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SPEAKING OF SAFETY

Making health, safety and the environment an integral and important part of education, work, and life

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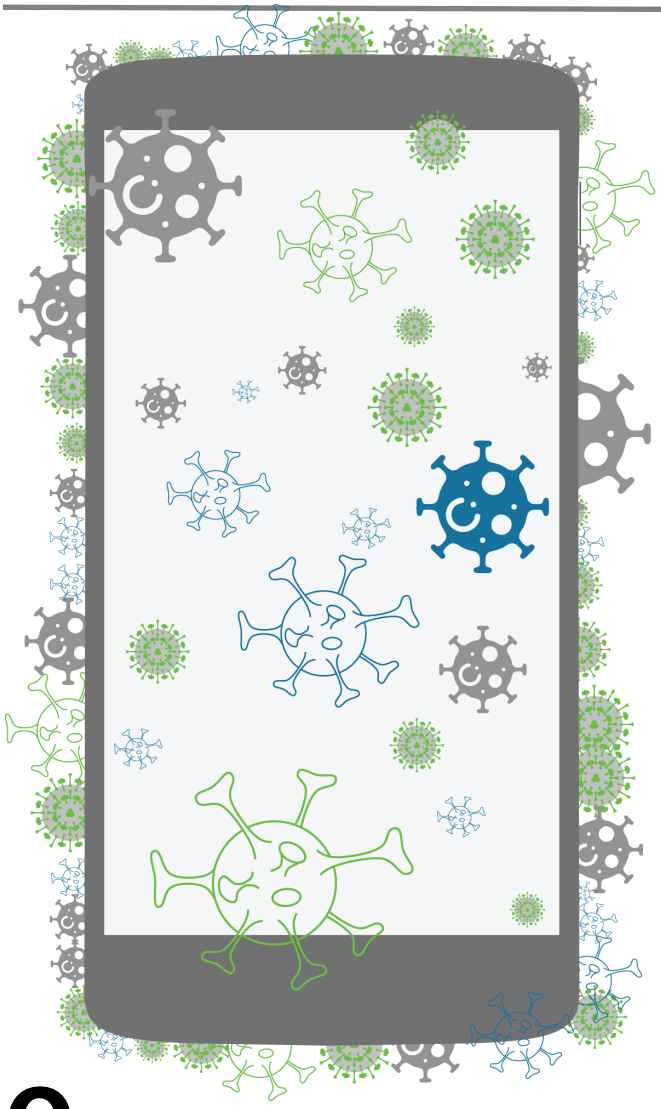

THE STICKY ISSUE OF CELL PHONES IN THE LAB

17,000 bacteria per square inch

Touched every **2-3** minutes

64% use their phone on the toilet

Does your lab have a cell phone policy?

Sources: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5466825/
https://www.reviews.org/mobile/cell-phone-addiction/

On average, Americans check their phones within 10 minutes of waking up, and continue checking them about 344 times per day, or once every 2.8 minutes during waking hours. That means most of us touch our cell phones more than any other object in our lives.

All that contact means our favorite digital companions are also the dirtiest. The average cell phone has 17,000 bacteria per square inch — many times more than the average toilet handle. But since 64% of us also admit to using our cell phone *on* the toilet, that shouldn't be so surprising.

Using mobile devices in the lab presents an obvious risk of cross-contamination. Harmful substances and

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IN THIS ISSUE

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microbes in the lab can hitch a ride home on a cell phone, and substances brought into the lab on cell phones can contaminate research samples. In addition, mobile devices in the lab can be a distraction, a potential ignition source and an information security risk.

A 2017 review of 245 laboratory workers worldwide showed 60% use their phones in the laboratory, and 92% had witnessed phone usage by others in the lab.

Despite the risks, asking people to part with their cell phones — even temporarily — can meet with stiff resistance. One environmental health and safety supervisor was surprised by how quickly the discussion escalated when she brought up the issue at a staff meeting. "We've already had someone complain to Human Resources, so this could quickly become a mess," she said.

A 2015 study found that some people are so attached to their phones that they actually experienced anxiety and decreased cognitive function when their phones were placed just a few feet out of arm's reach.

Of course, there are real-world reasons why we feel compelled to keep our devices close. Cell phones can be expensive and may carry sensitive personal and financial information. Parents and caretakers who work in a lab want to be available for their family members. Mobile apps have become an everyday tool in some labs, and cell phones are the only means of emergency communication in others. (See box, "Emergency Communications," page 8.)

For these and other reasons, an outright cell phone ban may be unrealistic for most labs. "Most institutions don't prevent people from bringing the

Continued page 8

CELL PHONE POLICIES: WHAT OTHERS ARE DOING

Many academic institutions, such as **Boston University,** base their policy on guidelines from the Clinical and Laboratory Standards Institute (CLSI), which takes an unambiguous stance against phones in labs: "The use of personal electronic devices should not be allowed . . . any time chemicals, hazardous materials, or biohazardous materials are used in the laboratory."

University of Birmingham (UK):: "Mobile devices may be prohibited or restricted in labs handling chemicals (which is likely to be all laboratories), and this should be assessed on a case by case basis."

University of Connecticut: "No cell phones or other electronic devices may be used at any time in the laboratory."

Rather than prohibiting cell phones, the **Cornell University** lab safety manual states: "All labs are strongly recommended to have a means of communication in the event of an emergency. This can include a phone or cell phone." Cornell has also produced an informal safety video about safely using cell phones in labs.

Florida State University policy states: "EH&S discourages the use of cell phones and other electronic devices in the laboratory. Before using a cell phone, lab workers should remove PPE."

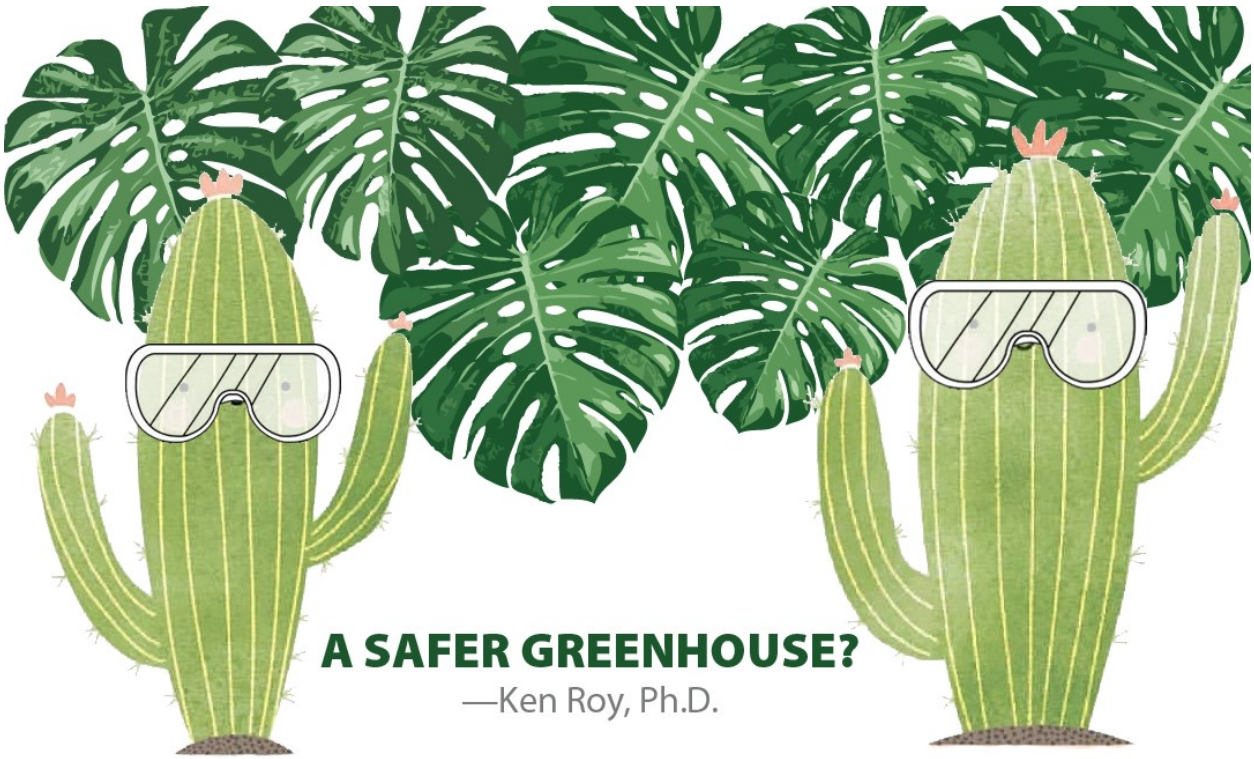
Montana State University recommends "a self-enforced, common sense policy . . . We advise that personal devices only be used in the lab as needed for research-related communication."

University of Nottingham (UK): "Personal mobile phones and music players must not be brought into or used in laboratory areas where . . . There is a high risk of them becoming contaminated with any of the hazardous substances being handled in the laboratory." However, the policy also acknowledges that "there may be situations, such as lone working, where it is important to ensure the availability of a mobile phone as a control measure."

Oklahoma State University: "No cell phone or ear phone usage in the active portion of the laboratories, or during experimental operations."

University of Washington: "Cell phones and pagers are not allowed to be used while working in the undergraduate laboratories, to prevent any distractions from leading to mistakes or accidents."

After copying the CLSI guidelines (above), the **University of Wisconsin, Milwaukee** policy acknowledges: "Due to the integration of cellphones in to everyday life, this policy may be difficult to enforce at all times in the laboratory."



A SAFER GREENHOUSE?

—Ken Roy, Ph.D.

Greenhouses have been around for several thousand years, allowing for the survival of domesticated plants during inclement weather by growing them indoors. History-wise, the first recorded primitive greenhouses are credited to the early Roman Emperor Tiberius who had a fascination for Armenian cucumbers. He charged his gardener to find a means of providing the Roman Emperor with his favorite Armenian cucumbers daily year round. The gardener developed artificial methods to address the command of his Emperor. The Armenian cucumbers were grown in wheeled carts so they could receive the most sun throughout the day. With cold night temperatures, the carts were moved indoors and in some instances in houses glazed with oiled cloth. This allowed for sunlight and trapped the sun's rays for warmth, and the first greenhouses were born.

The early Roman concept of creating a special environment conducive to plant growth year round has been captured by today's greenhouse structures. With the advances in greenhouse design, thanks to the evolution and revolution at times in technology and science, elementary and secondary schools have been able to make use of these affordable structures for formal academic research and study.

Many schools foster the study of plants in biology and environmental science classes by using greenhouses. Also STEM and agri-science courses often include the study of plants using greenhouses. As with all science activities, use of the greenhouse needs to be done with safety in mind. What are some issues which should be addressed for safety consideration? Here is a beginning list of items that teachers should embrace for a safer greenhouse operation:

1. **Engineering Controls** – Make sure ventilation, heating systems, fans and other engineering controls are operating at peak efficiency. This includes the adoption of a preventive maintenance schedule. Teachers should work with their school's maintenance department to schedule preventive maintenance activities to address potential safety hazard issues dealing with filters, electrical systems, heat sources, water sources, leaks and more.

2. **Alarm/Sensor Systems** – Greenhouses should be monitored for environmental elements such as humidity, temperature, etc. Sensor systems are available and will help to maintain a safer and healthier working environment for all: teachers, students and plants.

3. **Standard Operating Procedures (SOPs)** – Have a list of standard operating procedures for both students and teachers/custodians relative to working in and cleaning the greenhouse.

4. **Personal Protective Equipment** – Always have appropriate personal protective equipment or PPE such as safety glasses with side shields, indirectly vented chemical splash goggles, vinyl or nitrile gloves, non-latex aprons and footwear available with a means of sanitizing. Use of fertilizers, pesticides, and other hazardous chemical products in a greenhouse often require use of such PPE.

5. **Housekeeping** – Included in SOPs should be housekeeping rules. Everything from cleaning off tools after use to keeping walkways clear from trip or slip hazards must be addressed.

6. **Safety Acknowledgement Form** – Students and parents should sign a safety acknowledgement form noting the greenhouse can be an unsafe place and has SOPs and behaviors which must be followed for a safer operation and learning/working environment.

7. **Inspections** – Greenhouses should be inspected on a regular basis – each day of the week to ensure appropriate plant specimens are being grown, housekeeping is being done, security is in place and engineering controls are fully operational.

8. **Electrical Security** – All electrical receptacles in the greenhouse should be GFI- or GFCI-protected to prevent electric shock or electrocution.

9. **Produce** – Before using any fruits or vegetables for academic investigations, greenhouse products should be thoroughly washed. Additionally, eating of any greenhouse products should be prohibited since health controls cannot be guaranteed.

10. **Food/Drink** – Like all science laboratories, use of food and drink should be prohibited in the greenhouse to prevent the potential for cross-contamination.

11. **Fertilizer/Pesticide Use** – Make sure school policies are reviewed relative to applications of fertilizers and pesticides before considering use on greenhouse plants. Pesticides can be especially toxic and hazardous. Natural alternatives should be explored and used whenever possible. Also provide appropriate application techniques and secured storage for these chemicals.

12. **Trash** – Many schools sort their trash. In this way plant material and other compostables should be placed in special containers for appropriate trash removal and potential composting activities.

13. **Insect Magnets** – Never leave food, wrappers, etc. around the greenhouse in that they will attract insect pests.

14. **Sharps** – Never leave sharps like razor blades, knives, and pruners laying around. Place them in appropriate and secured storage areas, which should be dry to prevent rusting.

15. **Labeling** – Always label all equipment with the teacher's name, especially if the greenhouse is shared by several classes of students.

16. **Slippery Surfaces** – Avoid wearing flip flops, sandals and leather soles to prevent slip/fall hazards.

17. **Trip, slip or fall hazards** – Make sure the floor of the greenhouse is clear of obstacles, including extension cord wires, trash, etc.

18. **Hand Washing** – Always wash hands with soap and water after working in the greenhouse.

BOTTOM LINE!

The bottom line is, greenhouses can be great educational vehicles for hands-on plant study activities in science, agri-science, STEM and other relevant curriculum areas. Always plan ahead safety-wise to secure and maintain a safer teaching/working environment for students and teachers.

References:

Botany Suite 101, "History of the Greenhouse;" http://sharonfalsetto.suite101.com/history-of-the-greenhouse-a81808

The Ohio State University, "The Biological Sciences Greenhouse Facility;" https://bioscigreenhouse.osu.edu/

New "Greenhouse Manual" Released for Educators Across the Nation" https://www.usbg.gov/blog/new-greenhouse-manual-released-educators-across-nation

Ken Roy, Ph.D. is a past board chair of the Laboratory Safety Institute and a regular contributor with this column, "Safer Science: Be Protected!" He is also Director of Environmental Health & Safety for Glastonbury (CT) Public Schools, Chief Science Safety Compliance Adviser for NSTA and Safety Compliance Officer for NSELA. He can be reached on Twitter at drroysafersci.

SELF-EXPLAINING ROADS: AN INTIGUING MODEL FOR LAB SAFETY

In 1995, cognitive scientists Jan Theeuwes and Hans Godthelp published a paper titled "Self-Explaining Roads" which revolutionized urban engineering and became one of the leading principles in road design worldwide.

The idea is to use road markings, lane widths and roadside objects to cause drivers to drive in desired ways, rather than relying solely on signage. Many of us drive on self-explaining roads every day and instinctively obey their subtle cues without even realizing it. For example, the researchers found that a narrow lane with park benches close to the curb can effectively encourage lower speeds.

"What can chemical laboratories learn from self-driving roads? Could laboratories be designed in similar ways?" asked Ron McLeod in the article "Approaches to Understanding Human Behavior When Investigating Incidents in Academic Chemical Laboratories," which appeared in the April 2022 issue of *Chemical Health and Safety*, a journal of the American Chemical Society.

The article noted that there is a heavy reliance in industry on signs and labels for effectively conveying risks, but signs are only effective when people actually read them. Thus, the article suggests using engineering controls that make following the written directions more intuitive. For example, a surface placed at knee height affords it being used as a step, even if it has a sign on it that says "DO NOT USE AS A STEP." A better solution is to place the surface at a different height.

The physical characteristics of an environment can affect real-life behavior, sometimes with tragic results. For example, in the case of the fatal lab fire at UCLA in 2008, Sheri Sangji, was working in a crowded fume hood, without room to use the 1–2 foot needles recommended by the chemical's manufacturer.

Rather than quickly pointing fingers and assigning fault, McLeod's thought-provoking paper encourages accident investigators and safety professionals to take a broad-based approach, recognizing that human behavior is complex and affected by "psychological, interpersonal, physical, medical, social, organizational, cultural, economic, environmental, and anthropological motivations."

2022 ENDS WITH 5 NEW LABORATORY DEATHS

Sadly, the final month of 2022 saw two fatal lab incidents in India and Iran.

December 19, 2022: Four persons died and another received serious burns when a toluene spill caught fire at Laurus Laboratory in JN Pharma City, India. "Some leaders said the management of various pharma firms . . . have been ignoring the safety norms whereas the officials of the various departments have been accepting kickbacks to remain silent," reports the Deccan Chronicle.

December 10, 2022: "One person died and one was injured in a fire that broke out in the chemical laboratory of the Isfahan Industrial University in Isfahan province of Iran," according to MENAFN.

Earlier in the year, a lab technician died as a result of a cylinder explosion at the Government Shahbaz Sharif Hospital in Multan, Pakistan.

The Laboratory Safety Institute tracks lab fatalities worldwide on its Memorial Wall page.

MAKE YOUR OWN LAB SAFETY COURSE

With the bewildering array of regulations and the sheer number of things that could go tragically wrong, lab safety is a heavy responsibility — a responsibility inherited suddenly with little training at times.

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- ❑ Handling Glassware
- ❑ Labeling
- ❑ Legal Aspects
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- ❑ Recordkeeping
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- ❑ Scope of the Problem
- ❑ Student or Employee Involvement
- ❑ Ventilation

More: Labsafety.org/build-your-own

EMERGENCY COMMUNICATIONS:
GETTING THROUGH WHEN EVERYTHING GOES DOWN

The good news is, communications systems improve with each major disaster. The bad news? So far, no single technology has emerged as 100% Armageddon-proof. For every story of someone who was able to get through on a landline when cell service was out, there is another story when the opposite was true. Much depends on what kind of disaster it is and which structures are damaged.

Sadly, when it's time to talk budgets, landlines are frequently on the cutting block because "everyone has a cell phone nowadays." But before scrapping the wire, consider the cons: (1) Mobile phones become useless in a power outage, while low-voltage landline systems stay online. (This point is losing ground, however, as more cell towers are being built with backup generators.) (2) Networks can become quickly overloaded when everyone is trying to call at the same time. (3) Even in normal conditions, every wireless network has dead spots. Can you hear me now? (4) Cell phone batteries run out, most in about a day. (5) The cell phone may not be immediately reachable when needed. What if it was left in the car?

Then again, landlines aren't guaranteed not to fail either. If the line or the switching equipment is damaged, mobile phones may again be the best option. If you use a cell phone in a disaster, the Federal Emergency Management Agency (FEMA) recommends texting rather than calling to avoid tying up voice networks, and because data-based services like texts and emails are less likely to experience network congestion.

The Occupational Safety and Health Administration (OSHA) leaves it up to each employer to determine the preferred means of emergency communication, whether that's a landline, a cell phone, or even a manual pull box alarm (29 CFR 1910.165(b)(4)).

Keep in mind that although OSHA does not specify either landline or cell, the fire department or another agency may. The Environmental Protection Agency (EPA) mandates that all hazardous waste generators (large or small) have "immediate access to an internal alarm or emergency communication device" (40 CFR 262.16(b)(8)(iv) and 262.254). When one commenter asked if a cell phone counts as such an emergency communication device, the EPA responded in 2016: "Although cell phones are a useful means of communication, they should not be relied upon solely to satisfy this requirement." Score another one for the trusty landline.

Depending on the situation, phones, two-way radios, satellite devices, or even an old-fashioned whistle could be useful in a disaster. More important than the specific technology is having a well-trained, knowledgeable staff that can quickly assess the situation and make intelligent judgment calls. To borrow from Kenny Rogers, you gotta know when to hold 'em, know when to phone 'em, know when to pull the alarm, know when to run. Emergency planning is one of the topics covered in all one-, two- and three-day courses at labsafety.org.

cell phone into the lab unless it's a BSL-3 or BSL-4," said Ian Olesen, who teaches biosafety for the Laboratory Safety Institute.

What most labs *can* do, he said, is regulate the use of cell phones. For example, many labs have a policy prohibiting the manipulation of mobile devices with gloved hands or placing phones on any lab surface.

"I allow cell phones in lab except during quizzes and exams but we provide ordinary zip-lock sandwich bags to put the phones in so that they are protected and don't carry contamination out of the lab. Sort of like gloves for the cell phones," said Sandra Koster, a senior lecturer at the University of Wisconsin, on the DCHAS-L online discussion group.

Cell phones in labs can be a sticky subject, but ignoring the issue doesn't make it go away, either. A well-communicated policy protects people, laboratory research, and (last but not least) our cell phones themselves.

LABORATORY SAFETY GUIDELINE #9:
Make Safety an Integral and Important Part of Education, Work and Life

Too often, safety is mentioned as an extra — an addendum or a footnote, something that we do only if we have time after the "important" work is done.

Safety needs to be more than a priority. It needs to be foundational, fused to the core of every work process and every thought process.

On my first day at Dow, we were told that we were being paid to do three things: 1) work safely, 2) conduct active research programs, and 3) publish the reports and patent disclosures resulting from our research. Safety was job #1, and it was not separate from the work. It *was* the work.

Applying the principle to schools, teachers (particularly teachers of art, science, and technology) need to have sufficient time (as part of their regular working day) to set up and test experiments, to look up the hazards of chemicals, and to find out what protective equipment and facilities are needed. This is their job. Other collateral activities may be completed as time allows.

Organizations that put safety first in this way usually discover that their business goals naturally fall into place as a result.

Alcoa is a perfect example of this. When Paul O'Neill took over as the new CEO of Alcoa in 1987, it was in a state of financial decline. At a meeting with shareholders, O'Neil announced his goal to make Alcoa the safest company in America. Someone in the audience asked about ROI. "I'm not certain you heard me," O'Neill replied. "If you want to understand how Alcoa is doing, you need to look at our workplace safety figures. . . . We're going to focus on safety over profits." Convinced that O'Neill was going to kill the company, some investors panicked and sold their shares.

By the time O'Neill retired in 2000, Alcoa not only had a low injury rate, its annual net income was five times larger than before he arrived, and its market capitalization had risen by $27 billion. When asked how he knew his safety-focused policy would work, he explained the underpinnings of his philosophy. Every employee, he said, has "discretionary energy," meaning that they can decide how hard to work. The maximum percentage of this energy is delivered to Alcoa only "when employees are treated with dignity and respect every day," he said. "A down payment on that is nobody ever gets hurt here, because we care about our own commitment to our safety, and we care about the people we work with."

When a company puts the health and safety of people above profits, employees feel valued and cared for, which pays off in terms of worker satisfaction, productivity and retention. In other words, when safety stays at the top, so does the company.

—Jim Kaufman, Ph.D.

Jim Kaufman originally wrote Laboratory Safety Guidelines while he worked for the Dow Chemical company to share with schools, colleges and universities industry-tested lab safety principles.

Since then, Dow (1986), Fisher Science Education (1989), Carolina Biological Supply (1994), Fisher Safety (2012), Workrite (2017) and SCAT-Europe (2019) have produced co-branded editions of the guidelines in various poster formats. These guidelines have been translated into 22 languages, plus English Braille!

In each issue of *Speaking of Safety*, we publish an article expounding on one of the guidelines. The entire collection of revised and expanded guidelines is available in a 50-page booklet on labsafety.org.

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Loose Threads

Cleaning Out Old Chemicals? Use Dots.

Our immediate need is to clean out the chemical storage of old, obsolete, and simply dangerous chemicals, and then hopefully have a chemical hygiene plan in place so that we do not have to go through this again. Do you have any recommendations?

I have a simple and non-invasive method:

1. Purchase some Avery colored adhesive dots.
2. Put them in the labs and storerooms.
3. Over the next year, have everyone put a dot (and user initials) on the cap of every chemical that is used.
4. At the end of the year, make a list of everything that has no dot.
5. Circulate the list.
6. If anyone wants to keep something, they have to put their initials on the container to signify their responsibility to know how to store, use, clean up and dispose of it.
7. Send the adjusted list to vendors for bids.

— Jim Kaufman, Ph.D.

These questions, answers, and comments are taken from the Laboratory Safety Institute's mail, email, phone calls, and internet discussion list.

For reference, here is the Laboratory Safety Institute's short list of waste management vendors:

Capitol Environmental Services
Newark, DE (800) 560-2374 | capitolenv.com

Clean Harbors
Norwell, MA (800) 282-0058 | cleanharbors.com

SET Environmental
Wheeling, IL (800) 634-6856 | setenv.com

Stericycle
Lake Forest, IL (877) 927-8311 | stericycle.com

Triumvirate Environmental
Somerville, MA (800) 966-9282 | triumvirate.com

Veolia Environmental Services
Chicago, IL (312) 552-2800 | veolianorthamerica.com

Waste Control Specialists
Dallas, TX (972) 715-9800 | wcstexas.com

Waste Management
Houston, TX (800) 963-4776 | wmsolutions.com

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April 26, Nov. 19	**Safety in the Elementary School Classroom**

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