ENVIRONMENTAL HEALTH AND SAFETY

Lab Chatter

EHS Newsletter • April/May 2021

IN THIS ISSUE

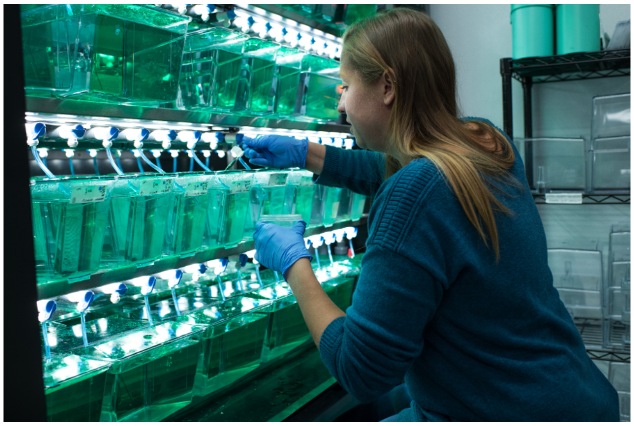
CONTACT EHS

Ronnie Souza
EHS Director
Biological Safety Officer
Radiation Safety Officer
Phone: x2488
Email: rsouza@une.edu

Peter Nagle
EHS Specialist
Phone: x2791
Email: pnagle@une.edu

Jesse Millen-Johnson
EHS Specialist
Phone: x2046
Email: jmillenjohnson@une.edu

UNIVERSITY OF NEW ENGLAND
INNOVATION FOR A HEALTHIER PLANET



SAFETY SPOTLIGHT

When Pharmaceuticals are Hazardous Waste

By Peter Nagle

Laboratory chemicals and pharmaceuticals are often thought of separately when it comes to disposal. This is not always the case as some pharmaceuticals can be regulated as hazardous waste. Remember, an unwanted product is a hazardous waste if it exhibits at least one of the following characteristics: ignitability, corrosivity, reactivity and toxicity. Furthermore, if a material is specifically listed (P or U listed) as a hazardous waste, it must be managed and disposed of as a hazardous waste. Below are examples of pharmaceuticals that are also hazardous waste and management practices that must be followed when they are generated.

P-Listed Hazardous Waste Materials

- P-listed wastes are considered acutely hazardous
- Any unused portions of these or wastes generated by spill clean-up or contamination by the original product are considered hazardous waste
- Unused dilutions or formulations of the original product are considered hazardous waste
- Empty containers associated with these items must either be collected as hazardous waste or triple rinsed before being considered empty
- P-listed rinsates must be collected as hazardous wastes
- Examples of P-listed pharmaceutical waste include:
  - Arsenic trioxide (P012)
  - Epinephrine (P042)
  - Phentermine (P046)
  - Nicotine and salts (P075)
  - Nitroglycerin (P081)
  - Physostigmine salicylate (P188)
  - Physostygmine (P024)
  - Warfarin>0.3% concentration (P001)

Continued on page 2

Characteristic Hazardous Waste Pharmaceuticals

- Pharmaceutical chemicals or formulations may contain components which are regulated as characteristic waste (ignitable, corrosive, reactive, or toxic)
- The presence of these compounds is infrequently identified in labeling, as the regulated constituent may be a minor percentage of the overall product
- An alcohol solution is considered aqueous and thus not ignitable if it contains less than 24 percent alcohol by volume and more than 50 percent water by weight. Otherwise, it is regulated as ignitable and therefore hazardous waste
- Knowledge of the entire product makeup is critical to waste determination
- Examples of characteristic waste pharmaceuticals include:
    - Thimerosol, Merthiolate (toxic: mercury)
    - Barium sulfate (toxic: barium)
    - Benzoin Tincture (ignitable: alcohol)
    - Mercurochrome (toxic: mercury)
    - Silvadene (toxic: silver)
    - Insulin (toxic: m-cresol)
    - Styptic pens (toxic: silver, ignitable: silver nitrate)
    - Selenium sulfide (toxic: selenium)
    - Tresaderm (corrosive: phosphinic acid)

Chloral hydrate: A unique case, as it is regulated as both a controlled substance (Schedule IV) and a listed hazardous waste (U034). If you need to dispose of chloral hydrate, please contact EHS before attempting disposal. A disposal method for controlled substances may not be compliant with hazardous waste regulations and vice versa.

Though these are not all-inclusive lists, you can see there are many pharmaceuticals and other compounds used in health care and research settings that are regulated as hazardous waste. Sometimes it is not obvious from the labeling if a pharmaceutical could be a hazardous waste. Referring to the Safety Data Sheet (SDS) can be helpful, especially Section 9, "Physical and Chemical Properties", where the flash point or pH of the material can be found.

Click here for a more extensive list of pharmaceuticals and chemicals commonly found in health care settings that are regulated as hazardous waste. Of course, if you ever need help identifying a product for waste disposal, you can always call EHS for assistance.

GREENING YOUR LABORATORY

By Alethea Cariddi, UNE Asst. Director of Sustainability

April is Earth Month. We are reminded each year with the return of light and warmer temperatures that our environment is precious. Something to revel in. Scientific research and medicine are fields that create significant waste, and for good reason: we want untainted experiments and safety is of the utmost importance. Yet unsustainable practices shouldn't be a foregone conclusion. The principles of sustainability can be implemented in laboratories with mindfulness, planning, and intention.

Communication and collaboration are key to reducing waste in any sector, and laboratories are no exception. Central purchasing processes can mean a more efficient experience. Knowing what supplies your colleagues need and when they need them can mean a consolidation of orders, which can also result in financial savings from bulk purchasing and/or shipping.

Right size purchasing also helps reduce waste and cost. Buy only the amount you will use because the rest will sit unused until expiration, then require disposal at additional cost. This is true for chemicals, PPE, and one-time use supplies, like pipette tips, etc.

Continued on page 3

UNE
UNIVERSITY OF NEW ENGLAND
INNOVATION FOR A HEALTHIER PLANET

Prof. Karen Wetterhahn

Two Drops

By Jesse Millen-Johnson

On August 14th, 1996, renowned Dartmouth College chemistry professor Karen Wetterhahn spilled 1-2 drops of dimethylmercury (C2H6Hg) on the back of her fully gloved left hand. Wetterhahn was Director of the college's Toxic Metals Superfund Research Program and a seasoned, safety-conscious professional. Wetterhahn was transferring the dimethylmercury to a container via pipette in a fume hood. After the spill, she removed her gloves, washed her hands, and donned fresh gloves. She continued her research and soon forgot the incident.

Three months later, Wetterhahn noticed stomach discomfort and weight loss. Then in January, 1997 she felt numbness and tingling in both legs and had difficulty hearing, seeing, walking, and speaking. Standard imaging scans and other medical tests were negative. Finally, high levels of methylmercury (4,000 μg/L) were detected in her blood, compared to the normal range of 1-8 μg/L. Tests on her hair indicated a one-time methylmercury exposure, occurring roughly six months prior. Wetterhahn suddenly remembered the tiny spill in August. Doctors immediately began chelation therapy.

The treatment was aggressive but ultimately could not save her. Wetterhahn fell into a coma in February. Her brain and nervous system were severely damaged. After four months with only brief periods of semi-consciousness, she was removed from life support and died in June. She was 48 and left behind a husband and two children. An autopsy revealed high mercury levels in the frontal lobe of her brain.

Dimethylmercury is a colorless, mildly sweet-smelling organometallic chemical. It was most often employed in nuclear magnetic resonance spectroscopy, but is seldom used today due to the extreme hazard. It is reactive, flammable, and has a high vapor pressure, enabling it to pass through skin. In 1996, latex gloves were thought to offer adequate protection. However, OSHA stated in 1998 that independent post-accident testing showed dimethylmercury "permeates latex, PVC, and neoprene almost instantaneously." With only 2 drops entering Wetterhahn's skin, she still received a lethal methylmercury dose in 15 seconds.

Continued on page 4

If chemical purity is a concern, plan ahead. Again, only buy the amount you will use for the procedure or project. If a chemical can be shared, make sure to abide by secondary labeling requirements if you want to divide the amount for multiple researchers.

Reducing energy consumption in the lab is an important sustainability practice. Ensuring hood sashes are closed ultimately reduces electricity and fossil fuel use by making building heating and cooling more efficient. Checking hood sashes can be part of a daily routine before leaving the laboratory, as well as turning out the lights and shutting the door. All equipment should be assessed for ease of power termination. While some lab equipment needs recalibration if turned off/unplugged, other devices do not. They can be included in a routine shut-down checklist.

UNE's School of Mathematics and Physical Sciences has signed the Beyond Benign pledge to adopt sustainable chemistry principles. The American Chemical Society (ACS) also promotes its 12 Principles of Green Chemistry for labs to utilize. **Click here** for more information on Beyond Benign and **here** for the 12 Principles of Green Chemistry site.

A commitment to sustainable laboratory practices requires planning, collaboration, and a willingness to "think outside the box." It's that time of year, bursting with spring renewal. Perhaps a laboratory Earth Month resolution is in order?

UNE
UNIVERSITY OF NEW ENGLAND
INNOVATION FOR A HEALTHIER PLANET

A 1998 Special Hazard Information Bulletin released by OSHA stated only special laminate gloves with abrasion-resistant gloves worn over them had proven effective in protecting skin from dimethylmercury. Face shields of at least 8 inches were also deemed necessary, as well as medical monitoring of all individuals using dimethylmercury. In the years since the accident, dimethylmercury has largely been replaced with much safer Grignard reagents and diethylmercury and ethylmercury compounds.

Can lessons be learned from this tragedy? After all, Wetterhahn was following standard safety procedures, including latex gloves, goggles, and a fume hood. There are several takeaways, however, which can be viewed in the frame of OSHA exposure controls per the OSHA Hazard Communication Standard:

Work Practice Controls: Avoid using especially dangerous chemicals altogether, if possible. Evaluate ways to achieve satisfactory results with substitutes. For example, in the 1990s less toxic inorganic mercury salts were used effectively in NMR spectroscopy instead of dimethylmercury. In fact, Wetterhahn had these less toxic mercury salts in her lab and used them regularly, but an unexpected result led her to double-check her work that fateful day with dimethylmercury, which was the gold standard for NMR spectroscopy at the time. If she'd repeated the process with mercury salts, the accident would not have occurred. Even today, it's important to know your Chemical Hygiene Officer and EHS team, and not be afraid to ask questions or express concerns. Even experienced researchers may not know every hazard. It's also necessary to label all hazardous substances in the lab with full names (no abbreviations) and specific hazards, so mix-ups with similar looking products don't cause exposures and other individuals like first responders can quickly identify chemicals if a spill or fire occurs.

Engineering Controls: Are there built-in devices that can make processes safer? These include fume hoods, which Wetterhahn was already using at the time. This at least kept her from inhaling significant amounts of dimethylmercury vapor in addition to the skin exposure. If an engineering control is present, it can improve safety by removing the need to use PPE devices such as respirators, which can be prone to failure and user error. If in doubt about inhalation hazards, it's better to use fume hoods as opposed to assuming chemicals are safe or that your exposure will only be brief/minimal.

Personal Protective Equipment (PPE): Err on the side of caution. Don't avoid proper PPE or use less than necessary to save time. Consider using extra PPE, such as double gloves, when appropriate. Don't assume basic latex or nitrile gloves protect against all chemicals. And remember that Safety Data Sheets may not list all hazards/necessary PPE.

THE UNE CHEMICAL SHARING PROGRAM

The UNE Chemical Sharing Program is a great way to reduce hazardous waste, lower costs for your department, and have a positive environmental impact on campus. If you have any commonly used chemicals or lab equipment that you are thinking of disposing, please contact EHS so it can be made available for the program and listed in the upcoming issues of *Lab Chatter*.

UNE
UNIVERSITY OF NEW ENGLAND
INNOVATION FOR A HEALTHIER PLANET