Zaera's Lab Safety Instruction

January 2022

✓ Always Lab Coat in Rooms
✓ Do Not Eat in Room
✓ Label All Containers with Chemical Name and Hazard Class
✓ Take Off Gloves to Touch Doors

1. Safety Training for New Group Members

Lab Safety Manual is the first step new members need to follow. Please visit the Zaera group website to download the following documents.

https://zaeralab.ucr.edu/docs-manuals

0. Research Ethics
1. Introduction
2. Injury and Illness Prevention Plan
3. Chemical Hygiene Plan
4. Emergency Action Plan
5. Standard Operation Procedures (only General Lab, Hazard Classes, Processes)
6. Physical Hazards Guide
7. Zaera's Lab Safety Instructions

When your UCR Net ID is available, visit the website of UC learning center (http://ucrlearning.ucr.edu). Log in with your Net ID, and search the course for "Laboratory Safety Orientation (Fundamentals) 2013", which covers the topics below. You have to pass the final quiz at the end of each course. Please export your transcript to a PDF file for me by clicking "Training Transcript", which is under "Learn" of the menu "Learner".

1. Laboratory Safety Orientation (Fundamentals)
2. Chemical Hygiene Plan
3. Hazardous Waste Management
4. Injury & Illness Prevention Plan (IIPP)
5. Personal Protective Equipment (PPE)
6. Fire Extinguishers
7. Emergency Action Plan & Fire Prevention Plan
8. Fume Hood Safety

After then let Ilkeun (ilkeun@ucr.edu) know, so he will get your signature on review and training record sheets and show you how to handle chemical wastes in our group. You need to finish all of them first prior to starting your work in our group.

2. Laboratory Safety Manual

"Laboratory Safety Manual" is placed with a chemical spill kit and a safety face shield in each room under "Lab Safety Manual" sign. "Safety Data Sheets (SDS)" and "Standard Operating Procedures (SOP)" are also available with PDF format in folders named "SDS" and "SOP", respectively, on the desktop of the office computer in room 141. All lab workers are required to review the manual and to sign on acknowledgement that they understand the contents. Also, Members keep the e-file copies and refer to them whenever needed. The manual includes general

laboratory safety rules, maintenance, handling of hazardous waste, and general operating procedures for compressed gases, toxic chemicals, and electronic equipments. Additional useful documents for lab safety can be found at http://www.ehs.ucr.edu/, the web site of the Environmental Health and Safety (EH&S) Department. If you have any question, consult Ilkeun Lee who is the *lab safety manager*. Otherwise, please contact EH&S directly. "Annual Lab Safety Self-Audit" from EH&S or Lab Safety Coordinators is on July, so please do your best not to have any violation. This self-auditing is continued to keep the lab clean and safe without have any accident in our lab.

3. Laboratory Hazard Assessment Tool (LHAT)

Prof. Francisco Zaera conducts hazard assessments specific to activities in our laboratories, including when new activities are adopted, or there is a modification of activities. The hazard assessment must occur at least once each calendar year. All the members should evaluate their specific needs, recommendations, and requirements for PPE based on their research activities. The Laboratory Hazard Assessment Tool (LHAT) identifies hazards to personnel and specifies Personal Protective Equipment (PPE) to be used during work activities. Upon request of recertification, you will receive an email from LHAT. If so, please recertify the updated hazard assessments as soon as possible. New members get vouchers to redeem flame-resistant lab coats.

4. Purchasing Lab Supplies

If you need to buy an item, search Aldrich, Fisher, VWR, or any vendor. Visit their websites and find a page for its catalog number and price. You need to save the page in pdf format and send it to Ilkeun. You may need to get a quote if the website doesn't list the prices. We purchase gas cylinders from the campus storehouse, not the stockroom (CS 113), so contact Ilkeun first for all the gas cylinders. You can get some chemicals (not gas) and stuff from the stockroom, and please notify Ilkeun by email.

5. From purchasing to handling chemicals

All the chemicals, even water, have to be labeled with chemical full name with hazard information (e.g. toxic or flammable), so anyone can know all chemicals in our lab and track them from the time of purchase. To optimize the handling and inventory of chemicals in our lab, the following procedure needs to be followed:

1. If you need to use a new chemical, report Ilkeun first with your own detailed protocols.
2. Read its SDS and SOP provided by Ilkeun.
3. After reviewing them, sign on its acknowledgement page.
4. Check our chemical inventory by use of "UC Chemicals" App to see if we already have the chemical. If you don't have the app, you can download it from your App Store. It is free. You need to log in with your UCR NetID.

5. If we already have some, go to the designated place and find the chemical. If a member's name is listed on tags or bottle's labels, it is reserved for the member. So, you have to ask the member first for availability prior to use.
6. Also wear all the PPE required according to its SOPs, and handle the chemical in a fume hood. Make sure that you are familiar with the safety risks of handling the chemical according to its SDS, and follow appropriate procedure for its handling. What you need to do is following your detailed protocol whenever you use the chemical. If there is any change in your protocol, please update Ilkeun immediately. Take the quantity required and return the original bottle back to its original place. If you place a wrong place, we lose our inventory and waste money.
7. If not available in our lab, ask Pris if there are some in the stockroom (CS 113). When you bring any chemical from there, please notify me with chemical name, bottle size, and quantity. Also fill out a form for Zaera group with the items you took.
8. Otherwise, ask Ilkeun to submit a purchase request to the department. We can place an order below $200 without Francisco's permission and the minimum amount of chemical only.
9. Once the purchased chemicals arrive, update Ilkeun immediately with the location you store.
10. Always keep all the chemicals in the designated places and consult with Ilkeun if you have any issue regarding the storage.
11. If you produce an empty bottle, please take a photo of its barcode and send it to Ilkeun. Please don't forget this. After then, move the empty bottle to the cabinet right next to the fume hood in room CS 135.

Usually, the **Safety Data Sheets** (SDS) come with the chemicals purchased. However, this is not the case with common chemicals. Electronic versions of PDF files are usually available from the website of the chemical company, and we have SDS copies for many chemicals more than what we have in our lab. We don't print all the SDS, but keep them on the office computer and your laptops. Ilkeun updates your chemical list, SDS, and SOP.

6. Lab Specific Training for Chemical Waste Handling (Online and Offline)

All the members are required to be trained for the handling of any chemical waste produced from their experiments. You will be familiar with the **Waste Accumulation Storage Tracking electronically** (**WASTe**) at http://ehs.ucop.edu/waste/ during your lab specific training. This program was developed for the labeling and disposal of hazardous waste at all UC campuses. You need to use your UCR NetID to log in. Additional online training is available in UCR learning center (http://ucrlearning.ucr.edu) or visit the EH&S website for hazardous waste management (https://ehs.ucr.edu/training/online/hwm/indexlms.html).

1. If you're going to produce chemical waste after use, you need to have a proper chemical waste bottle in advance prior to your experiment. Please do not begin the chemical use without having a chemical waste bottle. We may have one in which the same or

compatible chemicals were already wasted. If so, you can add your waste into the waste bottle after updating the chemical waste label with your chemical waste and hazard information. If no appropriate waste disposal bottle is available from our waste list, start one using an empty bottle of a proper size. However, you have to check the original company label, because a little amount of chemical could be remained at the bottom of the bottle. Please check the partial list of incompatible chemicals posted at the right side of fume hood in room 135 and refer to "**Hazardous Chemical Waste Management"** in the Chemical Hygiene Plan for instructions.

2. Log in to **US Safety** (**http://ehs.ucop.edu/**) and click WASTe (Waste Accumulation Storage Tracking electronically) in the left side menus under More Apps.
3. Choose "View My Tags" on Containers menu and click "Chemical".
4. Check if we already have one tag for the same chemical.
5. If so, click the tracking #.
6. See who created the waste bottle and ask if you can add.
7. If not, click "New Tag" and click "Chemical" for type.
8. Fill out all the information according to the hazard class of your chemical wastes.
9. Click "Save & Print" to print the tag and put it into an envelope, which is available in a small box right next to the waste storage location in CS 137.
10. After attaching the label onto the chemical waste bottle, place it in the second baskets of flammable or corrosive.
11. You may keep using the same waste bottle up to 80 vol. % for the same and other comparable chemical wastes for 180 days. The waste bottles you created will be on your responsibility, so please manage them fully as EH&S keeps monitoring the system.
12. You must move your tracking # to "Containers Ready for Pickup" by clicking the arrows on the left side column if the waste bottle is close to 80% full or older than 180 days (even if it is less than 80% full). Ilkeun may request the pick-up the old wastes without a notice to group members. Or, the EH&S may take them when they visit our lab. The tracking items move down automatically to the containers list for pickup. EH&S comes later to pick them up without notice.

7. Chemicals and Chemical Waste Labels

Once a chemical is stored in a container, not the original bottle, the container must be labeled with the chemical full name and hazard information, even water. Original chemical bottles are to be stored at designated places in room 135, 137, 139, 143, and 162 according to their physical phase and chemical hazardous class. Please note that safety auditor checks an unknown chemical left without a proper label. Therefore, all chemicals (including water) need to be properly labeled. The labeling must include a chemical full name and its hazardous information (except in the case of the original bottles, which are already labeled appropriately). Chemical waste containers are placed right next to the leak detector in room CS 137. Empty bottles for chemical waste and envelopes for waste labels can be found in the cabinet, right next to the fume hood in CS 135. Please be fully aware that some chemicals cannot be mixed, or require different solvents. A table for chemicals comparability is posted in the chemical waste area. We also have red plastic

containers in CS 135, 139 and 162 for sharps waste such as needles. Besides, each room has a broken glass box.

8. Responsibility for Individual Equipment

All the systems in our laboratory are supervised under the assigned users. If you need to use a system or borrow any stuff, permission from the responsible person is required in advance. After securing permission, please review the User Guide or Manual from the person in charge or from our group website and be familiar with the system you're going to use. It is better to get the operator's help as well. The responsible user is required to update the Manual of the system under his/her supervision, with proper illustrations, whenever any changes are made.

As of September 2021, the major equipments have been assigned to the members as the following. They are responsible for management in schedule, contact for service, maintenance, repair, and report.

UHV Chamber #1 Victor (CS 135): Ameer Siddique
UHV Chamber #2 RAIRS (CS 135): Mindika Tilan Abeyrathna Nayakasinghe
UHV Chamber #3 Michelle (CS 143): Md Abdul Motin
UHV Chamber #4 Praxis (CS 137): Ilkeun Lee
UHV Chamber #5 UC (CS 143): Mohammed Alam
UHV Chamber #6 Nano-Reactor (CS 137): Ilkeun Lee
Reactor #1 ALD Films (CS 137): Mohammed Alam
Reactor #2 ALD Powder (CS 143): Yihan Zhou
Reactor #3 ALD Powder (CS 143): Mohammed Alam
FT-IR #1 EQUINOX_RAIRS (CS 135): Mindika Tilan Nayakasinghe
FT-IR #1 EQUINOX_Transmission (CS 135): Mindika Tilan Nayakasinghe
FT-IR #2 TENSOR_Transmission IR Cell (CS 135): Tongxin Han
FT-IR #2 TENSOR_HATR (CS 135): Zihao Wang
FT-IR #2 TENSOR_Liquid-Solid Cell (CS 135): Zihao Wang
FT-IR #3 TENSOR_DRIFT IR Cell (CS 137): Ilkeun Lee
FT-IR #3 TENSOR_Liquid-Solid Cell (CS 137): Ilkeun Lee
FT-IR #4 TENSOR_Ge-ATR (CS 143): Ilkeun
FT-IR #4 TENSOR_RAIRS (CS 143): Md Abdul Motin
GC #1 Agilent-Batch Reactor (CS 135): Minhaj Tahsin Ahmed
GC #2 Agilent-Chiral (CS 135): Tongxin Han
GC #3 HP-UV-Vis Reactor (CS 137): Ilkeun Lee
Parr-High Pressure Reactor (CS 135): Zihao Wang
Glove Box (CS 135): Ilkeun LEE
BET (CS 137): Zihao Wang
Catalyst Furnaces (CS 135): Tongxin Han
Centrifuge (CS 139): Ilkeun Lee

9. Responsibility for Common Items

Communal equipments also need to be properly maintained. If broken or in need of service, the person in charge is required to resolve the problems in a timely manner. Users must keep all instrumentations clean in working conditions.

As of September 2021, responsibilities for the common equipments are distributed as follows.

Fume Hood #1 (135): Tongxin Han, **#2 (139)**: Junghyun Hong, **#3 (162)**: Mohammed Alam

A user needs to stand by fume hood while working with chemicals. No one leaves chemicals unattended in fume hoods or elsewhere. In case of absence temporarily, it is required to leave a warning message with sufficient information about the chemicals for the benefit of other members. Clean the space after use and put the chemical bottles back in their original place after finishing. Don't leave any stuff in the hood for a long-term storage. Keep the 6" zone clear all the time.

Broken Glass box 1 (CS 135): Tongxin Hang, **box 2 (CS 137)**: Ilkeun Lee, **box 3 (CS 139)**: Junghyun Hong, **box 4 (CS 143)**: Md Abdul Motin, **box 5 (CS 162)**: Mohammed Alam

If the box becomes full, seal it with a tape and put it next to a trash box in the Hall.

Evaporator #1 (CS 135): Tongxin Han, **Evaporator #2 (CS 139)**: Junghyun Hong

Re-trapped solvents need to be treated as chemical waste immediately. Users are required to wash the adapter after use.

Oil Replacing Cart (CS 135): Mindika Tilan Nayakasinghe

Users need to keep the space clean to avoid making it slippery.

Balance (CS 137): Ilkeun Lee

Review the manual if it is the first time to use. Do not tune the balance manually as it does automatically.

Red Tool box (CS 139): Minhaj Tahsin Ahmed

Users must return tools immediately after use or before going home. Please, out of consideration to other lab members that may need them, do not leave any tools on the bench for long times. If someone from other research groups asks to borrow one of our tools, report the details to Minhaj, who will keep a record of it. If Minhaj is not available in the lab, write the name of the borrower, the tool he/she borrowed, and his/her room number on the sheet on the door of room 139.

Bench Tools & Parts boxes (CS 139): Ilkeun Lee

Users need to clean around the bench and floor after using the red vise, and to return all wrenches to the original boxes after use.

Hardware Parts in drawers (CS 139): Ameer Siddique

Hardware parts includes copper gaskets, flanges, bolts, clamps, O-rings, and tubes. If you need any of those, consult with Mohammed. Once their stocks are low, report to Ilkeun. There may be one big order rather than individually.

Computer & Printer (CS 141): Ilkeun Lee

The office computer will be used for handling all safety issues and printing of chemical waste labels. Since wireless Internet access is available on the campus, the IP addresses assigned to our laboratory will be used only for data transfer from old computers in the lab. Report to Ilkeun if no paper or ink.

Oven (CS 143): Md Abdul Motin

Users need to keep both inside and outside clean. Report any issue to Abdul.

For all of you assigned to equipment, please update the manuals when any change occurs. The manuals need to be detailed, describing how to power the instrument up, turning it off, and operating it under normal circumstances. They need to describe any needed maintenance and list any possible hazards, with what to watch out for and how to handle any possible problems you can foresee. The manuals must be revised at least every six months or every time you make a major change to the equipment.