bresell, Radiation Safety Officer

Back in 1984 my job was performing safety inspections of medical x-ray units. I was in Korea for an audit of a hospital's radiology clinic. A GE vendor was installing a new \$375,000 radiographic / fluoroscopic machine and trying to get it to work right. The problem was, to avoid a 100% import tax, he had to borrow equipment from GE's subsidiary. Unfortunately, the equipment was not calibrated and was not responding in an accurate, reproducible fashion. He asked to borrow my calibrated equipment to finish the installation.

Many research labs use instruments to measure samples. Except for a few simple instruments (e.g., ruler), electronic instruments require calibration. Some are supplied with calibration check sources (e.g., test strips, buffer tables, etc.).

The purpose of the check source is to verify that the equipment is still functioning properly.

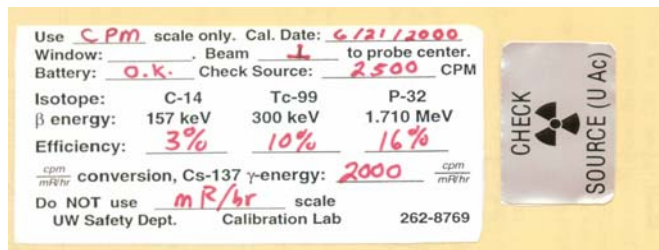
Even mechanical equipment requires calibration. For example, a pipette, is calibrated to pipette

100 μ l (0.1 ml) with an error of \pm 5%. Over time, the gaskets may wear and the error may change so that it is now \pm 15 - 20%. If your procedure

assumes a lower error, your data may be more widely dispersed and you may not be able to use it to predict a trend.

The purpose of calibration and check sources is to track the functioning of your instrument. If you have a calibration sample that came with your instrument, use it periodically and track the results.

The Safety Department calibrates portable survey instruments annually. *(Continued on Page 2)*





Calibration (cont.)

They place a check source on each calibrated instrument, and indicate on the calibration sticker the meter's response to the check source. Each day you use the meter, you should measure the check source and verify the meter's response is within an acceptable range (i.e., $\pm 20\%$).

Liquid scintillation counters also come with check sources. These are usually tritium (H-3) and C-14 standards. Because the chemicals in the cocktail degrade over time, these sources are technically only good for 10 years. People using these systems should run the check sources periodically, say monthly, and make sure the results do not change significantly. Often the high voltage can slowly change or the reflecting mirrors can become dirty, factors that can reduce sensitivity. Labs using these systems as a "go" / "no go" to determine whether they got a tag or not, may not notice the gradual change. If you have a maintenance contract with the vendor, the vendor may verify operation.

If you need to use a liquid scintillation counter or auto gamma, the Safety Department has counters at both our Annex (room 62, Biochemistry [11 AM - 2 PM]) or at the main office. Just come by and use them. If you are using an LSC, you will need to supply your own cocktail.

Environmental Compliance

If you are competing for a DOD grant, you may need to submit a "Certificate of Environmental Compliance" along with your application. This certificate is signed by Ronald R. Bresell, Associate Director, UW Safety Department. Ron will come by and sign it, you can FAX it to his attention (2-6767), or attach a completed certificate to an eMail, he will sign and FAX it back. Often these competitions have a dead line and it is not unusual for him to sign 10 or 15 in a week-long period.

Fume Hoods

A fume hood is a working enclosure designed to protect lab personnel from exposure to hazardous chemical air borne effluents as well as unexpected reactions. It should have an adjustable sash (vertical/horizontal), dished work surface for spill control, airfoils at sash entrance to prevent turbulence, interior baffles to distribute airflow, sash stop, flow monitor and Safety Department inspection label.

A hood should be exhausted through a building exhaust system and discharged at/or above the rooftop. Ductless or recirculating fume hoods are prohibited.

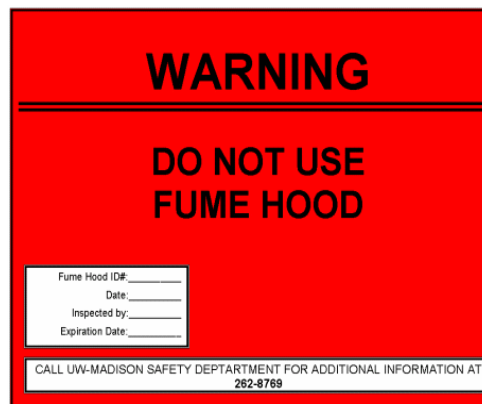
A fume hood must have an adequate face velocity (measured at the work opening) to ensure the proper removal of toxic materials. The current acceptable standard is 100 feet per minute (fpm) with a minimum vertical sash opening of at least 18 inches or defined combo sash opening (designed opening). The Safety Department annually checks the performance of each of the approximately 2200 chemical fume hoods on campus and marks with a sticker the sash position at which the 100 feet per minute face velocity is attained. The face velocity must be at least 100 feet per minute to get a "Passing" sticker (i.e., green). For work with carcinogens or highly toxic chemicals, or for radioactive iodinations, greater velocities may be required. Hoods which cannot meet the 100 fpm at the 18-inch opening (or designed opening), but can meet the 100 fpm rate at a sash height between 12 and 18 inches (or reduced designed opening) may be approved for temporary, restricted use "Failing" sticker (i.e. yellow) based on risk assessment. Hoods which do not pass are unsafe and should not be used and get a "Warning" placard (i.e. red). Unsafe fume hoods that are used will be locked down until repaired. Sometimes the fume hood exhaust fan/motor is turned off for maintenance or the belts driving the fan may break. When that happens, the fume hood no longer exhausts and does not protect you. Often the scheduled maintenance is announced to building occupants, but sometimes occupants are unaware that an exhaust system is to be shut down. If you suspect that your fume hood/exhaust system is not working, contact your Building Manager, CARS (3-3333) or Safety Department (2-8769). Although Safety checks and marks each fume hood, how can you be sure your fume hood is functioning properly? A simple way to monitor your hood's operation is to do a tissue test to be sure air is moving into the hood. Cut a tissue (e.g., Kimwipe, Kleenex, etc.) into a 1-inch wide strip about 6 - 8 inches long. Tape the tissue strip to the edge of the sash. Each time you use your hood, observe that the strip is being sucked into the hood.



Green



Yellow



Red

As long as the hood is drawing air as indicated by the tissue, your hood is under negative pressure. This is only a qualitative test for hood function (i.e., air moving or not moving into the hood). To properly evaluate a hood's performance, only a calibrated hotwire anemometer / velometer will give you an accurate quantitative measurement of face velocity. Remember that air flow rate/ face velocity/ containment *decreases* as you raise the sash, thus providing less protection for you. Some basic steps to insure an optimum airflow rate include:

- ✓ Keep the sash as low as possible.
- ✓ Maintain air flow pathways front to back.
- ✓ Keep work more than 6 inches (15 cm) behind sash opening.
- ✓ Keep heaters more than 12 inches (30 cm) behind sash opening.

Many factors can compromise the efficiency of hood operation. Most of these are avoidable; thus, it is important to be aware of all behavior that can, in some way, modify the hood and its capabilities. The following should always be considered when using a hood:

- ◆ Keep fume hood exhaust fans on at all times.
- ◆ If possible, position the fume hood sash so that work is performed by extending the arms under or around the sash, placing the head in front of the sash, and keeping the glass between the worker and the chemical source. The worker views the procedure through the glass, which will act as a primary barrier if a spill, splash, or explosion should occur.
- ◆ Avoid opening and closing the fume hood sash rapidly and avoid swift arm and body movements in front of or inside the hood. These actions may

increase turbulence and reduce the effectiveness of fume hood containment.

- ◆ Place chemical sources and apparatus at least 6 inches behind the face of the hood. In some laboratories, a colored strip is painted on, or tape applied to, the hood work surface 6 inches back from the face to serve as a reminder. Tests show that the concentration of contaminant in the breathing zone can be 300-times higher from a source located at the front of the hood face than from a source placed at least 6 inches back. This concentration declines further as the source is moved farther toward the back of the hood.
- ◆ Place equipment as far to the back of the hood as practical without blocking the bottom baffle.
- ◆ Separate and elevate each instrument by using blocks or racks so that air can flow easily around all apparatus.
- ◆ Do not use large pieces of equipment in a hood, because they tend to cause dead spaces in the airflow and reduce the efficiency of the hood.
- ◆ If a large piece of equipment emits fumes or heat outside a fume hood, then have a special-purpose hood designed and installed to ventilate that particular device. This method of ventilation is more efficient than placing the equipment in a fume hood, and it will consume less air.
- ◆ Do not modify fume hoods in any way that adversely affects the hood performance. This includes adding, removing, or changing any of the fume hood components, such as baffles, sashes, airfoils, liners, and exhaust connections. If you doubt the efficiency of your hood, call the Safety Department, and ask for Rhonda Lenerz, 262-1072. If your fume hood has a "Failing" sticker or "Warning" placard, please contact your Building Manager to initiate a work order to have necessary repairs made to the exhaust system.



Training Schedule

Chemical and radiation safety training is available weekly. There are two types of classes. Chem AM classes have the chemical safety class beginning at 9:30 AM and the radiation safety class beginning at 12:30 PM. Rad AM classes have radiation safety classes beginning at 8 AM and the chemical safety class beginning at 1 PM. The schedule of these classes from 1 February through 26 June, 2003 is in the table:

Chem AM	Start Time	June 4, 10, 17, 26; July 2, 8, 22; August 7, 13, 21;
Chemical Safety	9:30 AM	September 2, 10, 18, 24; October 2, 8, 14, 20;
Radiation Safety	12:30 PM	November 5, 13, 19; December 3, 11, 17
Rad AM	Start Time	June 13, 19; July 31; August 29; September 5; October
Radiation Safety	8 AM	28; November 25
Chemical Safety	1 PM	

All training classes are held in the Union South. No sign up is needed; a quiz is used to document training. Booklets for either class can be picked up at our Annex, room 62, Biochemistry. A complete listing of classes is found at <http://www.fpm.wisc.edu/safety>



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