Updated 08/09/2010

1. Use of chemicals

Highlights:

- Each coworker must have access to the material safety data sheets of his (her) own commercial products and must know how to read it.

- It is forbidden to use simultaneously a workplace for storage and for an experiment. (Exemple : a fume hood cannot be a storage place and a place for synthesis).

- The use of carbon tetrachloride is forbidden. The use of benzene requires an authorization if no other solvent can replace it.

- No more than 100 litres can be stored by laboratory (including wastes) in ventilated safety cabinet.

- This is forbidden to store alkali metals and their alloys. A small reserve is available at the chemical shop.

- **Hydrides, silanes, phosphorus, phosphines, nickel Raney, platinum on carbon** and other spontaneously flammable compounds are stocked in suitable flasks (ex. Dessociator) and, if necessary under inert atmosphere or appropriate liquid. **Avoid triethoxysilane**.

- A rule of thumb is that when you use potentially explosive/flammable chemicals, use a small quantity (mg scale). Don't try large reactions before you discuss with HU.

- All chemical reactions must be performed under a hood, even when considered harmless.

Common Explosion Hazards

1.1. Oxidants in combination with organics can lead to violent exotherms/explosions. Before disposing of large amounts, think of what it may react with and when in doubt place in a separate waste container. Oxidants (e.g., bleach, Cr^{VI} and Mn^{VII} salts, hypervalent iodine reagents, H_2O_2, etc) should be placed in separate waste from organic reagents/solvents. **H_2O_2 explodes when it is dried. Only use in H_2O_2 in water; never try to evaporate a reaction mixture in contact with H_2O_2.**

1.2. Oxidizing acids (e.g., nitric acid and aqua regia) can react extremely violently with organics (especially acetone), and the resulting explosions/release of corrosive solutions can lead to serious injury. Acids should always be stored in a **separate location** from organic chemicals. Additionally, waste bottles for acids should be clearly marked and placed in a **separate location** from organic waste. This will prevent mistakenly pouring acid waste in with organics (which is the most common cause of this type of explosion). **Aqua regia should not be used by students who have not be trained by the group safety officers on proper precautions for usage and disposal.**

1.3. Perchlorate salts can explode without warning, especially when concentrated in the presence of organics (once again, ClO_4 is a strong oxidant!). Always use a blast shield when

concentrating mixtures containing these salts and **avoid the use of the ClO_4 counter** anion whenever possible.

1.4. Metallic lithium/Al/Cs should **never** be placed in N_2 filled dry boxes or under a nitrogen atmosphere on your line. A violent and highly exothermic reaction will result from spontaneous "Li_3N" formation.

1.5. Remember that something as common as flash chromatography columns are run under high pressure and can crack/explode unexpectedly.

1.6. The condensation of liquid O_2, liquid N_2 and solid Ar in traps on your vacuum line can lead to explosions. See the vacuum line safety section for further details.

1.7. **Be careful with azides.** Azides can explode under turbulence. When you collect azides from a frit, do not scratch the wall or bottom of the frit to get more products. Scratching may lead to explosion. If you have to work with azides, use small amounts. Never heat an azide unless it is dissolved in solution. Be careful not to let all the solvent evaporate. Do not heat to high temperature. Let HU know if you need to work with azides.

NaN_3 is not compatible with certain heavy metals; It reacts with acid to form hydrazoic acid. Be careful.

NaN_3 reacts with halogenated solvents to form explosive diazomethane. Never use NaN3 in chlorinated solvents.

1.8. **Be careful with tert-BuLi.** Avoid it if you can. If you cannot, let HU know before you use it. In principle, you can only use it in the glove box. Tert-BuLi burns violently when encountering air. **Do not use tert-BuLi in THF and ether. It burns.**

1.9. Pyrolytic materials: follow recommendation of Aldrich Bulletin Al-134 (also on our website, the research page).

1.10. **Pd over Carbon catalysts** are known to be flammable. So it is normal if one sees fire when working reaction up. This is probably why some people use Pd/C that contains water. Water is compatible with this catalyst. So when you do hydrogenation reaction using Pd/C, be cautious. I think Heron and Oleg have some protocols for how to handle this situation. Pd/C with methanol is a dangerous combination, so should be avoided. With EtOH might be work. In any case, make sure you are aware of the danger and be ready for any small fire. In particular, work in the hood where there are no other flammable materials nearby (such as solvents, reagents). Have quick access to water to put out a small fire.

Toxicity Hazards

• Thallium salts (e.g., TlOEt).
• Alkyl mercury salts (e.g., HgMe2). **Warning: never use HgMe2.**
• Tin reagents (especially tetra-alkyl or tri-alkyl aryl Sn compounds).
• Alkylating agents (e.g., MeI).
• Be careful with sulfur containing molecules as they can be quite smelly! **Never use thioaceton!**

I. Exercise extreme caution when using these reagents!! Clean up spills in your hood and in public areas (balances, dry boxes, etc) immediately using appropriate procedures, and dispose of cleaning supplies/gloves in solid waste containers beneath the hood (to avoid fume inhalation).
II. Dispose of gloves (in solid waste container beneath the hood) whenever you may have come in contact with these reagents.
III. (i) dispose of all contaminated waste in a separate Ziploc bag before removing it from the box, and (ii) purge the box after the use of these compounds (and before opening the antechamber).

2. Forbidden unattended experiments

- It is forbidden to leave unattended an experiment if :
° use of toxic gas, like CO, phosgene, phsophines, chlorine
° very exothermic reaction as diazotation, Grignard, hydrogenation, nitration, etc.
° manipulation of alkali metals.
° prepare a reaction in autoclave.
° manipulation of flammable solvents in opened system.