Zaera’s Lab Safety Instruction
April 2014

1. Laboratory Safety Manual
“Laboratory Safety Manual” is placed with a chemical spill kit, safety face shield in each room under “Lab Safety Manual” sign. “Safety Data Sheets (SDS)” are available in the office computer in room 141. All lab workers are required to review the manual and sign that they understand the contents. Also, every member is asked to keep e-file copies and refer to it whenever needed. The plan includes general laboratory safety rules, maintenance, handling of hazardous waste, and general operating procedures for compressed gases, toxic chemicals (including hydrofluoric acid), and electronic equipment. 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) or contact EH&S. Ilkeun and Xiangdong will work as lab safety coordinators. Every spring 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.

2. Safety Online Training
Safety online training is available in UC Learning Center (uclearning.ucr.edu). The courses needed for Zaera group are as the following, and your training transcript in PDF format has to be submitted to Ilkeun. Additional training may be followed if needed for each member. If there is any missing, please get the training as soon as possible. That is the way that UC and EH&S track our records.

1. Laboratory Safety Orientation (Fundamentals)
2. Laboratory Safety Manual & Chemical Hygiene Plan (CHP)
3. Hazardous Waste Management
4. Fire Extinguishers
5. Injury & Illness Prevention Plan (IIPP)
7. Personal Protective Equipment (PPE)
8. Fume Hood Safety (for fume hood users)
9. Electrical Safety (for vacuum chamber operators)
10. Carcinogen Safety (if applicable)
3. Handling of chemicals from the time of purchasing

Many unknown chemicals and samples have been left by leaving members, without proper labeling or instructions for handling. It is safer and cheaper to have all chemicals properly labeled so everybody can know what all chemicals in our lab are and can 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. Check the chemical inventory first in the office computer if you need a chemical.
2. If we have some, go to the designated place and find the chemical. If a member’s name is listed at the next to the chemical you’re looking for, it is reserved for the member. So, you have to ask the member for availability.
3. Handle the chemical in the fume hood if needed. Make sure that you are familiar with the safety risks of handling the chemical according to its MSDS, and follow appropriate procedure for its handling. Take the quantity required and return the original bottle back to its original place. Empty bottles need to be kept for chemical waste in a cabinet under the chemical waste table.
4. Update your list of the chemicals that are using for your research.
5. If we don’t have the chemical in the laboratory, attempt to find out if it can be obtained from another laboratory at UCR. Many times organic and inorganic research laboratories have large elections of chemicals, and are willing to give us small samples if asked.
6. If not available anywhere, ask one of the lab safety coordinators before placing an order for it. We are using e-Shopping and can place an order below $200 without Francisco’s signature on purchase request forms. Please purchase the minimum amount of chemical possible.
7. Once the purchased chemicals arrive, update your list of chemicals with its MSDS in the office safety computer, and report lab safety coordinators of its addition using the yellow copy of the purchase request form.
8. Always store all chemicals in the designated place in room 135. Always consult with the lab safety coordinators.
9. If you produce chemical waste, find a proper chemical waste bottle already available in our lab for its disposal. If no appropriate waste disposal bottle is available, 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.
10. Log in to the On-line Hazardous Waste Tag Program (OTP) and create a tag for the waste disposal bottle.
11. Print the tag and put it into an envelope.
12. Place the chemical waste bottle in the second basket after attaching the label on it.
13. You may keep using the same waste bottle for the same chemical and other comparable chemicals for the period of time allowed by EH&S.

14. You must request chemical waste pick-up in OTP if the waste bottle is close to 80% full or older than 180 days (even if it is less than 80% full).

Usually, the Safety Data Sheets (SDS) come with the chemicals purchased. However, this is sometimes not the case with common chemicals. Electronic versions of PDF files are usually available from the website of the chemical company. They may also be already saved in electronic form on the office computer, also to be referred to when a member creates an online tag for hazardous information. Otherwise, MSDS documents may be printed, although this should be minimized to avoid generating excessive paper waste. In any case, the chemical inventory for each member and the MSDS information needs to be updated immediately once a new chemical is purchased or brought to the laboratory, so other member can handle it properly if needed.

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

Every member is required to be trained for the handling of the chemical waste that may be produced in the course of his/her experiments, and needs to be familiar with the On-line Hazardous Waste Tag Program (OTP) at “http://otp.ucop.edu/”. This program was developed for the labeling and disposal of hazardous waste at many UC campuses. The username for our laboratory is “zaera”, the password “4769Zaera”. Details on how-to-use chemicals are included in the appendix of the “Chemical Hygiene Plan”, and online training is available at http://www.ehs.ucr.edu/training/online/. The topics covered there topics include generating, printing, and submitting a waste pickup request. Lab safety coordinators will check that our present and future members follow the appropriate training (Laboratory Safety Orientation, Chemical Hygiene, and Hazardous Waste Management).

5. Chemicals and Chemical Waste Labels

Once any chemical is removed from its original bottle or container, it needs to be stored, with a UCR label, in room 135. Original chemical bottles are to be stored at designated places in room 135 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 a bottle for sharps waste such as needles and broken glass.

6. Responsibility for Individual Equipment

Each system in our laboratory is operated by the assigned user. If someone needs to use someone else's system, prior permission from the person responsible is required. After securing permission, acquire a copy of the appropriate User Guide or Manual from the person in charge or from Prof. Zaera, and become familiar with it. It is best to secure the help of the operator as well. Each user is required to update the Manual of the system under his/her supervision, with proper illustrations, whenever any changes are made.

As of December of 2012, the major equipment has been assigned to specific users as follows:

- **UHV Chamber #1 Victor**: Xiangdong
- **UHV Chamber #2 RAIRS**: Juan
- **UHV Chamber #3 Michelle**: Xiangdong
- **UHV Chamber #4 Praxis**: Stavros
- **UHV Chamber #5 UC**: Clinton, Huaxing
- **UHV Chamber #6 Nano-Reactor**: Yujung
- **FT-IR 1 EQUINOX_Transmission IR**: Juan
- **FT-IR 2 TENSOR_Liquid-Solid Cell**: Ilkeun
- **FT-IR 2 TENSOR_DRIFT IR Cell**: Ilkeun
- **FT-IR 3 TENSOR_Transmission IR Cell**: Yang
- **FT-IR 3 TENSOR_HATR**: Yufei
- **FT-IR 3 TENSOR_Liquid-Solid Cell**: Yufei
- **FT-IR 4 TENSOR_Ge-ATR**: Lei
- **GC 1 Varian-Batch Reactor**: Ilkeun
- **GC 2 Agilent-Chiral**: Zhihuan
- **GC 3 Agilent-High Pressure Reactor**: Zhihuan
- **GC 4 HP-UV-Vis Reactor**: Yoon Jae
- **Centrifuge**: Ilkeun, Yoon Jae
- **BET**: Zhihuan & Ilkeun

7. 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. Each member has to keep all instrumentation, especially those for common use, clean.
As of December 2012, responsibility for maintaining the common equipment is distributed as follows:

**Fume Hood 1 (135):** Ilkeun, **Fume Hood 2 (139):** Junghyun, **Fume Hood 3 (162):** Zhihuan  
Members need to stand by fume hood while working with a chemical. No chemicals should be left unattended in the hood (or elsewhere). If the user needs to absence him/herself temporarily while having chemicals in the hood, they are required to leave a warning message with sufficient information about those chemicals for the benefit of other lab members. Clean your space after use and put the chemical bottles back in their original place after finishing. Don’t leave any of your stuff in the hood for long-term storage.

**Balance (137):** Ilkeun  
A brief instruction is posted on the yellow cabinet. Review it before using the balance. The balance is tuned automatically.

**Oven (143):** Xiangdong  
Members need to keep these clean both inside and outside.

**Broken Glass box 1 (135):** Yang, **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):** Zhihuan, **Evaporator (139):** Junghyun  
Re-trapped solvents need to be treated as chemical waste immediately. Members are required to wash the adapter after use.

**Oil Replacing Cart (137):** Stavros  
Members need to keep the space clean to avoid making it slippery.

**Red Tool box (139):** Xiangdong  
Members need 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 another group asks to borrow one of our tools, report the details to Qiang, who will keep a record of it. If Qiang is not 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):** Huaxing, Clinton  
Members 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): Huaxing & Xiangdong

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

8. Standard Operating Procedures

Every time you purchase a new chemical, please research the best practice for its handling and draft a version of an SOP for it, taking into account the particular way in which you plan to use it (quantity, etc.). Give that to Ilkeun for further editing, so we can get the final version on the books. There are several resources to help you with this, both on the web and from EH&S. You can consult with Ilkeun, but I would like you to be the first to draft the SOP, since you will be the one using the chemical.

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.

9. 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

1. Introduction
2. Injury and Illness Prevention Plan
3. Chemical Hygiene Plan
4. Standard Operation Procedures (only General Lab, Hazard Classes, Processes)
5. PPE Hazard Assessment
If your UCR Net ID is available, you have total 8 online training to take on the UC learning center website (http://ucrlearning.ucr.edu). Log in with your Net ID, and search the courses with the keyword or title. You have to take final quiz at the end of each course, and please make your transcript in pdf format, which is available with an option in the system, for Ilkeun

1. Laboratory Safety Orientation
2. Laboratory Safety Manual & Chemical Hygiene Plan
3. Hazardous Waste Management
4. Injury & Illness Prevention Plan (IIPP)
5. Personal Protective Equipment
6. Fire Extinguishers
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 have to finish all of them first before you start your work in our group.