Wet Bench Training and Compliance

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Introductions

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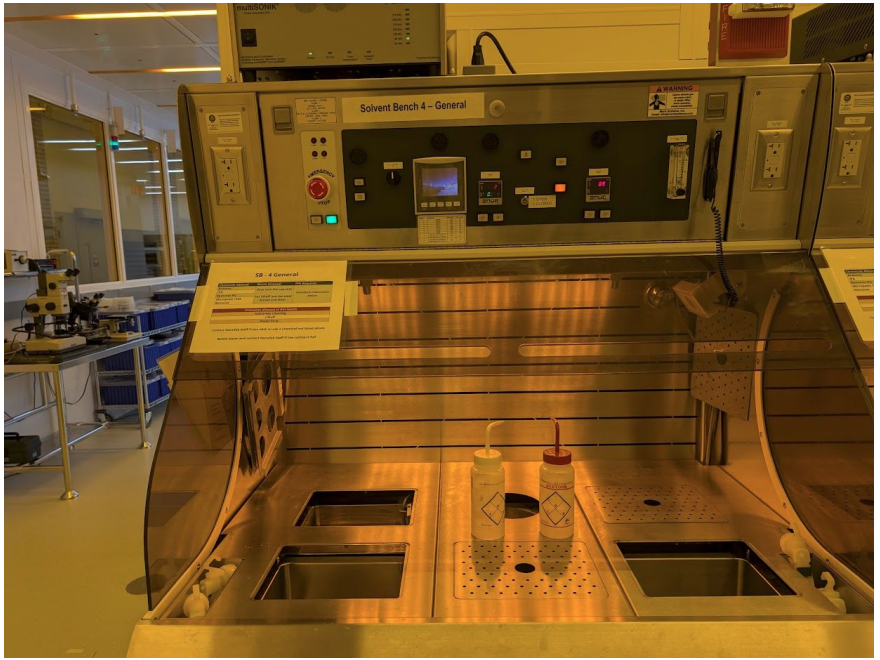
CMU Facility Overview

- 4’ decks- 1 user each
- No interlocks
- 6x Standard solvent benches
  - Acetone, IPA, NMP
- 3x Developer benches
  - MIF and MIC base developers
- 3x Spin benches
  - Resist coating only
- 1x E-beam developer bench
  - E-beam development/ lift off

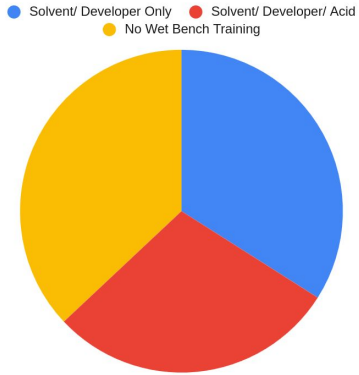


CMU Facility Overview

- 5x Corrosive benches
  - 2x HF, 3x no HF
- 1x PHS fume hood
  - EKC processing

CMU Wet Bench Usage

- 120 active onsite users as of April 2026
  - 37% not approved for any wet benches
  - 34% approved for solvent/developer/spinner benches only
  - 29% approved for acid benches and solvent benches
- 2 Staff providing all wet bench certification
- All chemical processes (including acetone/IPA cleans) are done at wet benches



Wet Bench Training Overview

Solvent/Spinner/Developer Training

- Group training
  - Max 4 users
  - “Classroom” session to go over policies, SDS locations
  - Spinner hands on training
  - Solvent/ developer bench in lab tour
- Quiz assigned - 100% required
- 2 hr training

Acid/PHS Training

- Prerequisite: Solvent training
- Group training with (easy) hands-on demo
- Quiz assigned - 90% required
- One-on-one practice with staff
  - **NO user training allowed**
- Additional training required for: HF, heated processes, mixtures
- 3+ hr additional training

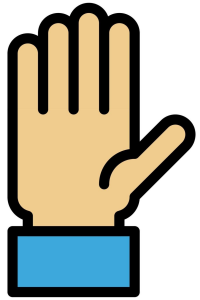
Comparing Solvent/Developer and Acid Bench Training

	Solvent	Acid
Staff Resources	Low: 1hr per user	High: 3+ hr per user
Approval Timeline	About 1 week to be approved	2+ weeks before user can start independent work
Training coverage	Broad overview of chemical processing	Overview of PPE requirements and safety In depth training on specific processes
Strengths	Fast onboarding Low Staff time commitment	Personalized training for all users Extensive staff oversight improves compliance
Challenges	Some users need more training Poor compliance with policies	Slow approval High staff time commitment Extensive approvals management

Discussion/Poll!

How much training do you require for wet bench users?

- Less than CMU
- About the same as CMU
- More in some cases and less in some cases
- More than CMU



Compliance Issues at CMU

- No enforcement other than staff observing issues from inside the lab
  - No benches are interlocked
  - Issues are often only noticed after the fact
- Waste not labeled or stored correctly
  - No or incomplete label
  - Waste not in correct storage Location
- Glassware used incorrectly
  - Not cleaned after use
  - Incorrect glassware used
- Misuse of spinners
  - Using wrong spin chuck
  - Running thick resists outside of thick resist spinner
- PPE/ Cleanliness Issues

Recent Initiatives: Making it easier for users to do the right thing

We have recently made some changes that focus on making it easier for users to do the right thing and follow our policies.

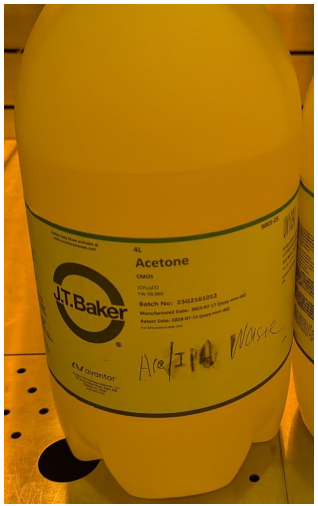
- Hazardous Waste tags
- Carboy waste disposal
- Wet bench placards
- Google Drive SDS repository

Hazardous Waste Tags

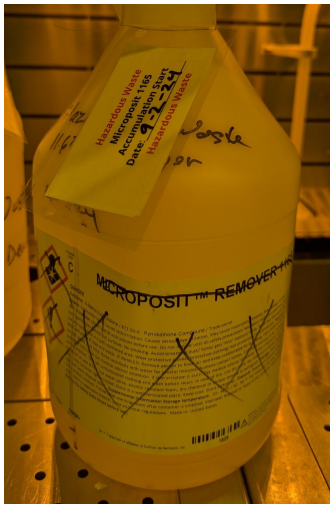
Created prefilled waste tags for common chemicals

- Hazards are more clear for waste
- Improved compliance with waste labeling
- Waste transfering is easier for technicians to complete
- More staff work to maintain labels

Before



After

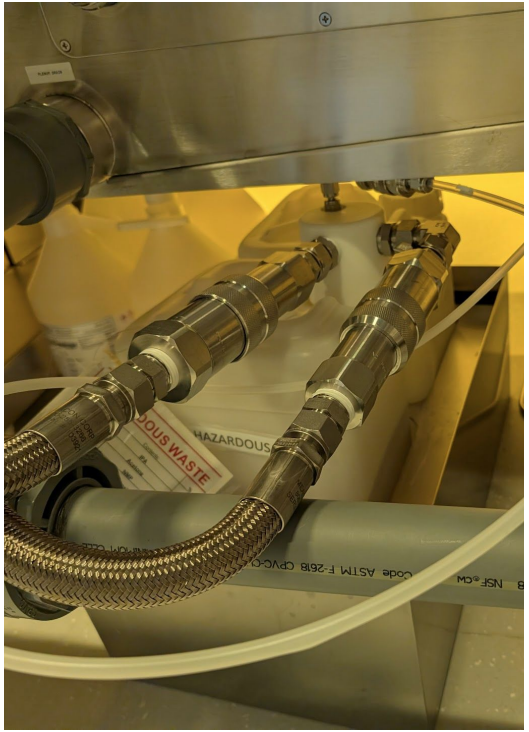


Hazardous Waste
MF-CD 26 Developer
Accumulation Start
Date:_____
Hazardous Waste

Characteristics		Contents	%
	Flammable	Water	95
x	Corrosive	Tetramethylammonium hydroxide	5
	Reactive		
x	Toxic		

Carboy Waste Disposal

- Increased the volume of solvent waste that may be disposed of in the solvent bench cup sink/carboy from < 50 mL to any quantity
- Acetone, IPA, or NMP can be disposed of
- Arranged with EHS to reuse the carboys



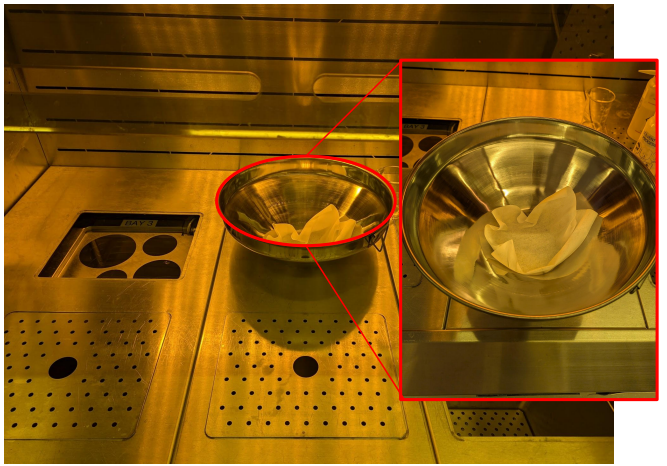
Carboy Waste Disposal

Strengths:

- Decreases the quantity of waste bottles
  - 2.5 gal carboy vs 1 gal bottles
- Simplifies process & enhances user safety

Challenges:

- Special considerations required for Lift off
- Users seem to make frequent errors
- Carboy changes are more challenging than dealing with bottles



Wet Bench Signage

All wet benches have signage listing

- Allowed chemicals
- Allowed processing
- Waste disposal for each chemical
- Additional PPE required

SB - 4 General

Chemicals Allowed	Waste Disposal	PPE Required
Acetone	Pour into the cup sink For liftoff use the steel funnel and filter	Standard Cleanroom Attire
IPA		
Remover PG		
Microposit 1165 Remover		

Processes allowed at this bench
Substrate Cleaning
Liftoff
Resist Strip

AB – 2 General

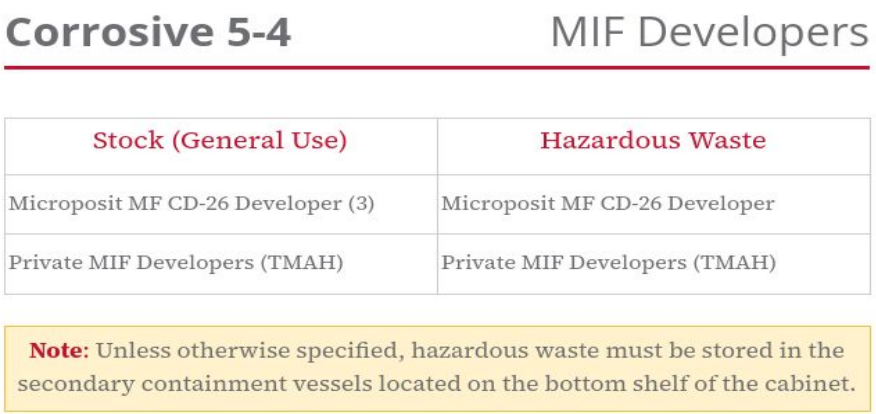
Processes Allowed at this Bench
General Etch Process
NO HYDROFLUORIC ACID ETCHING

Chemical Name	Chemical Formula / Constituents	Waste Disposal
Acetic Acid	CH3OOH	Bottle as Hazardous Waste
Aluminum Etch Type A	HNO3 + CH3OOH + H3PO4	Pour Down Drain
Ammonium Hydroxide	NH4OH	Pour Down Drain
APS Copper Etch 100	HCl + FeCl3	Bottle as Hazardous Waste
Chromium Etchant 1020 & 1020AC	H8N8CeO18	Bottle as Hazardous Waste
Ferric Chloride	FeCl3	Bottle as Hazardous Waste
Gold Etch Type TFA	KI, I2	Bottle as Hazardous Waste
Hydrochloric Acid	HCl	Pour Down Drain
Hydrogen Peroxide	H2O2	Pour Down Drain
Nickel Etchant TFG	PFOS	Bottle as Hazardous Waste
Nitric Acid	HNO3	Pour Down Drain
Phosphoric Acid	H3PO4	Pour Down Drain
Piranha Solution / Nanostrip	H2SO4 + H2O2 + H2O	Pour Down Drain with copious amounts of water
Potassium Hydroxide	KOH	Pour Down Drain
Sodium Hydroxide	NaOH	Pour Down Drain
Sulfuric Acid	H2SO4	Pour Down Drain
Tetramethylammonium Hydroxide (TMAH)	NC4H12OH	Bottle as Hazardous Waste
Ti Etch TFTN	HCl (30%) + water	Pour Down Drain

Chemical Cabinet Signage

All chemicals have signage indicating:

- Stocked chemicals
- Group owned chemicals
- Waste stored



Corrosive 5-4 MIF Developers

Stock (General Use)	Hazardous Waste
Microposit MF CD-26 Developer (3)	Microposit MF CD-26 Developer
Private MIF Developers (TMAH)	Private MIF Developers (TMAH)

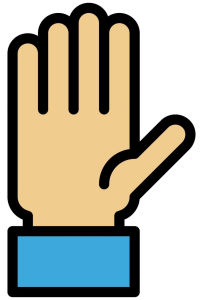
Note: Unless otherwise specified, hazardous waste must be stored in the secondary containment vessels located on the bottom shelf of the cabinet.

Advantages:

- Easier for users to find chemicals, waste bottles
- Easier for staff/work studies to stock chemicals

Discussion/Poll!

- Do other facilities interlock and require scheduling for their wet benches?
- To what extent is training and access for wet benches integrated in NEMO
- Questions on recent initiatives



Future Work

- Update Solvent/Developer training
  - Separate training for solvent processing and lithography
  - Individual check-off option
- Improvements to glassware
  - Periodic staff cleaning
  - Improved labeling
- Process operating procedures
- Interlocks and scheduling

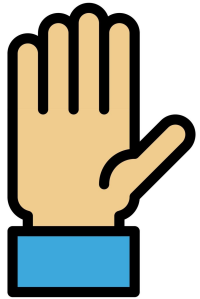
What CMU Does Well

- We have several initiatives making it easier for users to do the right thing that have improved compliance
- Training and waste management procedures use staff time efficiently
- All lab members using chemicals have a baseline training
- User of Acid/PHS benches have very robust training

Discussion/Poll!

What knowledge check do you have for wet benches?

- Quantitative check (Quiz etc)
- Qualitative check (supervised use before approval etc.)
- Quantitative and qualitative check
- Varies by bench
- Other



Questions/Discussion