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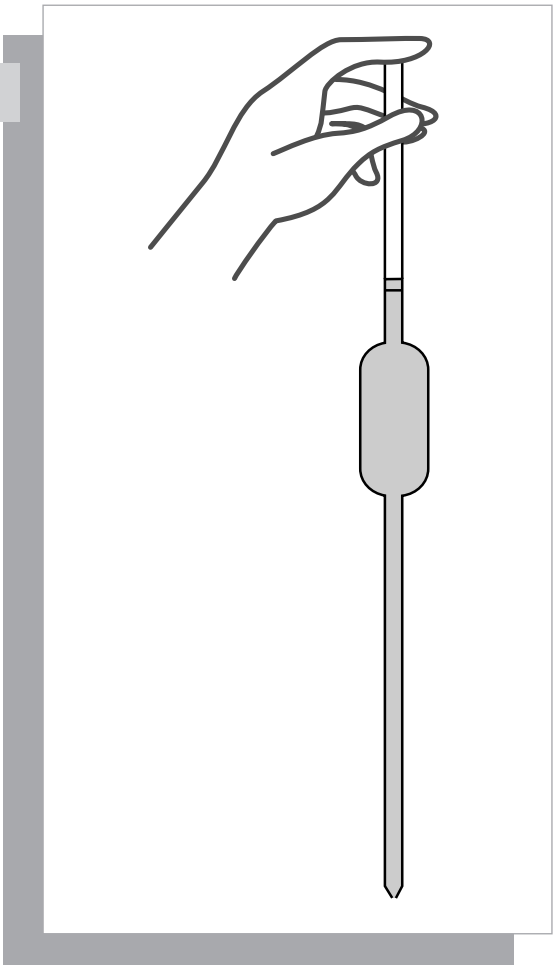
SAFETY AND ENVIRONMENTAL PROTECTION OFFICE

Safetywise

Ergonomics Issues Related to Pipetting

(The following Q & A was extracted from Safety@UVMVM.Bitnet)



Q: I have evaluated the work situations of numerous people working in laboratories who do a lot of pipetting (2-7+ hours per day). Most of them have similar symptoms (numbness in fingers; pain radiating from palm to elbow, frequently to shoulder and neck; decreased grip strength; etc.). We have tried using electronic pipettors for those working with µl volumes (and have had some decrease in symptoms from the use of the Matrix Impact multichannel pipettor), but have not found a good solution for those working with ml volumes. Our people are using an electronic pipette aid for ml volumes, but because of the length of the pipette (often more than 12"), they are forced into awkward postures when doing the work. This is further complicated by the fact that a lot of the work is done in a biological safety cabinet with sash heights at about 12". Comments? Solutions?

A: I don't think that anybody knows the definitive answers to this problem, yet. We have one case of double "carpal tunnel syndrome" in a worker who used a mechanical pipette for about six hours a day over a period of about two years. Surgery did not correct the problem and the worker had to take retraining and move to another job where there was no extensive hand or finger movement. We have had other workers who have developed early symptoms. These have been relieved by using electronic pipettes and instituting many of the pro-active procedures that are used for Keyboarders on PC's.

That is: Keep finger use below 4 hours per day. Take frequent breaks — at least 5 min every half hour. Design the work station and train the worker so that pipetting can be and is done with the wrists in a neutral position. It is important to reduce the tendinitis that occurs early on. (It is often necessary to redesign tasks to make them less like an assembly line!) Workers should be aware that the symptoms are delayed at first, and pain, pins, & needles etc. occur in the middle of the night, not at work!

Safety Equipment in the OLS Store

The following information concerns users of personal protective equipment:

An electronic notice board, SAFETYSUPP, has been established to provide an alphabetical listing of personal protective equipment in stock at HKUST. The listing includes an item number, brief description, model, quantity on hand, price and whether or not SEPO endorsement is required. Issuance of a respirator is an example of an instance where SEPO endorsement would be required, and the reason being that the user needs to pass a pulmonary function test, and receive respirator training and fit-testing prior to being issued a respirator. Furthermore, a few selected items are available on a short-term on-loan basis.

Items included in stock have been selected based on past user requests and observed needs. If any staff member would like to have a particular item maintained in stock, please send such request by e-mail to LSMARIAL, indicating item, potential source and/or catalog number, stock level and estimated use rate. Such items will be reviewed with SEPO and, if approved, procured at the best available price and added to the stock listing.

All requests to obtain items from the list can be made ordering equipment from the OLS Warehouse at extension 6875 or 6876, but remember that some items need prior endorsement by SEPO. To obtain such endorsement please contact Mr Jim Boyer at 7229 for laboratory related use, and Mr C M Li at 6485 for all other areas.

We hope that this new service will prove to be useful. Recommendations for improvement are always welcome.

REMINDERS: Hazardous Waste Issues at HKUST

Sewage Effluent and the HKUST License

HKUST is an Environmental Protection Department (EPD) license holder for wastewater effluent which goes to the Junk Bay Sewage Treatment Plant. This license has certain conditions which must be met in order to avoid prosecution and fines from the EPD. SEPO conducts monthly sampling of the wastewater from UST and from our neighbors, TVB, Shaw Brothers, and Clearwater Bay School, who contribute effluent to the UST wastewater system. The results of the sample analysis are sent to the EPD for their review. In most cases UST maintains consistent compliance with the 27 parameters specified in the license.

There have been a few occasions where SEPO monitoring has shown that an effluent parameter has exceeded the license terms for more than one month, and where the effluent has been traced to the source. Such a case occurred in the spring of 1995 with phenol. By following the wastewater plumbing, from the last manhole in the sewage system (before the stream leaves the campus), to the service tunnel under the phase 2 laboratory blocks, and then to the effluent pipes from individual laboratories, we traced the probable source(s) of the high levels of phenol. When consumption levels of the reagent were obtained from records, and these were compared with hazardous waste records

HOW TO CONTACT SEPO

		Ext	E-mail
SEPO General Enquiry		6513	SAFETY
Occupational Hygienist	Mr. Al Clancy	6509	EOCLANCY
Environmental Engineer	Dr. Pete Swearengen	6510	EOPETE
Safety Engineer	Mr. T S Li	6511	EOTSLI
Health Physicist	Dr. Paul Chan	6535	EOMWCHAN

Feel free to call any of us or send us an E-mail if you have specific safety or environmental related questions.

maintained by SEPO, it was possible to construct a mass balance that showed which laboratories were consuming phenol, but not removing any as chemical waste. SEPO met with the department head and asked the Safety Officer of the department to inform the faculty and staff of the problem, and ask for their help, and since that time, the levels of phenol have been in compliance with the license terms.

In order to avoid problems with the terms of the sewage license, SEPO wants to remind the readers to continue to dispose of laboratory waste in the 11 chemical waste streams collected by Enviropace, and to maintain accurate logsheets of the contents of the waste containers. Enviropace collects the waste based on the certified contents of each container, and subsequently treats the waste according to the waste streams in their treatment plant. More complete details on disposal can be found in the memorandum: "Procedures for Disposal of Liquid Chemical Waste at HKUST" which was distributed to all departmental Safety Officers on 20 July, 1995.

When certain toxic or highly reactive chemicals have passed their expiration date and need disposal, the Labpack system is now available from Enviropace. Specifically, the Labpack scheme will collect materials that: 1) are highly reactive, 2) are water reactive, 3) cannot pass the compatibility test, 4) are unwanted, and 5) have passed their shelf life as stamped on the original label. The Safety Officer of each department has been given forms for communication with SEPO about such Labpack waste, and can provide them to the waste generator. In addition, the user of Labpack should complete the "Labpack Waste Identity Sheet" from Enviropace and attach the sheet to each container which contains waste to be collected under the scheme. It is important to use a dark colored permanent ink to complete the sheet. As a general guideline, waste that can be disposed of safely through the appropriate standard waste containers from Enviropace should not be disposed of through the Labpack service. More complete discussion on the Labpack scheme can be found in the memorandum titled: "Procedures for the Labpack Waste Disposal Scheme at HKUST", which was distributed to all departmental Safety Officers on November 2, 1995.

Gel Waste Containers

The contents of a memorandum from SEPO to departmental Safety Officers is given below:

"Enviropace Limited will now collect gels and gels contaminated with toxic chemicals, such as ethidium bromide (EDB) from waste generators in Hong Kong. The container provided by Enviropace for the gels is a 20L open top vessel that can be sealed by the generator when disposal is complete.

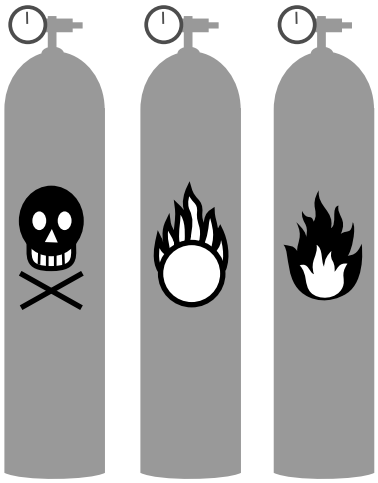
Waste generators who anticipate production in the 10-20L range can request the gel containers from SEPO and the full container will be collected during the regular weekly waste collection. Please continue to clearly label the contents of the gel waste container. For small volumes of gel waste, we request that several generators use a common container in order to fill the vessel. If sharing a container is not possible, then please continue to use double bags and clearly label the contents of the outside gel bag and SEPO will continue to collect it as before."

A second memo added:

"According to Enviropace guidelines, **solid materials** (such as pipettes, droppers, gloves, etc) **used with** polyacrylamide gels, or with gels contaminated with hazardous substances, should not be co-disposed in the Enviropace gel waste container. The gel waste containers are only for the disposal of gel material.

The acceptable practice for disposal of these related experimental materials is to rinse them and dispose of them in the municipal waste (normal trash container, wastebasket, etc.) The rinse solution for cleaning of such associated waste can be poured into the drain to the sanitary sewer."

Compressed Gas Cylinder Tales



HKUST cylinder usage

Much of the research at HKUST includes compounds and elements that exist normally in a gaseous state. The absolute quantities of gases used here would quickly fill all the available laboratory space if allowed to exist at room temperature and pressure. A more convenient mode of storage for these substances is in a compresses state within a suitable pressure vessel. There are over 400 such containers in use at HKUST in the form of the compressed gas cylinder.

Operations that use compressed gases include laser, analytical chemistry equipment, incubators, welding equipment, semiconductor manufacturing processes and many other operations throughout the University. Even air for the Emergency Response Team from Security is carried in cylinders to be used with the breathing apparatus the officers carry with them. There are so many cylinders in use for so many applications at HKUST that they often go unnoticed. For the most part, gas cylinders remain unnoticed until something happens that draws attention to one or more cylinders. Let's examine some of the materials that we use and store in compressed gas containers.

Types of gas

Inert gas is an elemental or molecular gas that is chemically very stable, and not likely to react with other chemicals under most conditions. Typical inert gases in use at the University are Helium, Argon, Krypton and Nitrogen. These gases are often used in conjunction with operations that include very reactive compounds and serve to help "flush" the more reactive molecules from system plumbing for maintenance purposes. Inert gas can have dangerous properties under certain conditions, and need to be treated with proper respect. Some types of high-energy physics experiments have vessels that must contain a completely inert atmosphere. If a person accidentally enters the enclosure with the inert atmosphere, he will lose consciousness quickly and could die from the lack of Oxygen. An all too common scenario consists of the first unaware victim passing out in the inert atmosphere, a co-worker tries to rescue him and also collapses, and others may tragically follow. The procedure for such a rescue requires the use of something like a self-contained supply of air, similar to that used by divers.

Fuel and Flammable cylinders have obvious beneficial uses around dinner time if your cooker happens to be connected to one of these. However, most of the flammable gases used at the University are associated with non-cooking functions. Many types of analytical chemistry instrumentation require a source of very pure Hydrogen, Methane, and/or Acetylene to function. Welding torches and those used by HKUSTís artisans in the Glassblowing Shop use flammable gas as a source of fuel. When a cylinder full of flammable gas leaks, or is damaged, explosion and fire can be the result.

Oxidizers and other corrosives are abundant in a research setting. Oxygen gas, necessary for life as we know it, is present in the atmosphere along with Nitrogen, Carbon Dioxide and a few other gases. The amount of Oxygen is less than 21% of the total mixture. This quantity is sufficient to cause metal to rust, fires to burn out of control, and certain foods to turn sour. Consider a source of nearly-pure Oxygen, at more than 150 times normal atmospheric pressure. This would be the realm of the compressed Oxygen cylinder. An enriched Oxygen environment can be a fire or explosion hazard. Fluorine gas is even more reactive and corrosive than Oxygen! Even a small Fluorine leak at the ppm level will not only draw attention, but is a serious health hazard.

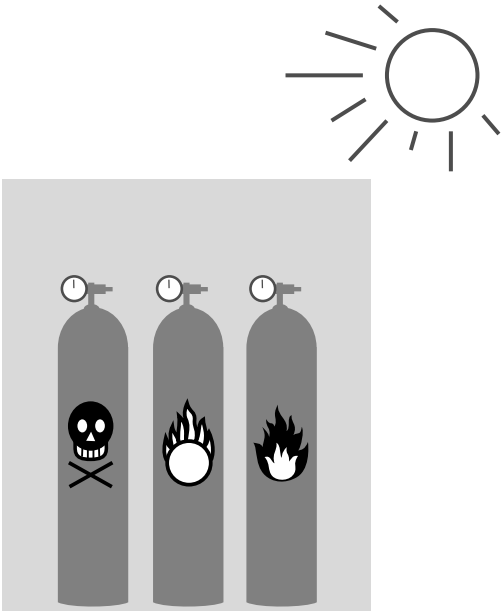
Toxic or poison gas is naturally of special concern. There are many toxic and poisonous gases used in the manufacture of semiconductor devices. Our lives seem to depend so much on the

silicon chip these days! Along with the "progress" comes the risk inherent in the manufacturing process. Some special semiconductor gases are not only poisonous, they are flammable, AND will spontaneously ignite on contact with the air! An accidental release of these types of gases can lead to significant damage to property and life. All types of compressed gases have this mix of benefit and risk. The key to their safe use lies in understanding and controlling the risks.

Standard Precautions

Protection from the sun is required to keep the temperature of the cylinders from reaching dangerous levels. As the temperature of the cylinder rises, the pressure of the gas inside rises. Under extreme temperature conditions, cylinders have been known to develop leaks or to rupture. By storing cylinders under an awning or on the north side of a building (south side for you folks down-under) much of the sun exposure can be eliminated.

Proper plumbing material is essential to prevent leaks and to keep the "pure" gas itself from reacting with the connecting tubing and changing its chemical content. In the case of Oxygen gas, all plumbing materials must be resistant to high-pressure Oxygen corrosion and must be exceptionally free of any oil or other organic material. If a small insect secretly crawls into the open end of a high-pressure Oxygen line during installation, and the operator unknowingly allow the system to be fully pressurized with Oxygen, the gas will react with the fuel source (the insect), rapid oxidation will occur (heat/fire), and the excess combustion products will escape by the easiest route (explosion).



Proper pressure limits for the compressed gas system must be observed to prevent leaks and explosions. Typically the pressure requirements for a gas at the point of use are for a very low level. The use of pressure regulators at the compressed gas cylinder location makes it possible to utilize a more cost effective delivery system to make-up the distance.

Proper labeling of compressed gas systems is essential to prevent a major catastrophe from occurring. The problem can arise when gas lines are removed for maintenance, then incorrectly re-installed. A system with a safe working design can be rendered deadly if the gas connections are made incorrectly. Rarely, a compressed gas cylinder can be incorrectly labeled at the factory. This type of accident can result in fire, explosion and sudden death, especially if the tank is labeled "Medical Oxygen" and contains Carbon Monoxide.

Cylinder Mishandling

Lifting a compressed gas cylinder presents a problem: where is the best place to "grab on"? Some commercial cylinder suppliers have been known to simply remove the cylinder outlet valve protective cap, wrap the outlet valve with a rope or steel cable, and lift the 100Kg steel cylinder like it were a fish on a fishing line. There are some serious engineering problems with this approach. First, the valve bodies attached to the cylinders are usually made of brass. Brass can be cut by steel cable under these conditions. Cutting the cylinder valve on a fully pressurized cylinder can result in the tremendous stored energy contained in the bottle being released with great force. A "Missile Hazard" is created because the force of the escaping gas will easily propel the steel cylinder through concrete walls, floors, roofs, vehicles and any other object that gets in the way. The second problem is that the entire weight

of the cylinder, and any torque incurred in the process of moving the mass on the end of a lever (the cable) is borne by the ordinary pipe fitting that connects the valve to the cylinder. The wall thickness of this fitting is less than 1cm, and the fitting is not subject to any routine certification or testing process. Placing one's faith in this single component without question is, itself, questionable. The best method for handling and lifting the mass of a compressed gas cylinder is to safely secure it to a trolley, lifting basket, or pallet for transport. SEPO is in the process of working with the suppliers in an attempt to improve their cylinder handling practice. Furthermore, SEPO is working with OLS to establish an inspection program to evaluate the condition of compressed gas cylinders at the time of delivery.

Securing the cylinder to a fixed object prevents the mass of the container from exerting an unwanted force upon one's foot, research equipment, flooring or the pavement if dropped from a high place. The drop from an extreme height might result in catastrophic cylinder failure with the attendant energy release/ missile hazard.

Improper fittings should NEVER be used on any compressed gas cylinder. To aid in preventing an accidental connection of a cylinder to the wrong supply line, most cylinder manufacturers have utilized standardized gas-specific outlet valve schemes. Most manufactures use a common fitting for Oxygen that is different from the common fitting for Hydrogen. Nitrogen, Helium and other inert gases often have the same sized fitting because of their compatibility in most cases. Special gas fittings, like for Carbon Monoxide, Nitric Oxide and others, might not be standardized between different cylinder manufacturers. Problems can arise if users attempt to modify a regulator to fit the wrong cylinder valve.

Complete draining of a cylinder by the user is usually not a good practice. If a cylinder is emptied and subsequently cooled (by our fine air conditioning system) to the point that room air is allowed to enter the cylinder, rust can form inside the pressure vessel. This rusting of the cylinder from the inside could lead to failure of the cylinder walls under periodic pressure test or while in use by an unsuspecting individual.

Storage Problems

Maximum allowed quantities for a facility are specified in the site license. However, in a true research and development environment many changes in plans can and do occur. The needs of HKUST change as fast as the technology available changes. The University needs to keep options open on how to manage a safe and adequate inventory of compressed gas without incurring undue risk to staff, students and the community. Well-planned storage and use should always be a top priority. Failure to adequately anticipate needs at all levels of management have distinct drawbacks.

Loss of floor space is one of those drawbacks. When adequate outdoor storage is not provided, researchers are left with storing cylinders in valuable laboratory areas. In an environment where almost every square centimeter of lab space is needed for the work in progress, compressed gas cylinders are often in the way.

Incompatible chemicals are sometimes crammed together because there is simply no where else to put them. Until that unlucky day when the unthinkable, the unlikely or even the unfortunate accident occurs, those cylinders might simply go unnoticed.

SEPO is committed to help identify potential problems, and to work with ALL parties involved to keep the research on-track, the personnel safe, and the pressurized gas inside the cylinders until needed AND wanted.

Sprains and Strains — First few hours of work are most hazardous, study suggests

Adapted from message distributed through SAFETY@UVMVM.BITNET, 11-APR-1995

TORONTO, Canada — You are more likely to suffer a sprain or strain injury during the first four hours of a workshift or the first two days of the work week.

That's one of the findings of a research study recently released by Ontario's Workplace Health and Safety Agency (WHSA). The study, "Patterns and risk factors for sprains and strains in Ontario, 1990" was co-authored by University of Toronto associate professor Bernard Choi and WHSA staff Marianne Levitsky, Roxanne Lloyd and Ilene Stones.

Dr. Choi said the analysis based on the WHSA's database seems to indicate that returning from a rest period — such as a weekend or a good night's sleep — leaves workers susceptible to sprains and strains. He suggested warm-up exercises — like the stretching that joggers do before runs — might help alleviate the problems.

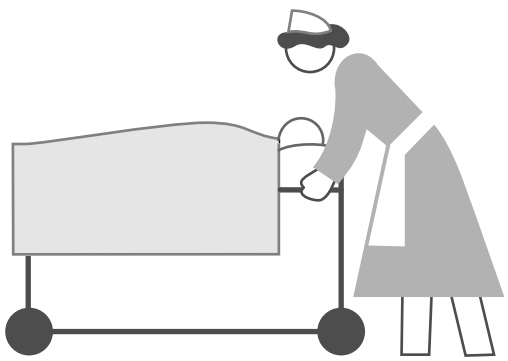
The data also suggest that the first few months of the year are the riskiest for sprains and strains. The study says this may be due to cold weather. Another major finding from the study was that nurses, nursing aides and truck drivers were more susceptible to sprains and strains than other workers.

"This is understandable when it comes to nurses," Dr. Choi said. "Nurses have to make many involuntary motions, such as when lifting patients, and involuntary motions increase the risk of sprains and strains." But Choi said the reasoning was less clear when it comes to truck drivers.

Some of the results presented in the study:

— sprains and strains accounted for 50% of lost-time injuries in 1990;
— sprains and strains were more likely to occur in the first four hours of work and least likely to occur in the final two hours;
— Monday is the most likely day of the week for sprains and strains to occur;
— workers between the ages of 30 and 59 are more likely to suffer such injuries;
— the occupations most at risk are nursing aides, nursing assistants, graduate nurses and truck drivers.
— bodily reaction from involuntary motions, overexertion in lifting objects, running and stretching, are likely to lead to sprains and strains.

The Workplace Health and Safety Agency intends to conduct additional research to determine whether the patterns identified in this study hold true for other years, and to further explore some of the associations suggested by this analysis.



Who to Contact for Assistance on Safety Matters...

Campus Safety Team

Assignment Areas :

Percy To (ext 6507) pager : 71128631 A/C 9007
For all non-lab areas

Tammy Lo (ext 6522) pager : 71128631 A/C 9097
Areas covered Academic Building, 3/f. and below
Senior Staff quarters
OLS warehouse and plant room
Workshops - OLS/ Mech./ Civil/ Industrial Engineering

S. T. Ho (ext 6520) pager : 71128631 A/C 9096
Areas Covered Academic Building, 4/f. and above
Sports facilities including sports halls
Swimming pool
Tennis courts
Athletics field, etc.
Pump house, plant rooms
Service tunnel
Workshops and Stores - EMO, Mech. Engineering
Staff Quarters - Junior

S. M. Chiu (ext 8620) pager : 71128633 A/C 9060
Area covered other than Academic Building
Student's dormitories
Library
Staff canteen, cafeteria, student canteen
Banks, bookstore, supermarket, clinic
Carparks and traffic roads

Team Leader : **C. M. Li** (ext 6485)
Pager : 71128633 A/C 9056

Laboratory Team

Assignment Areas :

Stephen Tsu (ext 6521) pager : 71128631 A/C 9094
Microelectronics Fabrication Centre
Physics
Technical support for Project Engineer, Dr. Samuel Yu
Safety supplies and equipment calibration coordinator

Alex Tse (ext 6538) pager : 71128631 A/C 9128
Chemical Engineering
Chemistry
Research Centre
Educational Technology Centre

Tongo Chan (ext 6520) pager : 71128631 A/C 9126
Materials Characterization & Preparation Centre
Computer Aided Design & Manufacturing Centre
Centre for Advanced Engineering Materials
Office of Laboratory Services
Special Radiological Measurements

Pak Ip (ext 6538) pager : 71128631 A/C 9005
Biology
Electrical & Electronic Engineering
Mechanical Engineering

Phyllis Yiu (ext 8620) pager : 71128633 A/C 9054
Biochemistry
Civil & Structural Engineering
Industrial Engineering & Engineering Management

Team Leader : **Jim Boyer** (ext 7229)
Pager : 71128631 A/C 9127

SAFETYWISE

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