

Appendix K

Chemical Inventory Guide

What is a chemical inventory?

A chemical inventory is an overview of all chemical substances and mixtures (including gas cylinders) used in a laboratory.

A complete chemical inventory includes

- Product name of each chemical,
- Amount of each chemical,
- Type of container it is stored in,
- Date the chemical was received,
- Location of the chemical,
- Specific storage area of the chemical,
- The name of the owner.

Some other items a chemical inventory might include

- If a chemical was moved or borrowed,
- When a chemical was received and opened,
- When a peroxide former was last tested,
- And discard date.

Each laboratory is required to maintain an updated and current chemical inventory.

Why is a chemical inventory important?

There are a few reasons as to why a chemical inventory is important.

- Ensure compliance with storage limits and fire regulations,
- Used in emergency situations to identify potential hazards for emergency response operations
 - Without a chemical inventory on hand, emergency responders cannot assess the situation and respond safely for themselves, and everyone present
 - See this story about a [UC Irvine lab](#). The responders decided it was safer to let the fire burn out instead since they did not know what was in the lab.
- *Your chemistry will be easier!*
 - Having an accurate and updated inventory will allow you to know what chemicals you have in your lab and how you can easily find them.

Who is responsible?

The responsibility of a chemical inventory ultimately lies with your principal investigator or laboratory supervisor.

HOWEVER, everyone that works in the lab is responsible for the upkeep and reconciliation of the chemical inventory.

Although a chemical inventory can at first be daunting to start and keep up with, it can be quite easy to maintain if certain steps are taken.

So where do we start?

Starting a chemical inventory can be a HUGE task. Below is a step-wise on how to approach starting a brand-new chemical inventory.

- Decide on a system to keep your chemical inventory.
 - Some institutions have their own chemical inventory management software.
 - Some do not have one (like UNT – although we are working on this!)
 - One system to use is Excel, others could be free software like [Chemical Management System](#) or [Quartzy](#).
 - Choose something that is best fit for your lab and institution!
- Organize your document, if using Excel, make a template
 - Depending on your choice of system, it might already have all the required fields necessary for a chemical inventory.
 - If you are using Excel, you will have to make a template with all the required fields (discussed above)
 - RMS already has a template for you to use – contact us for the blank template.
- Come up with a plan.
 - Some of our labs have over hundreds of chemicals which is a huge task to inventory.
 - Start out with a plan for all the lab members.
 - Choose a day or an hour a week until it's completed and divide up the work evenly.
 - Have one person take inventory of a particular cabinet or assign multiple people to a large cabinet or area. Assign people to the areas they use frequently!
 - If everyone works together, a chemical inventory can be finished quickly!
 - It is a good idea to work in pairs – have one person typing the chemical in, while another is reading out the chemical name, amount, bottle, and locations.
- Once finished, back it up!
 - Keep a separate copy of the inventory in case of emergency.
 - The inventory should also be accessible outside of the lab as well.
 - This is in case of emergency, and you cannot get to the physical copy inside the lab.

- It is best to keep the inventory on a drive like Google drive or One drive so it can be accessed outside of the lab or group computer.
- **Keep up with it.**
 - Now that your lab has done all that work – keep up with it.

The next few sections will discuss how to do just that!

Receiving and Using Chemicals

When your lab receives new chemicals...

- Input these into your chemical inventory immediately!
 - This will help you during reconciliation – you won't have to do much work every year to re-do an entire inventory if you've kept up with this!
- Always mark the date the chemical was received.
 - Make sure to keep track of when the chemical was received written on the physical bottle as well as in your inventory.
 - This will enable you to know when the chemical is past shelf-life and should be discarded.
 - If you know the disposal date – mark that too!

Discuss with your PI and Laboratory Supervisor about who has access to the inventory and make a plan on how to update it when receiving and ordering chemicals.

- If everyone has access to update the inventory, then it might be best if each individual is held responsible for those chemicals.
- Sometimes if a single individual is doing the ordering – it might be easier for them to always input the chemicals as they are received.

When your lab uses chemicals...

Ensure that when a chemical container is empty or being disposed of, it is removed from the inventory.

- Even if you are re-ordering a new bottle – for the time being, that chemical is no longer in your lab.
 - You can update the chemical in the system by removing the amount and received date and mark 'ordered' as a place holder instead.
- Once removed from the inventory – make sure to discard the chemical container appropriately.
 - Make sure to check with your PI, Waste Management, and the SDS (or other resources) about how to properly dispose of the chemical and/or empty container.
- When you always remove a chemical container as soon as it is empty, you avoid having a false duplicate in your inventory.
- This will also help you avoid having more chemicals on record than physically accounted for.

Moving Chemicals

If you need to move a chemical between lab spaces, update the location in the inventory!

- This will prevent duplications and will prevent you from having to search for that chemical.
- If the chemical is being borrowed, make sure to mark that in your inventory and who borrowed it.
- This will also ensure that you are aware of where your chemicals are at all times.
- Always make sure that the chemical that is being borrowed can be used by another lab (check with both PIs and the policy of the labs prior to borrowing chemicals)
- **REMEMBER** to follow proper protocols when transferring chemicals, such as utilizing proper PPE during transport and using a secondary transport container for the chemical bottle.

If all lab members do their part – it makes your yearly reconciliation VERY EASY!

Yearly Reconciliation

Yearly reconciliation is the annual process of comparing your physical inventory counts with records of inventory on hand. This is the yearly chemical inventory update request.

If you have not kept up with your inventory, yearly reconciliation can be a frustrating and difficult task. It can be like re-doing a new chemical inventory all over again. Some ways to avoid this are:

- Performing a bi-annual reconciliation
 - Take a few days every 6 months to reconcile and go through your physical inventory and compare it to your current and add or remove any chemicals to your inventory list.
- Keeping a record of purchase orders
 - If you keep a record of your POs with name of chemical and amount, it can be easier to find where that chemical is located to update your inventory.
- Do small checks throughout the year of certain cabinets.
 - Reconcile (check) a cabinet once a month for the physical inventory vs your record of that cabinet.

Tips and Tricks for Maintenance

A Chemical Inventory is a living document; thus, it requires your work and responsibility to keep it up to date and accurate. Unfortunately, there are no easy “tips and tricks” for maintenance of your inventory – however, following everything so far, if you take:

- 2 minutes inputting a chemical when you receive it,
- 2 minutes removing a chemical when you discard or finish it,
- 2 minutes changing the location of a chemical when you move it,
- And 2 minutes keeping purchase orders organized.

Those 8 minutes are better than many hours and days’ worth of attempting to reconcile your entire inventory every year when you notice that your physical inventory is off from your records.

As a reminder: Chemical Inventory is due annually.

If you are facing difficulties reconciling your inventory, please do not hesitate to reach out to the Chemical Hygiene Officer to talk about what steps your lab can take to make this easier.

Some suggestions are:

- Reconcile a small section with partnered lab mates twice a week.
 - This 'section' should be designated such that it takes less than an hour per day to complete.
- Take a working day to reconcile your inventory with all lab members participating
 - Take one day to complete this. If you have a much larger inventory, you might need two or more days.
- If you notice chemicals that are OLD or past shelf-life OR the integrity of the bottle is weak (rusting, oxidation) – please consider DISCARDING these chemicals and removing it from your inventory. Fill out a [Hazardous Waste Pick-up](#)
- If you have LEGACY CHEMICALS – discuss with your PI about discarding, especially if they are unknowns. See below for more information.

Chemicals to be Aware of

- If you notice any chemical bottles that are distorted OR expanded, please do not move or touch them. Submit a waste pick-up request and alert your PI and RMS immediately.
- If you have ANY of the following chemicals, please follow the information below
 - **Peroxide formers** (common solvents: IPA, Et₂O, THF, dioxane)
 - if you have peroxide formers and you notice crystallization or cloudiness – DO NOT MOVE OR TOUCH – contact your PI and RMS immediately for a waste pick-up.
 - *Peroxide formers that are cloudy or crystalline are shock-sensitive and can **explode**.*
 - When reconciling your inventory - This would be a good time to test your opened bottles for peroxides.
 - Check the specific chemical for which class it falls into – you may need to test the bottle every 6 months.
 - Obtain [peroxide test strips](#)
 - Portion out a small amount of the chemical (2 – 3 mL) and immerse the end of the test strip for about 1 second. Allow the test strip color to stabilize (about 30 seconds) and compare the test strip color to the colorimetric scale provided on the test kit bottle.
 - Please see this resource for information on [peroxide formers and inorganic peroxides](#).
 - **Inorganic peroxides (H₂O₂ or M₂O₂)** have special considerations for chemical compatibility and containers.
 - **Picric Acid** (solid or as part of a premade stain or solution)

- Pure picric acid is a **shock-sensitive explosive**. For that reason, it is shipped wet (or in solution), and it should be checked for its water content quarterly. Do NOT open a bottle that appears to be dry or that has not been checked for a long time – IMMEDIATELY CONTACT RMS.
- Keep a running track of when it is checked (can be useful as a part of inventory).
- **Perchloric Acid**
 - 70% perchloric acid is stable, however many of its salts (perchlorates) are **shock-sensitive explosives**. Old perchloric acid bottles may have formed crystals that are explosives.
 - If you discover an old bottle of perchloric acid, IMMEDIATELY CONTACT RMS. Do **NOT** attempt to move or open.
- **Hydrofluoric Acid**
 - Hydrofluoric acid is stored in plastic bottles. The plastic material deteriorates with time and becomes brittle.
 - Hydrofluoric acid is highly toxic - a minor exposure can have serious consequences.
 - If your lab has HF – please make sure you have calcium gluconate ([Calgonate](#)) on hand – check to make sure it is not expired, if it has, please obtain a new one.
 - Please make sure your lab also has an HF specific spill kit.
 - Do NOT store hydrofluoric acid in glass, it can dissolve glass (do NOT use glass waste containers for hydrofluoric acid).
 - If you discover an older bottle of hydrofluoric acid, do NOT attempt to pick up or move. IMMEDIATELY CONTACT RMS.
- **Hydrazine**
 - Hydrazine and other corrosives can cause corrosion of the container lid causing a leak that allows toxic vapors to escape.
 - If you notice a corroded bottle, submit a hazardous waste pick-up request.
- **Legacy Chemicals and Unknowns**
 - Legacy chemicals: unused chemicals that are stored for many years, often inherited chemical stocks from previous lab occupants.
 - These chemicals are often in the back of cabinets, desiccators, or drawers for many years, unnoticed and unused.
 - These chemicals can take up valuable space and some chemical can become dangerous as they age
 - Small leaks can go unnoticed and can cause violent reactions and generate toxic fumes.
 - If you have any legacy chemicals or unknowns – discuss with your PI about discarding these and contact RMS for a [hazardous waste pick-up request](#).

Chemical Storage

- Store chemicals in compatibility groups. Place barriers between groups.
- Store chemicals in a manner that minimizes spilling or leaking. Use secondary containment.
- Minimize the number of chemicals in your lab.
- Be aware of legacy chemicals. If it's likely not going to be used again, dispose through Hazardous Waste Program.
- Some resources are:
 - [Safe Chemical Use sections of Chemical Hygiene Plan](#)
 - [Appendix B: Chemical Segregation](#)
 - [Chemical Incompatibility Information Sheet](#)
 - [Nitric Acid Waste Incompatibility Info](#)