Argonne NATIONAL LABORATORY

User's Guide to

The EMC Specimen Preparation Laboratory

The Electron Microscopy Center for Materials Research
Materials Science Division
Argonne National Laboratory

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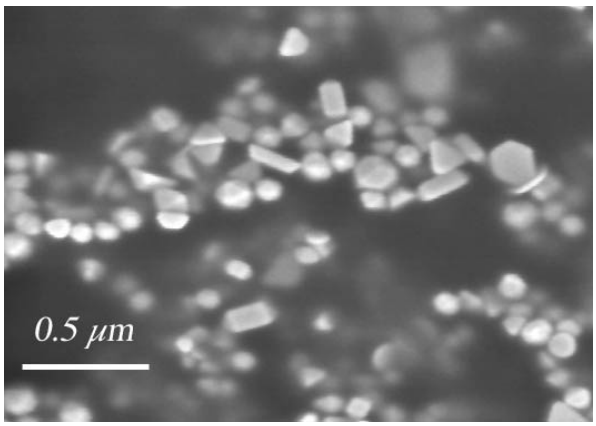

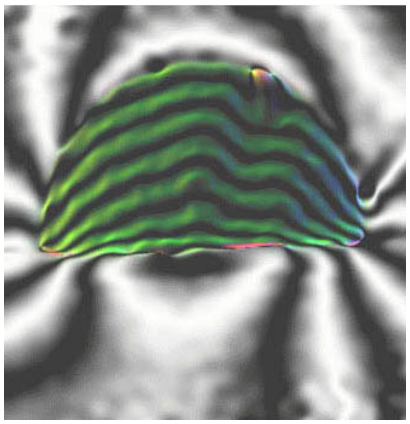

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Materials Science Division management has approved this document. All users of the Electron Microscopy Center for Materials Research are required to abide faithfully to its intent for their health and welfare and those of their fellow users.

APPROVALS:

Dean Miller
Director of the Electron Microscopy Center Date

Urs Geiser
ES&H Coordinator, Materials Science Division Date

George Crabtree
Director, Materials Science Division Date

Table of Contents

1. Purpose of This Document

The purpose of this document is to give researchers the minimum information that they will need to work safely in the Electron Microscopy Center (EMC) Specimen Preparation Laboratory (room DL126). Workers will find here a summary of the various environmental, safety, health, training, and general working requirements that they need to know. For more detailed guidance on specific safety topics, consult the *Argonne National Laboratory (ANL) Environment, Safety and Health (ES&H) Manual* at https://docs.anl.gov/lms/documents/legacy/eshman/index.html . Please note that the on-line documents referenced in this User's Guide are only available from secure Argonne networks.

2. Key People

Title	Name	Telephone
EMC Director	Dean Miller	2-4108
DL126 Lab Supervisor	Jon Hiller	2-7904 or 630-327-6678
EMC Safety Representative	Russell Cook	2-7194 or 630-327-9657
MSD Chemical Hygiene Officer	Urs Geiser	2-3509 or 630-310-9443

3. General Information

a) The EMC Specimen Preparation Laboratory (room DL126) is for the preparation of specimens for FIB, TEM, SEM, and optical microscopy within the EMC. No other uses of the laboratory are allowed without written approval of the EMC Director and a Safety Review.
b) All users are required to receive on-site, lab-specific training from EMC Staff before they will be allowed to work in the EMC Specimen Preparation Laboratory. See section 5 for details.
c) The Lab Supervisor or another EMC Staff member authorized by him will orient you to the EMC Specimen Preparation Laboratory.

4. Prerequisites

To use the specimen preparation facilities, you must, *a priori* . . .

a) Have an approved EMC proposal in which the specimen materials you'll be using and their known or suspected hazards are listed. If any of the specimen materials (not components) have a MSDS, you must give a copy of that MSDS to the Lab Supervisor.
b) Provide a copy of your Argonne Training Profile (obtain it on-line at https://portalapp8.anl.gov/etms/faces/trainingProfile.jsp) – or copies of course-completion certificates – to the Lab Supervisor as proof that you are current in these Argonne ES&H courses:
    - *EMC101*
    - *ESH-574 or 574RF, Chemical Waste Generator*. Non-Argonne users must develop a written waste-handling plan, in consultation with the Lab Supervisor and the EMC Safety Representative, in lieu of this

requirement.

c) Read the *Materials Science Division (MSD) Chemical Hygiene Plan* (download as a pdf file from http://www.msd.anl.gov/resources/esh/docs/09-2_MSD_ChemHygnePln.pdf).
d) Read the Safety Analysis Form for the TEM/SEM Specimen Preparation Laboratory and sign the participant list in DL126.
e) Read this document, including the appendices, and sign the User Certification sheet in appendix A3.

5. EMC Lab-Specific Training

a) Only EMC Staff members are authorized to train users in anything pertaining to the specimen preparation laboratory. Users are forbidden to train other users.
b) Each piece of *equipment* and each *procedure* has a separate, written Standard Operating Procedure (SOP). You may only use the equipment and procedures for which you have been trained. If you want to deviate from any SOP, you must first submit to the Lab Supervisor a written plan for a formal Safety Review (*Argonne ES&H Manual*, chapter 21.2).
c) Notify the Lab Supervisor in advance whenever you want to bring a visitor to the laboratory or include another person on a proposal for the specimen preparation laboratory.
d) If you are in doubt about anything, consult any of the EMC Staff members.

6. Laboratory and Chemical Safety

a) There are various physical and chemical hazards present in the lab. A sign on the lab door lists those hazards. Users must know and follow the safe working practices that pertain to those hazards.
b) Know the locations of these critical safety items: exits, eyewashes, safety showers, telephones, fire extinguishers, and Material Safety Data Sheets (MSDS).
c) Know the hazards of each chemical before using it, i.e. read the MSDS. Material Safety Data Sheets can be found in three-ring binders on top of the Flammable Hazards cabinet in DL126 or on-line at https://webapps.inside.anl.gov/cms/msds/.
d) Capped squeeze bottles containing organic solvents may be stored outside the fume hoods. Please store the bottles in the spill tray when they are not being used.
e) **Do not use flammable liquids** (flash point < 100˚F and vapor pressure < 40 psi at 100˚F) **or combustible liquids** (flash point > 100˚F) **near heat sources (e.g. hot plates), sparks, energized electrical equipment, or exothermic chemical reactions.** Examples of such liquids are acetone, alcohols, and other organic solvents. 100˚F = 37.8˚C. Remember that vapors from flammable liquids can be ignited by ignition sources that are far from those liquids.
f) **Always add acid to water** (or other diluent) and *pour slowly*. Remember to *always add acid* – "AAA". If you do the reverse, the mixture may splatter.
g) **Never mix acids (or oxidizers) with organic solvents except under the direct supervision of the Laboratory Supervisor or the EMC Safety**

Representative. Mixing organic solvents with acids (or oxidizers) can result in an explosion unless it is done under strictly controlled conditions. Never store organic solvents with acids or oxidizers.

h) Acutely toxic materials, carcinogens, and reproductive toxins have specific handling requirements. Before using such materials, consult with the Lab Supervisor and the EMC Safety Representative far enough in advance of your project that proper engineering controls and safety procedures may be reviewed and implemented.

i) Whenever a potentially hazardous chemical comes in contact with any part of your skin or eyes . . .
   - Immediately flush the affected areas with water for 15 minutes.
   - Notify the Medical Department as soon as possible.
   - After exposure to a chemical, call 911.
   - Clothing that is contaminated must be removed.
   - If it is necessary to use a safety shower, the affected person must be kept under the shower for 15 minutes.
   - Remember, water is only a first-aid remedy for chemical contact with the skin or eyes.
   - Professional medical treatment is essential.

7. Personal Lab Hygiene

a) Wash your hands before leaving the chemical-handling area.
b) Do not rub your eyes or touch other parts of your body while working with chemicals.
c) Never intentionally inhale or taste any chemicals in the lab.
d) Oral pipetting of chemicals is prohibited.
e) After working with chemicals, wash off the personal protective equipment (i.e. gloves, apron, face shield, etc.) that may have been contaminated.
f) Never intentionally touch any hazardous chemical, whether or not personal protective equipment is worn.
g) Remove your gloves anytime you are NOT working with chemicals. While wearing your gloves do not touch telephones, doorknobs, microscope controls, drawer or cabinet handles, or other surfaces that people normally touch with their bare hands.

8. Miscellaneous Health Issues

a) Report any symptoms that might indicate possible chemical overexposure such as headaches, dizziness, and irritations of the skin, eye, etc. to the Argonne Medical Department in building 201, your supervisor, and the Lab Supervisor.
b) Food and drink are not permitted in the laboratory.
c) Do not drink water from *any* of the faucets in the laboratory or use such water for washing eating utensils. Only "domestic" water from the water fountain (located in the corridor) and the washroom faucet is approved for consumption.
d) Pregnant Argonne employees are, according to *Argonne ES&H Manual 3.1.9*, “...encouraged to contact the Medical Department so that an evaluation can be made of her health status and work environment. This notification helps to

ensure planning so that the employee and the fetus may be protected against toxic substances, radiation, mutagens, and carcinogens." For non-Argonne employees, the MSD Chemical Hygiene Officer, EQO-Industrial Hygiene, and the Argonne Medical Department are available for confidential consultation. For additional information, see also *Argonne ES&H Manual 4.5.14.*

9. Personal Protective Equipment (PPE)

a) Personal Protective Equipment (PPE) is mandatory when you are working in the laboratory. At a minimum, this consists of . . .
   - safety glasses (with or without side shields) with other protection such as goggles or face shields as appropriate for the hazard.
   - pants: full-length.
   - shoes: closed-toe and impervious to liquids.

b) ***The following clothing types are forbidden when working in the lab: shorts, sleeveless tops, short skirts or dresses, sandals, perforated shoes, and canvas shoes.*** Depending on conditions in the lab, these clothing types *may be* permitted for those people who are simply traversing the lab to work in DL-120 (those people should make their own judgment about the hazards present near their route through the lab).

c) Lab coats, gloves (type determined by the hazard), full face shields, chemically-resistant aprons, and other PPE may be necessary, according to the task. Slip-resistant, reasonably-flat shoes are recommended.

d) When handling liquid nitrogen, use insulated gloves, a full face shield, and a lab coat that is buttoned-up. Read the *Argonne ES&H Manual*, section 4.10.10 for more information.

e) A glove selection guide can be found on the Argonne website at http://www.anl.gov/ESH/ih/glove_guide/index.htm .

10. Fume Hoods

a) Mixing of all chemicals must be done in a fume hood.

b) The heating of any chemical should be done in a fume hood.

c) Containers of chemicals that are open to the air should always be kept inside the fume hoods. Covered Petri dishes that contain small amounts of organic solvents may be outside the fume hoods for a short time, but only if it is absolutely necessary.

d) When using a fume hood, be sure the blower is operating and the sash is pulled down in front of you at least to the point that is necessary to maintain a face velocity of 125 fpm (see note on each hood).

e) Never place your head inside a fume hood.

f) Fume hoods are not to be used for storage.

11. Laboratory Etiquette

a) You are not allowed to borrow (i.e. remove) – either temporarily or permanently – any of the equipment, chemicals, tools, supplies, or other materials from the lab.

b) You are expected to supply your own specialized specimen tools and specialty supplies, excepting chemicals. A limited amount of commonly used

consumable items, chemicals, tools, and supplies, are provided by the EMC for use by the general EMC User community.

c) Do not disturb the tools or materials that belong to other users.
d) Keep clean the laboratory area in which you have been working. Immediately and thoroughly clean, dry, and return to storage all glassware.
e) Do not leave your tools and materials on the benches when you are not actually using the lab for specimen preparation.
f) If you must leave the lab temporarily, leave a note with your name and telephone number by the machine(s) you are using or in the areas in which you are working.

12. User-Supplied Chemicals and Materials

a) ***You are not allowed to use or store your own chemicals in the lab.*** Only those chemicals that are already in the lab will be permitted. Exceptions to this rule require written permission of the EMC Director, and, most likely, a Safety Review. This restriction does not refer to specimen materials.
b) If you have been given *written* permission to temporarily store a chemical in the lab, you must provide a MSDS to the Lab Supervisor and the container must have this minimum information on its label:
    - Chemical Tracking System bar code
    - chemical name (not chemical formula)
    - hazard information and warnings (diamond-shaped Hazardous Materials Classification label, etc)
    - your name, badge number, and telephone number
    - If the original container is too small for the label, it must be stored within a larger container that will accommodate the label.
c) You must clearly label your *specimen materials* with the chemical names or formulas. Abbreviations, specimen tracking numbers, etc. are not adequate. We must be able to identify the material.
d) You may have, if available, one *assigned* drawer in the lab for temporary storage of personal tools and materials for producing specimens.
e) You must remove your user-owned materials, tools, chemicals, etc., either at the end of your proposal(s) or your termination from Argonne, whichever occurs first.

13. Chemical Storage and Labeling

a) Chemicals must be stored only in the designated areas. Bottles must be kept clean, dry and capped.
b) Each chemical container should be clearly labeled with the required information (see the first 3 items under section 12.b). Any unattended chemical that is not properly labeled should be referred to the Lab Supervisor for immediate disposal.
c) Only flammable or combustible liquids may be stored in the Flammable Hazards cabinet.
d) Please clean the handles of any storage cabinet or drawer that you might have inadvertently touched while wearing gloves.

14. Waste

a) Minimize waste. This means that you should use the minimum amount of chemicals to get the job done and no more.
b) Dispose of all chemical waste properly.
    - Follow all process Standard Operating Procedures.
    - ***Chemical waste includes your unwanted sample material and TEM/SEM specimens***. You must dispose of these properly and with the required documentation. Consult with the Lab Supervisor *before* you start to generate waste.
    - Know where the hazardous waste Satellite Accumulation Area (SAA) is located.
    - Put waste organic solvents in the proper containers in the Flammable Hazards cabinet, and log the chemical and the amount disposed.
c) Any broken glassware, razor blades, scalpels, or other materials that could possibly cut or puncture must go into the "SHARPS" disposal containers.
d) Towels, swabs, gloves, etc. that have been used with acetone, methanol, toluene, or methyl ethyl ketone must be put into the YELLOW waste container.

15. Strongly-Recommended ES&H Courses and Reading

a) ESH-119, Pressure Safety Orientation
b) ESH-145, Cryogenic Safety
c) ESH-158, Fire Extinguisher Training – Hands-On Demonstration
d) Argonne ES&H Manual (http://www.aim.anl.gov/manuals/eshman):
    - Section 4.3, Hazardous Materials – Laboratory and Chemical Safety
    - Section 4.5, Hazardous Materials – Chemical Carcinogens
    - Section 4.10, Hazardous Materials – Cryogenic Liquid Safety
    - Section 11.3, Fire Protection – Flammable and Combustible Liquids
    - Section 12.1, Personal Protective Equipment

16. Appendices

A1. *Working-Alone Policy for the Electron Microscopy Center*

This policy states who may work alone in the Electron Microscopy Center (EMC) and under what circumstances. Although you may be authorized to work alone, it is a good idea to make sure that someone always knows where you are working.

Definition of "working alone":

Working alone is the performance of work by an individual who is out of visual and voice range of another person for more than a few minutes at a time. This situation may happen during normal working hours as well as off-hours. Persons who use the Specimen Preparation Laboratory (room DL126) may be in this situation as well as those who use electron microscopes.

Forbidden activities while working alone include the following:

- Mixing corrosives (acids and bases) to form a working solution.
- Working with liquid helium.
- Working in the IVEM-Tandem facility off-hours if EMC Staff are not present.

Working alone during normal working hours (0730-1730, Monday-Friday):

Microscope Users and Operators don't need to fulfill any special conditions to work alone in the electron microscope rooms. Microscope Trainees may not work alone: a supervising User must be present. Persons who are authorized to work in the Specimen Preparation Laboratory (room DL126) may work alone as long as they work according to the written Standard Operating Procedures.

Working during off-hours (night & early morning, weekends, holidays):

To work in the building after regular business hours (7 pm), you must first complete the *EMC101 EMC Users Orientation* course and then ask the building manager, John Herman (2-6348), to activate your badge for after-hours access. If you do not have a picture badge you also will need to ask the Building Manager for a building pass.

Microscope Users must qualify as Operators to work alone during off-hours. Microscope Operators don't need to fulfill any special conditions to work alone in the electron microscope rooms.

Persons who who want to be authorized to work off-hours in the EMC Specimen Preparation Laboratory (room DL126) must be able to demonstrate safe laboratory

practices to the Laboratory Supervisor (Jon Hiller) for each piece of equipment used before off-hour authorization is granted. They may then work alone as long as they work according to the written Standard Operating Procedures.

Off-hours workers in the AEM facility must record when they arrive and when they leave by signing the EMC Off-Hours Sign-In/Out Sheet. The sheet is located just inside the double entrance doors to room D128, the lobby of the the AEM facility. The purpose of the sign-in/out sheet is to provide another level of safety for off-hours workers by providing emergency responders with the names and locations of persons who are working in the EMC.

Contact systems:

According to section 1.6.7 of the *Argonne ES&H Manual*, "Measures to ensure the safety of those working alone may include regular contacts with the supervisor or other responsible person. All employees who work alone must have access to a telephone or radio in case of emergency, be trained in emergency reporting, and make sure that the phone or radio is working."

For off-hours work, the policy of the Electron Microscopy Center in this regard is the same as that of its parent division (MSD): "Notify others (family, coworkers) where you are and what you are doing. Have them check on you by telephone."

A2. *Chemicals in DL126*

This appendix lists the chemicals and materials stored or used in DL126. Items of particular concern are highlighted in red (acutely toxic OSHA-PEL and ACGIH-TLV values [< 1 ppm or < 0.5 mg/m^3]; "select" and Argonne Class 1 carcinogens; RCRA wastes). Acids and bases are flagged by green letters.

ACGIH = American conference of Governmental Industrial Hygienists
OSHA = Occupational Safety and Health Administration
PEL = permissible exposure limit (most are TWA rather than STEL)
RCRA = Resource Conservation and Recovery Act
STEL = short term exposure limit
TLV = threshold limit value (most are TWA rather than STEL)
TWA = time weighted average

The chemicals in the following table are used regularly for the purpose of producing specimens for TEM or SEM from a wide variety of materials. Most laboratory users will encounter only a small number of these chemicals.

Material Name	OSHA-PEL	ACGIH-TLV	Carcinogen Classification	Remarks
Acetone	1000 ppm	500 ppm		RCRA waste: F003, U002, ignitable.
Aluminum oxide 0.5 & 3 µm powder	10 mg/m^3	10 mg/m^3		Component in Allied Hi Tech colloidal suspension.
Allied Hi Tech red lube diamond extender.	50 ppm	50 ppm		PEL/TLV based on ethylene glycol & ethylene glycol monobutyl ether components
Ammonium sulfate				Warm aqueous solution dissolves MgO.
Amyl acetate	100 ppm or 525 mg/m^3	50 ppm		Extender for silver paint. RCRA waste: ignitable.
Apiezon vacuum greases				
Argon gas				Simple asphyxiant used for ion milling.
Bon Ami glass cleaner				
Boron carbide powder				
Calcium sulfate dihydrate	15 mg/m^3 total dust, 5 mg/m^3 respirable fraction	10 mg/m^3 total dust containing no asbestos & <1% crystalline silica		Also sold under the name Drierite.

Material Name	OSHA-PEL	ACGIH-TLV	Carcinogen Classification	Remarks
Carbon paint	see remarks	see remarks		The hazard varies with the manufacturer: it depends on the solvent used. Bottles are marked. Solvents may be RCRA wastes.
Carbon tetraflouride + 10% Oxygen				Gas mixture for plasma etching glasses.
Cerium (IV) oxide 0.5 & 3 µm powder	10 mg/m^3	10 mg/m^3		Component in Allied Hi Tech colloidal suspension.
Citric acid anhydrous				**Acid.**
Crystalbond 509	1 ppm	1 ppm		PEL/TLV based on one component: pthalic anhydride.
Crystalbond 555	1 ppm		Select Carcinogen. Argonne Class 1	PEL & carcinogen ratings based on 1 component: ethylene oxide.
Crystalbond 562				
EFFA Duster				dichlorodiflouromethane, CAS 75-71-8
EPO-TEK 353ND Parts A & B				Specialized epoxy glue for specimen preparation.
H. B. Fuller epoxy resin				General-purpose glue.
Ethyl alcohol	1000 ppm	1000 ppm		RCRA waste: ignitable.
Ethylene glycol	50 ppm	50 ppm		Used for some grinding slurries.
Glycerin	15 mg/m^3 total dust, 5 mg/m^3 respirable fraction	10 mg/m^3		Used for some grinding slurries.
Hydrochloric acid	5 ppm	2 ppm		**Acid.**
Iodine				Used as an ion-milling agent for some semi-conductors. **Oxidizer.**
Isopropyl alcohol	400 ppm	200 ppm		RCRA waste: ignitable.
Lapmaster abrasive polishing liquid				
LECO diamond suspension				
Loctite 420		0.2 ppm		Ethyl cyanoacrylate.
M-Bond 610 epoxy	200 ppm	200 ppm		PEL/TLV based on one component: tetrahydrofuran.

Material Name	OSHA-PEL	ACGIH-TLV	Carcinogen Classification	Remarks
Methyl alcohol	200 ppm	200 ppm		RCRA waste: F003, U159, ignitable.
Methyl ethyl ketone				RCRA waste: F005, U159, D035 (TCLP > 200 mg/l), ignitable.
MICRO cleaning solution				
Mineral oil	5 mg/m^3 (mist)	5 mg/m^3 (mist)		RCRA waste: "special".
Neolube #1 dry film lubricant	400 ppm	200 ppm		PEL/TLV based on one component: isopropanol. RCRA waste: ignitable.
Nitric acid	2 ppm	2 ppm		**Acid.**
Nitrogen gas				Used for backfilling vacuum chambers & ion-milling diamond.
Nitrogen liquid				
Old Dutch Cleanser				
Ortho-phosphoric acid	1 mg/m^3	1 mg/m^3		**Acid.**
Oxygen gas				
Potassium hydroxide		2 mg/m^3		**Base.** Used for etching Si.
1,2 Propanediol (propylene glycol)				Used in Allied Hi Tech diamond suspensions.
Silicon carbide powder	15 mg/m^3	10 mg/m^3		Used in slurries for cutting.
Silicon dioxide amorphous powder	20 M particles/ft^3	2 mg/m^3		Component in Allied Hi Tech colloidal suspension.
Sodium chloride				
Sodium hydroxide	2 mg/m^3	2 mg/m^3		**Base.**
SPI silver paint	0.01 mg/m^3	0.1 mg/m^3		PEL/TLV from one component: silver. RCRA waste: D011 (TCLP > 5 mg/l), ignitable.
Struers DP-Suspension				Diamond suspension for grinding & polishing.
Struers DP-Lubricant Green				Lubricant for grinding & polishing.
Struers cutting liquid for Accutom	5 mg/m^3 (mist)	5 mg/m^3 (mist)		Oil. RCRA waste: "special".

Material Name	OSHA-PEL	ACGIH-TLV	Carcinogen Classification	Remarks
Sulfuric acid	1 mg/m^3	1 mg/m^3	Mist is a Select Carcinogen & Argonne Class 2.	**Acid.**
Tetramethylammonium hydroxide				**Base.** Used to dissolve PMMA.
Three-in-One Oil	1000 ppm	1000 ppm		PEL/TLV from one component: ethanol. RCRA waste: "special".
Toluene		100 ppm or 375 mg/m^3		RCRA waste: F005, U220, ignitable.

The chemicals in the following table are used rarely and only in the production of TEM specimens by microtoming. These chemicals are not normally stored in DL126; rather, they are ordered and then used-up.

Material Name	OSHA-PEL	ACGIH-TLV	Carcinogen Classification	Remarks
Araldite GY-502 epoxy resin	5 mg/m^3	5 mg/m^3		PEL/TLV based on one component: 1,2 Benzenedicarboxylic acid dibutyl ester.
DER-736 epoxy resin				Polymer of epichlorohydrin-polyglycol, CAS 041638-13-5
DMAE epoxy resin				2-dimethylaminoethanol, CAS 108-01-0
DMP-30 epoxy resin				primary component is Tris-2,4,6-(dimethylaminomethyl) phenol, CAS 90-72-2
Dodecenyl succinic anhydride				
ERL-4206 epoxy resin	10 ppm	0.1 ppm	Argonne Class 1	Vinyl cyclohexene dioxide CAS 106-87-6
Nonenyl succinic anhydride (NSA)				CAS 28928-97-4

The chemicals in the following table are used rarely and only by select EMC staff for the purpose of producing analytical standards, or they are materials that are essential for EMC staff to maintain the operation of the center. Other laboratory users will not be using them.

Material Name	OSHA-PEL	ACGIH-TLV	Carcinogen Classification	Remarks
Beryllium	0.002 mg/m^3 (Be dust)	0.002 mg/m^3 (Be dust)	Select Carcinogen. Argonne Class 1	RCRA waste: P015 (acutely hazardous); bulk Be is in DL126 in a sealed container.
Chromium	1 mg/m^3	0.5 mg/m^3		RCRA waste: D007 (TCLP > 5 mg/l).
Copper	0.1 mg/m^3 (Cu fumes)	0.1 mg/m^3 (Cu fumes)		Bulk Cu is in DL126 and fumes are never created.
Dialac-C oil	5 mg/m^3	5 mg/m^3		Oil used solely for FEI & Philips microscopes. RCRA waste: "special".
Exxon Univolt 60 Oil	5 mg/m^3 (mist)	5 mg/m^3 (mist)		Electrical insulating oil used in AAEM. RCRA waste: "special".
Gadolinium				
Hafnium	0.5 mg/m^3	0.5 mg/m^3		
Magnesium				
Mica	20 M particles/ft^3			
Mikro-Kleer metal spray				
Molybdenum oxide	5 mg/m^3	5 mg/m^3		
Nickel oxide	1 mg/m^3	1 mg/m^3	Select Carcinogen. Argonne Class 1	NiO
Pfeiffer P3 vacuum oil	5 mg/m^3 (mist)	5 mg/m^3 (mist)		Oil for turbo pump bearings. RCRA waste: "special".
Phenanthrene	0.2 mg/m^3			Used in a sealed cartridge in the Zeiss FIB/SEM (DL135).
Santovac 5	5 mg/m^3 (mist)	5 mg/m^3 (mist)		Diffusion pump oil. RCRA waste: "special".
Selenium powder/pellets	0.2 mg/m^3 (Se powder)	0.2 mg/m^3 (Se powder)		RCRA waste: D010 (TCLP > 1 mg/l).
Silicon	15 mg/m^3 total dust, 5 mg/m^3 respirable fraction	10 mg/m^3		

Material Name	OSHA-PEL	ACGIH-TLV	Carcinogen Classification	Remarks
Silicon monoxide				PEL/TLV based on one component: silica.
Smooth-On PC Series Epoxy	10 mg/m^3	6 mg/m^3		
Solvent-refined neutral paraffinic oil	5 mg/m^3 (mist)	5 mg/m^3 (mist)		Brands: Edwards High Vacuum, Inland Vacuum, etc; for roughing pumps. RCRA waste: "special".
Tungsten		5 mg/m^3		
Tungsten hexacarbonyl				Used in a sealed cartridge in the Zeiss FIB/SEM (DL135).
Victawet				
Wenol metal polish		[a] 100 ppm [b] 5 mg/m^3		Also POL metal polish. [a] Aluminum oxide [b] Iron oxide (trace)
Yttrium barium copper oxide		0.5 mg/m^3		
Zinc				
Zirconium				

A3. *Specimen Preparation Laboratory User Certification*

1. I have read and I understand the *User's Guide to the EMC Specimen Preparation Laboratory*, and I agree to follow all prescribed safety procedures.
2. All of my specimen materials and their specific hazards, whether known or suspected, are listed in my EMC Proposal, and I have given the appropriate MSDS to the Lab Supervisor.
3. I have provided a copy of my Argonne ES&H Training Profile (or course-completion certificates) to the Lab Supervisor as proof that I am current in these courses:
    - *EMC Users Orientation* (EMC101) and
    - *Chemical Waste Generator* (ESH-574 or 574RF). Note: non-Argonne users must fulfill the alternative requirements of section 4b.
4. I certify that I have read the MSD Chemical Hygiene Plan.
5. I understand and will comply with the Working Alone Policy for the EMC (appendix A1).

Name and badge no. (print): _____

Signature: _____

Name of Argonne supervisor or sponsor: _____

Telephone of Argonne supervisor or sponsor: _____

Date: _____

****

Lab Supervisor Certification:

The above-named user has consulted with me on waste handling (section 14).

Signature: _____

Jon Hiller
Specimen Preparation Laboratory Supervisor

Please print this page, fill in the required information, and give it to Jon Hiller.