CATINO GROUP MANUAL

Updated 12/12/15

Guidelines and Procedures

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University of Scranton

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1. REASEARCH AUTHORIZATION

1.1. Prior to joining the Catino Group, students **MUST** complete the following forms and submit them to the Chemistry Stockroom for approval.

a. Department of Chemistry Research Authorization Form: https://www.scranton.edu/academics/cas/chemistry/forms/research-authorization.pdf

b. Safety Acknowledgement Form at: https://www.scranton.edu/academics/cas/chemistry/forms/SafetyAcknowledgement-2013.pdf

1.2. Students **MUST** print, read, and adhere to the following protocols regarding safety, waste, and working hours:

a. Chemistry Department Laboratory Safety & Protocol Manual: https://www.scranton.edu/academics/cas/chemistry/forms/LabSafetyManual-2014.pdf

b. Hazardous Waste Guidelines: https://www.scranton.edu/academics/cas/chemistry/forms/HazWaste%20Guidelines.pdf

c. Chemistry Department Laboratory Hours: https://www.scranton.edu/academics/cas/chemistry/forms/Research%20Hours.pdf

1.3. Research activity will commence only when the student and Dr. Catino receive written notification from the stockroom that the Research Authorization Form has been approved.

2. LABORATORY SAFETY

2.1. Laboratory goggles or approved safety glasses **MUST** be worn at all times in the research lab. There are no exceptions. Goggles and/or face shield are required for any experiment or purification where there is a potential splash danger.

2.2. Appropriate clothing **MUST** be worn at all times in the research lab. Pants and close-toed shoes are always required.

2.3. Lab coats are required in the research lab. Lab coats should always be hung on the designated hooks in the laboratory. They are not to be hung on the knobs attached to the hoods or hung over chairs in the write-up area outside of the laboratory.

2.4. Gloves are never to be worn outside of the research laboratory. Gloves must be removed before returning to the write-up room or going to the analytical lab. Gloves can be reused if they are not contaminated. Carefully remove them and place them on your bench for reuse. Discard gloves after using a toxic reagent or if you suspect any chance of contamination.

2.5. Cell phones are to be **TURNED OFF** or **SILENCED** while working in the research laboratory. Research in organic chemistry requires concentration and attention to your surroundings. Talking on the phone, sending text messages, or looking at social media are distractions that can lead to an accident or injury. These actions are permitted in the write-up room.

2.6. Talking to someone who is setting up a reaction, doing a work-up, or performing a purification can be distracting and can lead to an accident or injury. Use your judgment if you see someone performing these tasks and refrain from conversation until they have been completed.

2.7. Playing music in the laboratory requires permission from anyone sharing the laboratory space with you and must be kept at a low volume. Listening to music with headphones or ear-buds is not permitteds.

2.8. Know where **ALL** safety equipment is located in the research laboratory. This includes eyewashes, safety showers, fire extinguishers, first-aide kits, and phones. Any incident that requires the use of this equipment must be reported to Dr. Catino immediately.

2.9. Know the reagents that you plan to use in the research laboratory by consulting the MSDS. Know the toxicity, flammability, ignitability, reactivity, and corrosivity of the reagent you plan to use.

2.10. In the event of a spill of a toxic reagent, do **NOT** attempt to clean it up. Evacuate the area and report it immediately to Dr. Catino.

2.11. An open flame (e.g. a propane torch or Bunsen burner) is not permitted on the bench top in the research laboratory.

2.12. Nothing should be stored on the lab floors other than lab stools, trash cans, gas cylinders (braced to a wall or countertop), and broken glass bins.

2.13. Bottles of reagents that are not in shipping packaging must be transported from the stockroom to the lab on either a cart or in plastic carriers for secondary containment.

2.14. Try not to work alone (especially in the evenings) in the research laboratory. This is particularly true if you are performing a new reaction or doing a large scale-up with reactive materials (i.e., strong oxidants or reductants).

a. Working after hours (from 10:00 PM to 7:00 AM) is prohibited unless you are working with Dr. Catino.

2.15. Food or beverages are **NEVER** to be consumed in the laboratory. They are permitted in the write-up room. Alcoholic beverages are **NEVER** to be consumed inside the laboratory or the write-up room.

2.16. All group members must have Dr. Catino's semester schedule as well as his office and cell phone number.

3.1. FUME HOODS

Description of Process

A fume hood minimizes exposure to hazardous vapors (toxic, corrosive, stench) created from research activities/experiments.

Minimal Personal Protective Equipment (PPE)

1. Safety glasses or goggles
2. Lab coat
3. Gloves

Training

1. Upon joining the group

Preparation

1. Read the MSDS of any chemical(s) that you plan to use in the hood and understand the associated risks.
2. Make sure that the hood is operational before use by checking the monitor in the upper right corner.
    a. If the fume hood is not working or malfunctioning, do NOT attempt to use it. Post a sign indicating that the hood is out of order and report the problem to Dr. Catino.

Procedure

1. With the sash at the lowest position possible, open the windows of the hood by sliding them horizontally.
2. Place containers or equipment inside.
3. Never stick your head inside of a hood that contains chemicals or an ongoing experiment.
4. Close all windows when you finish dispensing chemicals or setting up equipment.
5. If a spill should occur, assess the situation. If there is minimal danger, attempt to contain the spill at the source. Evacuate the laboratory if necessary.
    a. Depress the Emergency button on the hood to increase the flow velocity if necessary.
6. Remove all containers and/or equipment from the hood after using them and return them to the appropriate storage locations or drawers.
    a. The hood is not a long-term storage location for chemicals or waste.
    b. Keep the fume hoods clean and free of clutter.
7. Always keep the windows of the hood closed and the sash in the lowest possible position to reduce energy consumption.

3.2. VACUUM MANIFOLD

Description of Process

A vacuum manifold (Schlenk line) is a piece of glassware connected to a vacuum pump that is primarily used in this group to remove trace amounts of solvent present in samples. It serves other functions as well that are not part of this procedure.

Minimal Personal Protective Equipment (PPE)

1. Safety glasses or goggles
2. Lab coat

Training

1. Upon joining the group
2. Annual retraining during the first week of Intersession

Preparation

1. Inspect your flask for any cracks.
2. (optional) Fill the dewar containing the trap with crushed dry ice. Then slowly add acetone to cover the dry ice.
3. Make sure that a valve is open on the manifold (the black part of the valve should point down). Turn on the vacuum pump and then close the valve. You will initially hear a gurgling noise that will disappear after a few seconds. If the noise does not disappear, check to make sure that all the valves are closed. Additionally, check the oil level on the pump. If the oil level is below the operational level, open a valve on the manifold, turn off the pump, and report the problem to Dr. Catino.

Procedure

1. Attach a vacuum adaptor to the round bottom flask (RBF) that contains your sample. Do not use grease as it could contaminate your sample.
2. Attach the vacuum tubing from the manifold to the vacuum adaptor and clamp the neck of the flask to a ring stand or monkey bar.
3. Open the valve on the manifold to which the flask is attached (the black part of the valve should point down).
4. Allow the sample to remain under vacuum until all the solvent has been removed.
    a. All the solvent has been removed when the combined mass of the flask and sample remain constant under vacuum.
5. To remove the flask, close the valve on the manifold and remove the hosing from the vacuum adaptor (you will hear the vacuum being released). Then remove the vacuum adaptor.
    a. If the sample begins to bump violently, immediately close the valve on the manifold, remove the hosing, and return the flask to the rotovap.

3.3. ROTARY EVAPORATORS

Description of Process

The rotary evaporator (rotovap) is a device for removing volatile organic solvents using vacuum, heat, and rotation.

Minimal Personal Protective Equipment

1. Safety glasses or goggles
2. Lab coat
3. Gloves

Training

1. Upon joining the group
2. Annual retraining during the first week of Intersession
3. User must understand waste disposal policies (cf. Section 3.0)

Preparation

1. Turn on the chiller (already set to 0 ^{o}C) and plug in the circulating pump.
2. Make sure that the round bottom flask (RBF) containing your sample is at least twice the volume of the amount of solvent being removed.
3. Turn on the rotovap water bath and set the temperature to 40 ^{o}C.
4. Turn on the vacuum pump and then close the valve between the pump and the rotovap. The valve is closed when it is in a horizontal position.

Procedure

1. Connect the appropriate bump trap to the rotovap and clip it into place (do NOT use Keck clips).
2. Attach the RBF to the bump flask and secure it using a Keck clip.
3. Carefully lower the flask into the water bath until the flask is halfway submerged.
4. Turn on the rotation to spin the flask.
5. Close the valve at the top of the condenser on the rotovap.
6. Watching the solvent in the RBF, slowly open the valve connecting the pump to the rotovap. Stop when you see the solvent beginning to bubble. The valve can be left at that position until the solvent has been removed.
7. Once all the solvent has been removed, close the valve between the pump and rotovap, open the valve at the top of the condenser (you will hear the vacuum dissipate), turn off the rotation, raise the flask from the water bath, remove the flask, and then remove the bump trap IN THAT ORDER. Note that the order of operations is exactly opposite to the steps in the set-up.
8. Rinse the bump trap with acetone (if necessary) and dispose of the condensed solvent in the appropriate waste container (non-halogenated or halogenated).

3.4. SOLVENT STILLS

Description of Process

A solvent still is an apparatus used to remove water from a solvent by reaction with an appropriate desiccant and subsequent distillation. Tetrahydrofuran (THF) and dichloromethane (DCM) stills are used in this laboratory.

Minimal Personal Protective Equipment

1. Safety glasses or goggles
2. Lab coat
3. Gloves

Training

1. Upon joining the group
2. Annual retraining during the first week of Intersession

Preparation

1. Initial the sign up sheet next to the still and put the date and time.
2. Turn on the water attached to the condenser. Make sure the nitrogen is on by viewing the bubbler (there should always be nitrogen bubbling even when the still is not in use). Make sure the valve between the collection flask and distillation pot is open.
3. Turn the dial on the Variac to the voltage indicated for reflux. It will take approximately 20 minutes for the solvent to begin dripping from the condenser.
4. Remove a stainless steel needle (12 inch) and syringe from the oven and place it into the desiccator to cool. After they have cooled, connect them together by twisting the needle onto the tip of the syringe.

Procedure

1. Close the valve between the collection flask and the distillation pot.
2. Collect the appropriate amount of THF or DCM and then turn off the Variac.
3. Using a dried syringe and stainless steel needle (12 inch), insert the needle into the septum on the collection flask and place it below the surface of the solvent.
4. Holding the needle and syringe together, slowly pull back the plunger drawing about 2 mL of solvent into the syringe.
5. Remove the syringe from the still and discharge the contents into the appropriate waste container.
6. Repeat steps 3-5 to rinse the syringe.
7. Holding the needle and syringe together, slowly pull back the plunger drawing in your desired amount of solvent. Afterward, lift the needle above the surface of the solvent and pull back the plunger drawing in some of the nitrogen.

8. Remove the syringe by holding the needle and pulling backward. Once removed place the needle tip into a Teflon cork until needed.
9. Open the valve between the collection flask and the distillation pot to drain the distilled solvent back into the still pot.
10. Turn off the water running to the condenser and mark the sign up sheet that you have finished using the still.

3.5. CHEMICAL REFRIDGERATOR

Description of Process

The chemical refrigerator is used to store chemicals or research samples that might degrade or decompose at room temperature.

Minimal Personal Protective Equipment (PPE)

1. Safety glasses or goggles
2. Lab coat
3. Gloves

Training

1. Upon joining the group

Preparation

1. Read the MSDS of a chemical(s) to determine if refrigeration is necessary. Also consult the label of the bottle itself for storage conditions.
2. Research samples that require refrigeration must be capped (septum or Teflon stopper), parafilmed, and labeled with a string tag.
3. Labels for research samples **MUST** have the following information:
    a. Write the full name of compound (if it has an MSDS)
    b. Draw the structure of the compound.
    c. Write the notebook page from which the compound was prepared (e.g. AJC-I-023).
    d. Include any associated hazards on the label.

Procedure

1. Always open the door of the refrigerator carefully as there may be samples on the inside door that can be jolted loose and/or fall.
2. Place bottles or samples in the area designated for the Catino Group. Bottles that have been previously opened (e.g. SureSeal) should have additional parafilm around the cap. Small round bottom flasks (RBFs) are be placed inside of egg-cartons and large RBFs should be placed on cork rings.

Inspection

1. The refrigerator will be periodically inspected by Dr. Catino. Reagents or samples not in accordance with these instructions will be brought to the attention of the specific group member.

3.6. CLEANING GLASSWARE

Description of Process

Cleaning glassware is one of the most important operations in a research group. It is absolutely essential that it be performed correctly so that contaminants are completely removed.

Minimal Personal Protective Equipment (PPE)

1. Safety glasses or goggles (preferred)
2. Lab coat
3. Gloves

Training

1. Upon joining the group
2. User must understand waste disposal policies

Preparation

1. All soiled glassware, syringes, needles, and NMR tubes must be rinsed out with acetone into the appropriate waste container **AT THE HOOD**.
2. Once rinsed with acetone, glassware, syringes, and needles can be placed into the grey DIRTY GLASSWARE BIN to the left of the sink until the end of the day.

General Procedure

1. Scrub the inside and outside of the glassware with a brush and soapy water to remove salts and other water-soluble residues.
2. Rinse the glassware with warm water at least three times to remove all the soap.
3. Finally rinse the inside and outside of the glassware with a small amount of acetone and place on the drying rack.
4. If the glassware is still visibly dirty after this procedure, soak it in the base bath (cf. procedure 2.7)

Procedure for Fritted Filter Funnels

1. Scrub the inside and outside of the funnel with a brush and soapy water to remove salts and other water-soluble residues.
2. Rinse the funnel with warm water at least three times to remove all the soap. Make sure to allow the water to drip through the frit.
3. Rinse the inside and outside of the funnel with a small amount of acetone. Be sure to allow some acetone to drip through the frit.
4. Finally, invert the funnel and spray acetone into the frit until the camber is completely full. Place into the paper-towel lined bin to the right of the sink and all

the acetone to slowly seep through the funnel. Allow the funnel to remain there overnight before returning it to the appropriate drawer.

5. If there is any colored material in the frit after this procedure, return the funnel to the DIRTY GLASSWARE BIN and ask Dr. Catino for further instructions.

Procedure for Stainless Steal Needles

1. All stainless steel needles **MUST** be cleaned immediately after use as salt residues can cause clogs that are difficult to remove.
2. Rinse out the needle with acetone into the appropriate waste container at the hood.
    a. If you used the needle for a reactive organometallic compound (or any compound that reacts with water), the needle must first be rinsed with hexanes, then ethanol, then acetone. This is best accomplished with the syringe attached and pulling up a few milliliters of each. Discharge the contents into a small beaker containing ethanol to quench any unreacted compound in the needle.
3. Once the needle has been rinsed with acetone, it can be placed into the DIRTY GLASSWARE BIN until the end of the day.
4. To clean the needle for the re-use, use a water squirt bottle and rinse the needle with several milliliters of water.
    a. If you are unable to squirt water through the needle, place the needle into the small sonicator next to the sink.
5. Rinse with acetone and allow the needle to sit in the drying bin (to right of the sink) for at least 12 hours. **Never** place a freshly rinsed needle with acetone into the oven.
6. Finally return the needle to the appropriate beaker in the oven.

Procedure for NMR Tubes

1. All NMR tubes **MUST** be cleaned immediately after use.
2. Rinse out the NMR tube into the appropriate waste container using an acetone squirt bottle.
3. Once the NMR tube has been rinsed with acetone, it can be placed in the DIRTY GLASSWARE BIN until the end of the day.
4. To clean the NMR tube for re-use, use a water squirt bottle and rinse the tube by filling it and pouring it out, then repeat twice with acetone.
5. Rinse with acetone and allow the NMR tubes to sit in the drying bin (to right of the sink) for at least 1 hr. **Never** place a freshly rinsed NMR tubes with acetone in the oven.
6. Place the NMR tubes into the appropriate beaker in the oven and allow to dry for no longer than 1 hr. Afterward, transfer the dried tubes to the desiccator for storage.

3.7. BASE BATH

Description of Process

A base bath is a concentrated solution of potassium hydroxide (KOH) in isopropanol. It is used to clean glassware that cannot be cleaned by conventional means (e.g. water, acetone, scrubbing). The base bath is located below the sink in a yellow bucket.

Minimal Personal Protective Equipment (PPE)

1. Safety goggles
2. Lab coat
3. Neoprene gloves with long cuffs

Training

1. Upon joining the group

Preparation

1. All soiled glassware must be rinsed out with acetone into the organic waste.
2. Wash with water and detergent. Scrub if necessary and rinse with several times with water.

Procedure

1. Using the tongs that are on top of the base bath, gently lower the glassware into the bath being sure to allow the solution to completely fill the glassware.
2. Allow the glassware to remain in the solution for several hours or overnight.
    a. It is important to remove glassware after this time as it can be etched from prolonged exposure to base.
3. Wearing the minimal PPE, remove the glassware from the base bath using tongs. Be sure to allow as much of the solution as possible to drain back into the bucket.
4. Rinse the solution from the glassware using tap water.
5. Rinse with acetone and place on the drying rack.

Inspection

1. The base bath will be periodically inspected by Dr. Catino. Glassware that has been left in the bath for prolonged periods of time will be brought to the attention of the appropriate group member.

3.8. DRYING OVEN/DESSICATORS

Description of Process

The drying oven (100 ^{o}C) is used to dry glassware, syringes, and needles for use in chemical reactions. Molecular sieves are also stored in the oven. The desiccator to the right of the oven is used for allowing hot glassware (specifically syringes and needles) and sieves to cool prior to use.

Minimal Personal Protective Equipment (PPE)

1. Safety glasses or goggles
2. Lab coat
3. Cotton-backed work gloves (next to oven)

Training

1. Upon joining the group

Preparation

1. All glassware must be washed, rinsed with acetone, and allowed to dry on the drying rack or bin for at least 15 minutes (cf. Section 2.7).
2. Stainless steel needles must be rinsed with acetone and allowed to sit in the drying bin (to right of the sink) for at least 12 hours (cf. Section 2.7).

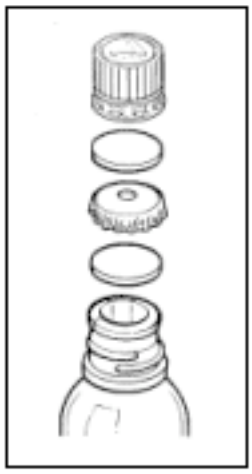
Procedure

1. Place glassware in the oven being mindful that round items tend to roll.
    a. Stainless steal needles are to be placed with the needle pointing up in the appropriate beakers.
    b. Syringes and plungers are to be placed in the appropriate beakers and allowed to dry for no longer than 48 hrs.
    c. NMR tubes are to be placed in the appropriate beaker and allowed to dry for no longer than 24 hrs. After this time, the NMR tubes are to be transferred to the appropriate desiccator.
2. Chemicals of any kind are **NOT** permitted in the drying oven (only molecular sieves are permitted).
3. Solvents (bottles or squirt bottles) or chemicals are never to be placed on or near the drying oven.

3.9. SURE/SEAL™ BOTTLES

Description of Process

Sure/Seal™ Bottles are used to store liquid reagents that are moisture and/or oxygen sensitive. The reagents in Sure/Seal bottles often react violently with water and/or air. They require a needle/syringe and an inert gas (nitrogen) to be dispensed. A schematic of the bottle assembly and cap is shown below.



Minimal Personal Protective Equipment (PPE)

1. Safety goggles
2. Lab coat
3. Gloves

Training

1. Upon joining the group
2. Annual retraining during the first week of Intersession
3. **Permission from Dr. Catino each time you plan to use a Sure/Seal™ Bottle.**

Preparation

1. Read the MSDS of the chemical that you plan to use and understand the associated risks.
2. Sure/Seal™ bottles **MUST** be used in the hood under a nitrogen atmosphere.
3. The flowing safety equipment **MUST** be in place prior to working with a Sure/Seal™ bottle:
    a. An appropriate fire extinguisher (required)
    b. An eyewash station (required)
    c. A safety shower (required)
    d. A safety shield (recommended)

4. The syringe and needle used to withdrawal sample from a Sure/Seal™ bottle **MUST** be dried in the oven and cooled in the desiccator prior to use.

Procedure

1. Clamp the Sure/Seal™ bottle to a ring stand to ensure that it does not move.
2. Turn on the nitrogen gas manifold and remove a nitrogen needle from the Teflon stopper. Make sure that you can feel nitrogen flowing through the needle.
3. Open the screw cap lid and insert the nitrogen needle into the septum making sure that the needle is above the surface of the liquid.
4. Insert the needle of your syringe into the septum and below the surface of the liquid.
5. Holding the needle and syringe together carefully pull back the plunger drawing chemical into the syringe as shown in the picture below.

6. After you have obtained your desired amount, holding the needle lift it above the surface of the chemical and pull back the plunger drawing in some of the nitrogen atmosphere.
    a. Be careful not to pull the plunger too far back so as to separate it from the syringe.
7. Remove the syringe by holding the needle and pulling it upward.
8. Immediately place the needle into the septum of your reaction or into a Teflon stopper.
9. Remove the nitrogen line from the Sure/Seal™ bottle.
10. There will be two holes created by the needles that pierced the septum of the Sure/Seal™ bottle. Place a small piece of Teflon tape over the holes and screw the cap back on.
11. Finally wrap the outside of the bottle with parafilm and return it to the appropriate location.
    a. If you are the first person to use a reagent in a Sure/Seal™ bottle, it must be dated, initialed, and marked “in service.”

4.0 WASTE DISPOSAL

4.1. The University of Scranton is subject to various state, federal, and local requirements regarding the disposal of chemical waste.

4.2. All group members must read and adhere to the Hazardous Waste Guidelines for the Department of Chemistry at the University of Scranton found at: https://www.scranton.edu/academics/cas/chemistry/forms/HazWaste%20Guidelines.pdf

4.3. The hazardous waste generated in this lab is primarily liquid waste that is segregated into the following classes:

a. General Organic Waste (hexanes, ethylacetate, acetone, etc.)
b. General Halogenated Waste (dichloromethane, chloroform, etc)
c. Aqueous Wash Waste (water, acetone, ethanol, etc)
d. Aqueous Acid Waste
e. Aqueous Base Waste

4.4. The general organic, general halogenated, and aqueous acid & base waste containers are kept in the fume hoods. The aqueous wash waste is kept near the sink.

4.5. A yellow bucket for solid waste (used silica gel, magnesium sulfate, etc) is kept under the rotovaps.

4.6. Every waste container **MUST** be capped and labeled as follows:

a. The class of waste (e.g. general halogenated waste)
b. The full names of **ALL** the liquids inside the waste container (no abbreviations or structures)
c. The start date that the waste container was put into service
d. The end date that the waste container was removed from the laboratory and taken down to the Chemistry Stockroom.
e. The full name of the person generating the waste and the research group (e.g. John Smith/Catino Group).

4.7. Additional packing tape **MUST** be used to adhere waste labels to each bottle.

4.8. Each hood is equipped with a red “sharps” container. This is only to be used for disposable needles. Disposable plastic syringes of various sizes are to be rinsed with acetone, dried, dissembled (pull plungers out) and disposed of in the trash.

4.9. Each hood a glass waste container next to it for disposable Pasteur pipettes, test tubes, broken glassware, TLC plates, etc.

a. Only items that have been cleaned with acetone or an appropriate solvent (e.g. ethanol) can be discarded into the glass waste container.
b. Do **NOT** put used/emptied reagent bottles into the glass waste. They are to be washed, dried, and placed in the appropriate drawer for reuse.

5.0 GENERAL

5.1. Any prolonged absence from the lab must be reported to Dr. Catino.

5.2. Each member is required to use CambridgeSoft E-Notebook on the group computer in the write-up room. Traditional notebooks are **NOT** permitted.

a. Each member will receive training upon joining. For the first 5 notebook pages, approval is required from Dr. Catino to proceed in the lab.

b. Each notebook page **MUST** be printed and placed into a 3-ring binder. Any information associated with that notebook page is then to be paper-clipped to that page.

c. All research samples and spectral data must have the associated notebook page written on it for reference (e.g. AJC-I-054).

5.3. Group members are expected to be good lab citizens. If you use up a particular reagent or consumable, please go to the Chemistry Stockroom to get more. This often includes acetone, solvents (e.g. hexanes, ethyl acetate, dichloromethane), and disposable test tubes.

5.4. The last person to leave the laboratory is required to check the following:

a. Close all sashes/windows to the fume hoods and turn off the lights.
b. Turn off the rotovaps and chiller/circulating pump (cf. Section 2.3).
c. Turn off any vacuum pump (cf. Section 2.2)
d. Check each solvent still to make sure that heating has been turned off and condenser water has been turned off (cf. Section 2.4).

6.0. TRAINING CONFIRMATION

Student Acknowledgment

By signing below, I agree that I have read and understood the Catino Group Manual. I agree to follow the Operating Procedures in this manual. I understand that sanctions will be imposed if I do not abide by the rules and procedures outlined in this manual.

Student Name (printed) _____

Student Signature _____ Date _____

Advisor Acknowledgement

By signing below, I certify that the student listed above has received the training outlined in this manual.

Arthur J. Catino, PhD _____ Date _____