Zaera's Lab Safety Instruction

June 2017

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.

http://research.chem.ucr.edu/groups/zaera/labdocs.html

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 that they understand the contents. Also, every member is asked to keep the e-file copies and refer to it 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 (Catalysis Subgroup) and Xiangdong (ALD Subgroup) as *lab safety coordinators*. Otherwise, please contact EH&S directly. Every spring quarter there will be "Annual Lab Safety Self-Audit" from EH&S or Lab Safety Coordinators, so please do your best not to have any violation. Continuous self-auditing is the best way to keep the lab clean and safe, and to not 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. You may get a new voucher for PPE to redeem.

4. From purchasing to handling chemicals

Many unknown chemicals and samples have been left by leaving members, without proper labeling or instructions for handling. 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 chemical, read its SDS in the "SDS" folder of the office computer or get one from Sigma Aldrich website or other vendors.
2. 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 UCR NetID to log in.
3. If we have some, go to the designated place and find the chemical. If a member's name is listed on tags or comments of the detail information or bottle's labels, it is reserved for the member. So, you have to ask the member for availability prior to use

4. Read its SOP, which would be available in the "SOP" folder of the office computer.
5. If it is your first use, prepare your own detailed protocol for the chemical for Ilkeun. He will add it to its SOP for update.
6. After reviewing its SOP including your detailed protocol section, sign on its acknowledgement page.
7. Also wear all the PPE required, and handle the chemical in the 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. Take the quantity required and return the original bottle back to its original place.
8. If not available anywhere, ask one of the *lab safety coordinators* to submit a purchase request to the department. We are using eBuy online system and can place an order below $200 without Francisco's signature on purchase request forms. Please purchase the minimum amount of chemical possible.
9. Once the purchased chemicals arrive, Ilkeun updates our chemical inventory first and let you know the store locations.
10. Always keep all the chemicals in the designated places and consult with the lab safety coordinators if you have any issue regarding the storage.
11. 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 in 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.
12. Log in to **US Safety** (**http://ehs.ucop.edu/**) and click the icon of WASTe (Waste Accumulation Storage Tracking electronically)
13. Choose "Create a New Tag" for the waste disposal bottle.
14. Fill all the information according to the hazard class of your chemical wastes.
15. Print the tag and put it into an envelope, which is available in a mall box right next to the fume hood in CS 135.
16. Place the chemical waste bottle in the second basket after attaching the label on it.
17. You may keep using the same waste bottle up to 80 vol. % for the same chemical and other comparable chemicals for the period of time allowed by EH&S.
18. You must request chemical waste pick-up in **WASTe** 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.

19. If you produce empty bottles, please take a photo of barcodes and send it to Ilkeun so that he removes the bottles from our inventory on "UC Chemical" app. Please don't forget this. After then, move them to the cabinet under the chemical waste table 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. All the SDS documents haven't been printed yet to avoid generating excessive paper waste, but you can see them on the office computer.

5. Personal Training for Chemical Waste Handling (Online and Offline)

Each member is required to be trained for the handling of any chemical waste produced in the course of his/her experiments, and needs to be familiar with the **Waste Accumulation Storage Tracking electronically** (**WASTe**) at "http://ehs.ucop.edu/waste/". 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. Details on how-to-use chemicals are included in the appendix of the "Chemical Hygiene Plan", and online training is available at http://ucrlearning.ucr.edu/. Lab safety coordinators make sure that our members follow the appropriate training and handling chemical wastes.

6. Chemicals and Chemical Waste Labels

Once any chemical is removed from its original bottle or container, it has to be labeled with chemical full name and hazard information. Original chemical bottles are to be stored at designated places in room 135, 137, 139, and 143 according to their physical phase and chemical hazardous class. Please note that safety auditor checks unknown chemicals left on benches without proper labels as a chemical waste. Therefore, all chemicals (including water) need to be properly labeled. The labeling must include hazardous information (except in the case of the original bottles, which are already labeled appropriately). Chemical waste containers are placed right next to the fume hood in room 135. Empty bottles for chemical waste and envelopes for waste labels can be found in the lower cabinet. In case of problems with this, ask the lab safety coordinators. 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 and 139 for sharps waste such as needles and broken glass.

7. Responsibility for Individual Equipment

Each system in our laboratory is supervised under the assigned user. If you need to use a system that you're not responsible, 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 best to secure the

help of the operator 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 October of 2014, the major equipment has been assigned to specific users as follows:

UHV Chamber #1 Victor: Bo Chen
UHV Chamber #2 RAIRS: Yang Xu
UHV Chamber #3 Michelle: Xiangdong Qin
UHV Chamber #4 Praxis: Ilkeun Lee
UHV Chamber #5 UC: Clinton Lien
UHV Chamber #6 Nano-Reactor: Ilkeun Lee
FT-IR 1 EQUINOX_Transmission IR: Yang Xu
FT-IR 2 TENSOR_Liquid-Solid Cell: Ilkeun Lee
FT-IR 2 TENSOR_DRIFT IR Cell: Ilkeun Lee
FT-IR 3 TENSOR_Transmission IR Cell: Yufei Ni
FT-IR 3 TENSOR_HATR: Yufei Ni
FT-IR 3 TENSOR_Liquid-Solid Cell: Yufei Ni
FT-IR 4 TENSOR_Ge-ATR: Xiangdong Qin
GC 1 Varian-Batch Reactor: Ilkeun Lee
GC 2 Agilent-Chiral: Tianyi Yu
GC 3 Agilent-High Pressure Reactor: Tianyi Yu
GC 4 HP-UV-Vis Reactor: Ilkeun Lee/Rashed Aleisa
Centrifuge: Ilkeun Lee/Seungjin Lee
BET: Tianyi Yu

8. Responsibility for Common Equipments

Communal equipment also needs to be properly maintained. If broken or in need of service, the person in charge is required to resolve the problem in a timely manner. Users have to keep all instrumentation, especially those for common use, clean.

As of June 2017, responsibility for maintaining the common equipment is distributed as follows:

Fume Hood 1 (135): Seungjin, **Fume Hood 2 (139)**: Junghyun, **Fume Hood 3 (162)**: Tianyi

Users need to stand by fume hood while working with a chemical. No chemicals should be left unattended in the hood (or elsewhere). If a user needs to absence him/herself temporarily while having chemicals in the hood, it is required to leave a warning message with sufficient information about those chemicals for the benefit of other lab 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 long-term storage.

Broken Glass box 1 (135): Seungjin, **Box 2 (137)**: Ilkeun, **Box 3 (139)**: Junghyun

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

Evaporator (135): Tianyi, **Evaporator (139)**: Junghyun

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

Balance (137): Ilkeun

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

Oil Replacing Cart (137): Tianyi

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

Red Tool box (139): Bo/Xiangdong

Users have to return tools to the tool's box 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 Xiangdong, who will keep a record of it. If Xiangdong 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.

Small Bench Tool boxes (139): Clinton

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

Hardware in drawers (139): Xiangdong

Hardware includes copper gaskets, flanges, bolts, clamps, O-rings, and tubes. If you need any of those, consult with Xiangdong. Inventories for these general supplies should be collectively once their stock is low. Report to Xiangdong, so they can place one big order rather that doing this individually for each item.

Computer & Printer (141): Ilkeun

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

Oven (143): Xiangdong

Users need to keep these clean both inside and outside.

For all of you assigned to a particular piece of equipment, write or update the manual for it. The manual needs to be detailed, describing how to power the instrument up, turning it off, and operating it under normal circumstances, and it also needs to describe any needed maintenance. It also needs to list any possible hazards, with what to watch out for and how to handle any possible problems you can foresee. The manual has to be revised at least every six months or every time you make a major change to the equipment.