

The Kim Group
Quantum INnovation LABoratory

*Safety Manual
& Lab Regulations*



Version 1
December 2016

Table of Contents

- Page 3: Welcome!
- Page 4: QuIN Lab Commandments
- Page 5: Emergency Procedures
- Page 6-7: Non-emergency Procedures
- Page 8: Required Safety Courses & Training
- Page 9: Monthly Safety Inspection
- Page 10: Personal Protective Equipment
- Page 11: Equipment Administrators
- Page 12-15: Before Starting an Experiment
- Page 16-18: Chemical Waste Disposal
- Page 19: Gases and Cryogenics
- Page 20: Glovebox Safety
- Page 21: Glovebox Citizenship
- Page 22: Optics Lab and Laser Safety

Welcome!

Welcome to research in the QuIN Lab, the Kim Group!

This manual is a guideline to give an overview of safety regulations in the lab, as well as highlight emergency procedures.

In addition to this manual, you should also refer to:

1. The “Quick-start guide for New Lab Members”
2. The safety presentations on
 - S01001 Employee safety orientation
 - S01081 Workplace violence awareness
 - SO2017 WHIMS2015
 - S01030 Cryogenic and compressed gas safety
 - S01010 Laboratory safety
 - S01066 Laser Safety training theory
 - S01038 Emergency First aid

These are available online <https://uwaterloo.ca/safety-office/training/training-programs>

Completed certificates of members should be kept in the binder, located in the Chem. And Optics Labs.

QuIN Lab Commandments

1. Always be honest, respectful, and diligent.
2. Always wear **safety goggles** in the labs. Wear lab-appropriate clothing, especially **close-toed shoes** and long pants.
3. Always consult Prof. Kim or the safety officer before trying any new experiments or procedures. Always document your work.
4. Always leave the lab **cleaner** than you found it.
5. Contain dangerous chemicals in the glovebox or hood or the flammable fridge.
6. Label all waste and sample vials correctly.
7. Always transport chemical samples using a secondary closed container.
8. Ensure the safe condition of all lab areas before leaving the lab, especially at the end of the day. (e.g. Turn on the laser sign when the laser is on, and Turn off the laser sign when done. Check the doors are locked)
9. Headphones and shiny/sharp jewelry are not allowed in the lab.
10. Volunteer for a group job!

Emergency Procedures

Fire & health-threatening hazardous material releases: (includes all compressed gas cylinder leaks or valve failures)

1. Call 911 and UW POLICE (24 hr-7 days/wk) 519-888-4911 or ext. 22222.
2. Activate fire alarm. Close door to lab or room.
3. Evacuate area or building.
4. Administer first aid.

Chemical spill: remove clothing, deluge with water for at least 15 min. or until emergency personnel arrives.

5. Notify Prof. Na Young Kim - 226-338-6758.
6. Notify the safety officer.

Release or incidents NOT immediately health-threatening:

1. Contain or clean up the spill only if you are trained to do so. Otherwise,
2. Call ext. 35755 (UW Safety Office)

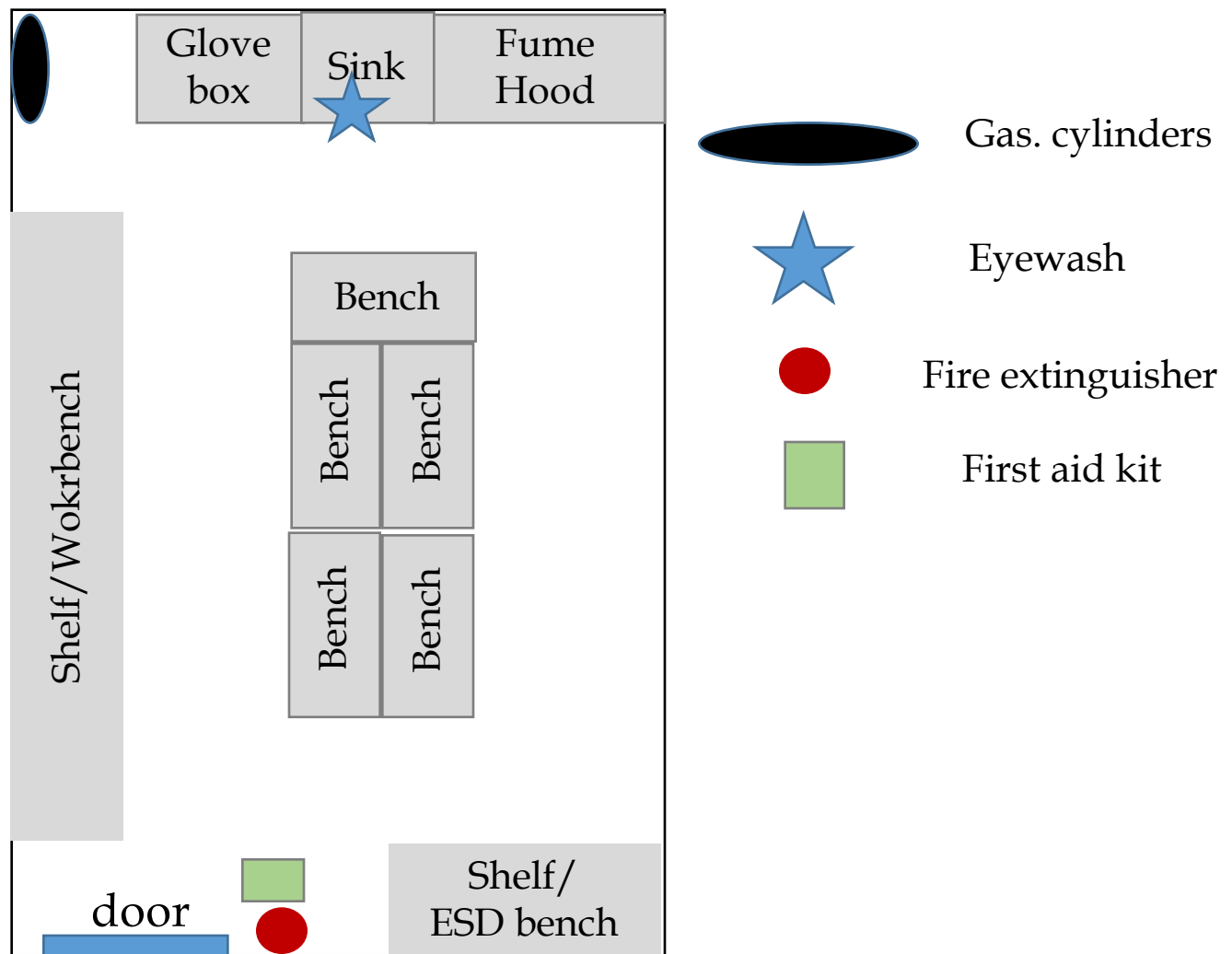
24-hour 7-day/wkk contact = UW police ext.22222.

5. Notify Prof. Na Young Kim - 226-338-6758
6. Notify the safety officer.

Non-Emergency Procedures

All incidents, large and small, must be reported to Na Young Kim & the safety officer.

Ex. Small extinguished fires, minor wounds, emergency equipment shutdown, small injuries that require first aid or a visit to hospital or clinic, electrical hazards, small spills that can be cleaned up by the group, and any unsafe conditions.

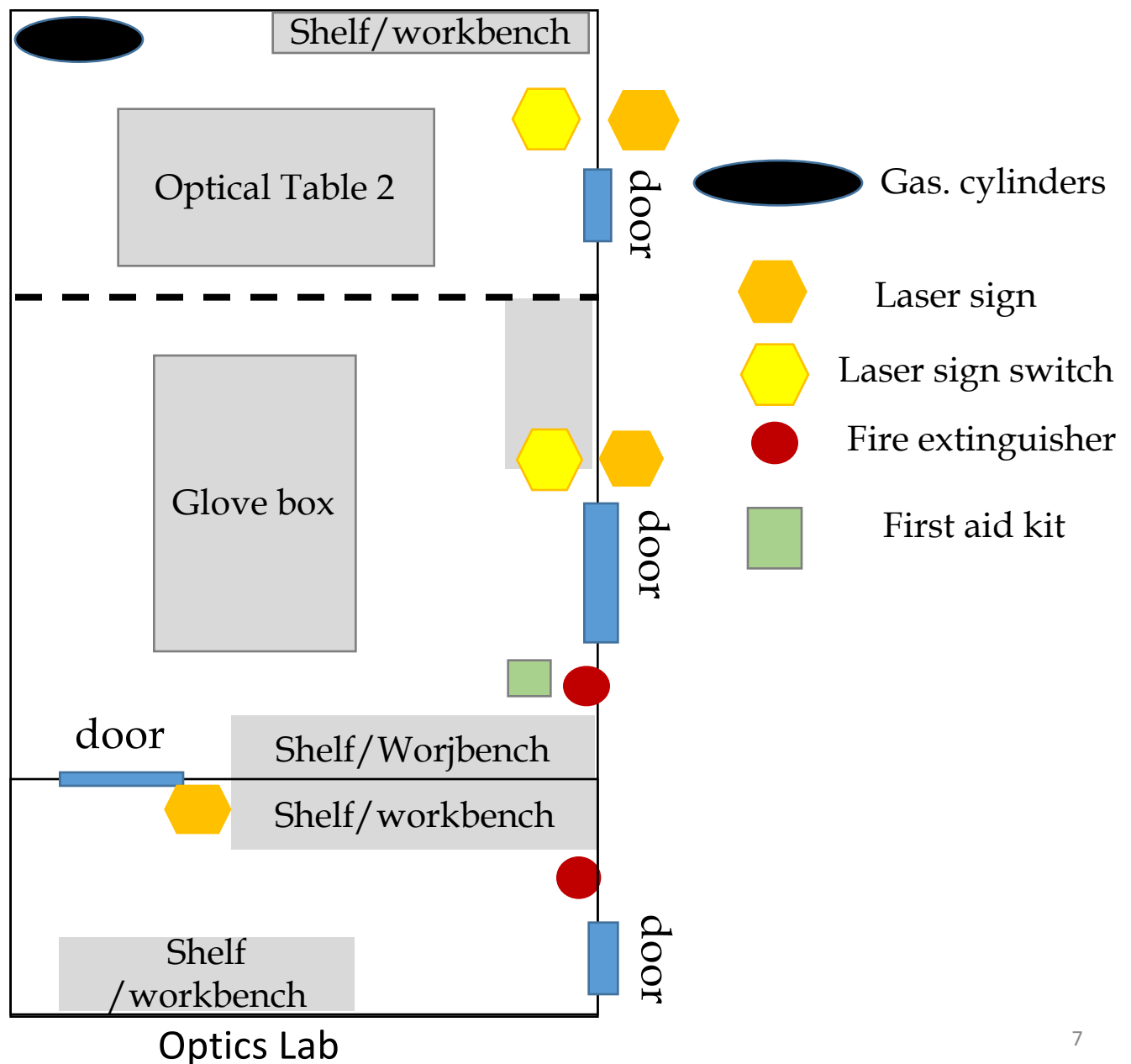


Wet Lab (2117A)

Non-Emergency Procedures

All incidents, large and small, must be reported to Na Young Kim & the safety officer.

Ex. Small extinguished fires, minor wounds, emergency equipment shutdown, small injuries that require first aid or a visit to hospital or clinic, electrical hazards, small spills that can be cleaned up by the group, and any unsafe conditions.



Safety courses & training

All members MUST take the following safety classes:

- S01001 Employee safety orientation
- S01081 Workplace violence awareness
- SO2017 WHIMS2015
- S01030 Cryogenic and compressed gas safety
- S01010 Laboratory safety

All researchers working with lasers MUST complete:

- S01066 Laser Safety training theory

The following training may be useful:

- S01038 Emergency First aid

These are available online <https://uwaterloo.ca/safety-office/training/training-programs>

Completed certificates of members should be kept in the binders, located in the Chem. And Optics Labs.

Monthly Safety Inspection

All members will rotate to perform a monthly safety inspection of the lab space regarding:

- i) General safety
- ii) Hazardous materials and waster
- iii) Compressed gases

- Winter 2017 Inspection
 - Jan. 2017: Jonathan Wu
 - Feb. 2017: Michael Mierzejewski
 - Mar. 2017: Hillman Leung
 - Apr. 2017: Lauren Meadowcroft

The inspection ensures proper labeling and storage of chemicals, proper fume hood use (i.e. , sash closed when not in use), proper gas cylinder storage, proper dewar storage, etc..

All lab members will familiarize themselves with the “Laboratory inspection checklist” and uphold practices that comply with the list.

The inspection forms are available in the binder and the completed form will be checked by Prof. Kim and/or the safety officer (Mats).

Personal Protective Equipment

Safety goggles must be worn at all times upon entry into the Wet Lab. Please choose a pair that fit.

Safety goggles must be worn when you handle high power lasers in the Optics Lab. Please choose a pair that fit.

Shoes covering the feet are required.

Shoe Covers must be worn at the sticky mats upon entry into the Wet Lab and the Optics Lab. Please remove the dirty sticky mats.

Long pants must be worn in the laboratory.

The routine use of **labcoats, beard covers, masks** etc in the Wet Lab is highly encouraged; please replace them when they get dirty. Do not bring labcoats into the Optics Lab or office area.

Gloves must be worn at all times when handling chemicals in the Wet Lab. Nitrile gloves are suited for resistance to solvents and organic chemicals, while latex gloves provide general resistance to acids and bases.* Change gloves when they become dirty. Remove gloves before exiting the wet lab.

*Special gloves (Neoprene, Silver shields) may be required for your work.

Equipment Administrators

Please contact the following people for safety information and for instrument training, maintenance and general questions:

Safety Committee: Na Young Kim

Win 2017

Glovebox: Michael Mierzejewski

Lasers: Na Young Kim

Hood: Michael Mierzejewski

Microscope & Spectrometers: Na Young Kim

Simulation Computer: Mats Powlowski

Instrument administrators are responsible for writing and maintaining standard operating procedures for their equipment:

Before starting an experiment

Practical safety considerations that accompany your experiment:

1. THINK!

- 1) What equipment do you need? Do you know how to use it?
 - If you have not used a piece of equipment before, ask for a demonstration (or formal training if necessary), and have someone observe your technique before working on your own (e.g. cryogenic handling, lasers, glovebox, etc.)

- 2) What chemicals will you use?
 - Do you know how to safely handle them?
 - Do you know how they might interact with one another? With the air? With water?
 - Read MSDS for each chemical and ask someone who has used it about safety concerns. If no one in our group is familiar with the chemical, find someone in another group who is. - DO NOT depend on the MSDS alone!

- 3) If you are unsure of any of the above, just ASK. The locals are friendly!

Before starting an experiment

2. PLAN

- 1) Write down an experimental procedure, taking the above items into account.
- 2) Be sure to consider potential burn/spill/fire/explosion/corrosive hazards for your experiment.
 - What extra personal protective equipment might you need? (The general lab requirements may not be enough.)
 - Should you use a face shield? Do you know which type of fire extinguisher you would use and where to find it?
- 3) How will you clean up after your experiment?
 - Will there be toxic waster/byproducts that need to be disposed of?
 - How will you clean/prepare the equipment to ensure it will be safe for the next user?

Before starting an experiment

3. GET A SECOND OPINION

- 1) Make sure you ask someone to review your plan and see if there are any safety hazards that have not been considered. This is necessary at any experience level.
- 2) The less familiar you are with the materials/techniques you are using:
 - the more senior the colleague you should speak with,
 - the more detail you should provide,
 - the more detailed questions h/she should ask you about your plan

If the experiment you have not performed previously involves any of the following, you must review it with at least two lab members (preferably including a lab safety officer) before proceeding:

- Toxic chemicals: i.e., organometallics; heavy TM and main group metals: Cd, Te, Pb, Se, As, Co, Hg; silanes
- Oxidizers: piranha, peroxides, permanganates, perchlorates
- Strong reductants: Na, Li, K, etc.
- Corrosives: piranha, nitric acid, aqua regia
- High temperature: $T > 200\text{ }^{\circ}\text{C}$
- Large volume reaction ($> 250\text{ mL}$)
- IR, UV, or Pulsed lasers

Before starting an experiment

4. PERFORM YOUR EXPERIMENT:

- 1) Even the best laid plans can have problems. Make sure to pay close attention to what you are doing while you work.
 - Avoid distractions (no headphones).
 - Be prepared for potential problems (even non-safety problems that occur may cause you to rush to correct them, thereby causing an unsafe situation).
 - It is best to work with others in the general area, in case there is a major unforeseen problem. Be extra cautious if this is not possible. It may be best to wait if your experiments is particularly unfamiliar and/or dangerous.

5. THINK!

- 1) Have you cleaned up chemical and materials waste (pipets, vials, etc.)?
 - In the glovebox? At the balances? Other common areas?
 - At your bench/hood/wherever your experiment was performed?
 - If not, you may have contaminated your labmates' experiments.
 - Pay attention to sharps disposal, so labmates do not cut/stab themselves.
- 2) Have you cleaned/prepared any equipment for the next user?
 - Turned off hotplates?
 - Turned off vacuum pumps and/or gas cylinders if necessary?
 - Turned off laser sign?

Chemical Waste I

LIQUID WASTE

Safety office will provide containers for liquid waste. Please:

1. Keep aqueous and organic waste separated.
2. Label waste containers with contents. Use pencil.
3. Estimate percentage of components
4. Keep lid of waste capped with pressure-release top when not in use.
5. Do not overfill liquid waste containers.
6. Submit a pickup request when waste is full or before 8 months:

Refer to: <https://uwaterloo.ca/safety-office/programs-and-procedures/laboratory-safety/biosafety/hazardous-waste>

VOLATILE WASTE

Please do not dispose of volatile waste directly into the contaminated waste buckets. Quench material if needed and allow it to evaporate in the fume hood before moving to the open lab environment.

e.g.: Kimwipes saturated with solvents, pipets with odorous chemicals (i.e., thiols)

Chemical Waste II

SOLID WASTE

There are both trash cans and contaminated waste containers in the lab. Please dispose of non-contaminated materials in the trash bins (handled by custodial staff without PPE).

Chemical waste (gloves, used vials, pipets, syringes) is collected with PPE by Safety office.

SHARPS

DO NOT dispose of sharps in either the liquid waste or the contaminated solid waste buckets:

- * needles (do not recap needles)
- * razor blades

Please use a designated sharps container (one in hood)

HAZARDOUS WASTE

All laboratory chemical waste must be managed as hazardous waste unless it is listed on the UW non-hazardous waste list.

Chemical Waste III

USED BATTERIES

Used batteries cannot be collected in labs. Please bring your used batteries to the ESF or campus Tech Shop (lower level of SLC) for recycling under the Call-2-Recycle program, or contact Greg Friday at ext. 35755 to make arrangements for pick-up.

FLUORESCENT & UV LAMPS

These items are universal waste and cannot be thrown into the regular trash or broken glass boxes.

Please in a hard-sided contained, labeled with "universal waste", identify what the contents are, and indicate the date. For disposal, contact the facilities manager.

Gases & Cryogenics

CYLINDERS

Gas cylinders should always be fixed to the wall with the chain holders when in use and when stored.

DO NOT move a cylinder when it is uncapped or with the regulator attached.

Ensure that you have the proper regulator for the gas you need (i.e., Ar, H₂).

Please use a cart when transporting cylinders.

DO NOT let the glovebox Ar cylinders run empty, and only use the high purity Ar.

CRYOGENS (i.e., dry ice, LN₂, LHe)

Please use with proper ventilation and handling.

Dewars must be restrained at one point. If you have never used a cold trap with a vacuum manifold, please ask the safety team (Prof. Kim, Safety Officer) for help.

Glovebox Safety

Manuals, including purging instructions, are located on the tops of the gloveboxes.

SAFETY

1. Put a sign on the glovebox when hotplate is on or hot.
2. Minimize contamination.
3. Prevent glovebox holes by being smart with sharps: use dust-busters to clear broken pipette shards, keep caps on needles, and don't stuff too many pipettes in or out.
4. Prevent spills: close solvent bottles, use a vial holder, keep a new piece of Al foil under work space to keep glovebox floor clean. If you spill, clean it up with Kimwipes and purge the glovebox.

Glovebox Citizenship

1. Wear a pair of latex gloves over the glove-box gloves, to keep the glovebox gloves relatively new and contamination-free.
2. Please keep the glovebox clean: do not leave any used items on the glovebox floor (i.e., used foil, used gloves, used pipets). Also, be sure to label and store all vials. Do not leave samples sitting out for extended periods of time.
3. Properly introduce materials into the glovebox with adequate pumping in the antechambers
4. Sign the logbook with name, date, time, and material before you go in. When done, record pressures of H₂O, O₂, Ar, end time, and other notable occurrences.
5. Report any concerns to the glovebox guru or Prof. Kim.

Optics Lab Safety

New Laser / Optics Lab Users

1. Sign up for laser safety training.
2. Contact Prof. Kim before using a laser.
3. After training by the group guru, indicate completed training in the safety binder.
4. Be sure to keep the optics lab inventory up-to-date, whenever new equipment arrives or equipment is borrowed/loaned out.
5. **MUST** inform Prof. Kim whenever new equipment arrives or equipment is borrowed/loaned out.

Laser User Regulations

1. You must be an authorized laser user to work with lasers.
2. **Protect yourself:**
 - Wear safety goggles when there is the possibility for exposure above the maximum permissible exposure (MPE) for your laser.
 - Remove shiny jewelry (especially rings or watches) during laser use.
 - Perform regular stray beam.
3. **Protect your colleagues:**
 - Ensure proper signage is posted when laser is in use.

Non-Laser Users.

Obey hallway laser signs. It is a good idea to knock when entering the optics lab even if a “laser in use” sign is not on.

Medical attention **CAN** mitigate the effects of laser exposure if provided promptly. In case of an emergency, call 911 from a campus phone.