

EMC101 – User Orientation Course for the CNM EMC Group

1. Course Objectives

Welcome to the EMC101 user orientation course for the Electron Microscopy Center (EMC) at Argonne National Laboratory's Center for Nanoscale Materials (CNM). The objectives of this course are to:

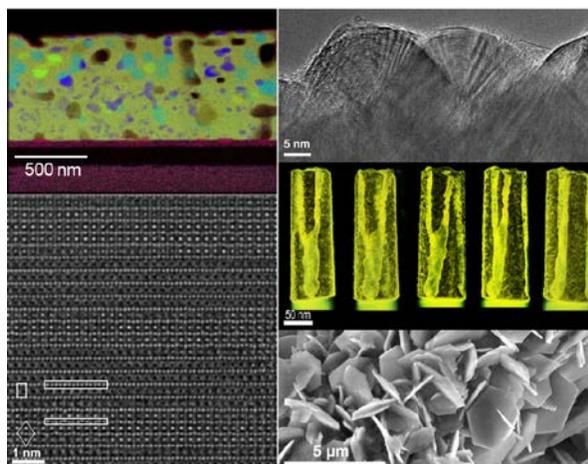
- Provide users of EMC resources with location-specific safety and response information.
- Inform users about CNM policies, procedures, and resources applying to EMC users.
- Inform users of their obligations as users of an Argonne-managed DOE/BES facility.

2. Introduction to the EMC Facilities

The EMC is part of the Center for Nanoscale Materials user facility. Since the EMC's capabilities are not located within the main CNM building, this EMC-specific orientation is required and includes relevant information about CNM policies and procedures.

The EMC consists of the following facilities:

- Sub-Ångstrom Microscopy and Microanalysis Laboratory (SÅMM) houses aberration-corrected transmission electron microscopes (TEMs) in building 216.
- Analytical Electron Microscope Facility (AEM) in D-wing of building 212.



More information about EMC instruments can be found on the CNM website (<http://www.anl.gov/cnm/group/electron-microscopy-center>)

3. Emergency Information

3.1 Reminder: In any emergency, dial 9-1-1 from any Argonne telephone (or 630-252-1911 from cell phones)

This topic is thoroughly discussed in Argonne's *User Facility Orientation* (ESH100U).

3.2 Reporting Emergencies

Without putting yourself at increased risk, you should follow the instruction of the person you speak to while reporting the concern and should stay reasonably near the area. You must notify your process custodian, laboratory supervisor, or scientific contact when you complete your 9-1-1 call. There are no penalties for dialing 9-1-1.

3.3 Medical Emergencies

Dial 9-1-1 in cases of injury, illness, or medical emergency. The Argonne Fire Department will respond and offer transportation to an offsite medical facility. If a user who is not an Argonne employee enters the Argonne Medical Department with an injury, illness, or medical emergency, they will be given minimal treatment, and the medical staff will call the

Fire Department for transportation to an offsite medical facility. Users who are not Argonne employees are expected to carry their own health insurance for treatment at offsite medical facilities.

3.4 Key safety people are:

The telephone numbers for the people listed below are posted near each telephone.

Name	Title	Function
Stuart Feinberg	Environment, Safety, & Health (ESH) Coordinator and Quality Assurance Coordinator for the Nanoscience & Technology Division Serves as facility safety officer	Responsible for: <ul style="list-style-type: none"> • Supporting implementation of the ESH policies and procedures of Argonne and the CNM's parent division. • Consulting with staff and users on technical safety issues.
Daniel McGann	Alternate Area Emergency Supervisor (AES)	Responsible for emergency planning/activities in Building 212 and 216.
Bruce Stockmeier	Principal ESH and User Safety Manager and Quality Assurance Representative for the Nanoscience and Technology Division Serves as facility safety officer	Responsible for: <ul style="list-style-type: none"> • Supporting implementation of Argonne ESH policies and procedures • Formulating ES&H policies and procedures for CNM's parent division • Consulting with staff and users on technical safety issues.

3.5 Evacuation Procedures and Audible Alarms

While in buildings 212 and 216, you might hear either of two audible emergency alarms. The table below describes these audible alarms and the actions you are to take in response to each. These are in addition to the site-wide alarms that are discussed in course ESH100U.

Signal Type	Signal Sound	Cause	Action Required
Local Evacuation	Loud steady bell accompanied by strobe lights and a public announcement to evacuate.	Fire, explosion, or other emergency.	Leave the building using routes to the north and west. Do not enter other wings of the building. Go to the Cafeteria (Building 213). Ensure that an EMC group member is aware that you have reported to the assembly point.
High Gamma Radiation Field	Loud steady horn in building 212 F-wing.	Loss of radiation shielding in the Alpha Gamma Hot Cell Facility.	If you hear the alarm, move away from the sound and assemble in the E-Wing Filter Storage Room (E-107) near the E-wing loading dock for personnel accountability.

3.6 Tornado Sheltering

When a tornado warning is announced by the site-wide public address (PA) system, you should use corridors and stairways – not the elevator – to make your way to the nearest designated tornado shelter. Shelters are on the first/ground floor.

Building 212:

- Corridor C10 (closest shelter for the AEM facility)
- Rooms G166 and H100 (don't use unless you happen to be in the immediate area)

Building 216:

- Room A106

The building drawings that follow depict the location of these shelters, identifying them using green highlighting. The actual locations have signs that say “Tornado Shelter.”

In the event of a tornado, please reduce risks to others by ensuring Argonne knows where you are.

- If in building 212, find and stay with an EMC group member.
- In building 216, follow the posted instructions in A106 for shelter and reporting your presence.

3.7 Emergency exercises

Tornado drills and evacuation drills are required annually. Tornado drills are conducted in the spring and evacuation drills are conducted in the fall. If you are present in the buildings at the time of the drills, you must participate. Your actions should mimic actual emergencies.

3.8 Hazards

Each EMC laboratory is posted with a list of the hazards present in that particular room.

The range of hazards present in the building 212 is very broad. EMC users should minimize their potential exposure to hazards by confining themselves to the EMC areas, the main corridors, and general access areas. Do not enter non-EMC laboratories unless you are escorted by the supervisors of those laboratories. Hazards in building 212 include:

Alpha Gamma Hot Cell Facility (AGHCF)

This complex, located in F-Wing of building 212, is a Category 3 Hazard Nuclear Facility and is governed by specific and strict DOE Orders and Federal Regulations. Do not enter this facility.

Controlled areas

Radiologically controlled areas include, but are not limited to, the AGHCF, E109, and DL114. The topic of controlled areas is covered in Argonne's *User Facility Orientation* (ESH100U).

Elevator gate

Building 212 has a freight elevator in E-wing that is used extensively. The elevator gate will close automatically, from the top. A warning alarm will sound beforehand; but you want to make sure you are not in the way. The gate closes rapidly. It has a pressure-sensing strip at the bottom to reverse direction; but that is the safety barrier of last

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resort. DO NOT STAND STILL IN THE DOOR OPENING. NEVER TRY TO "BEAT" THE DOOR ONCE THE WARNING ALARM SOUNDS.

Cryogenic liquids

Cryogenic hazards include portable dewars of liquid nitrogen and liquid helium that may be found throughout the building. Also, there are large outside storage tanks for liquid nitrogen on the east side of the building.

Compressed gas cylinders

Compressed gas cylinders are located on the E-wing loading dock and throughout the building.

4. User Work Approval (UWA) Records

Proposals that are allocated time on an EMC instrument must have a signed CNM User Work Approval in place prior to the start of work.

4.1 User Work Approval (UWA) Content

A User Work Approval (UWA) consists of:

- A definition of approved work
- A description of hazards
- Required hazard controls
- User acknowledgements and facility approvals.

The first section of a User Work Approval (UWA) consists of a description of your proposed (and CNM-approved) research and a list of standard operating procedures (SOPs), incorporated by reference, that should enable you to perform the work reliably and safely.

- Each SOP warns about hazards directly related to the activity covered by the SOP.
- Each SOP specifies actions to be taken to protect against hazards to personnel and equipment that arise during the conduct of work covered in the SOP.

All user activity must conform to SOPs listed in the UWA.

The second section lists hazards not well covered in the SOPs.

The third section specifies hazard controls not well covered in the SOPs.

In the fourth section, users agree to follow all written User Guides, SOPs, posted notices, and verbal instructions of EMC group members regarding laboratory practices and instrument operation. If uncertain about the safe and appropriate operation of an instrument, you must consult with the EMC group.

4.2 Sanctions

Failure to follow appropriate procedures and instructions may result in termination of user privileges. Users may be charged for costs associated with repair or replacement of equipment resulting from misuse and/or abuse.

4.3 Modifications to Approved Work

The CNM and EMC understand that plans may change in a research environment. If you want to add personnel or processes to your approved work package (UWA), inform your scientific contact. Such needs can generally be accommodated if they are consistent with approved work as described in the summary work description of the UWA. A revised UWA will be issued based on the requested changes.

5. General User Information

5.1 Categories of Users

Trainees (people being trained to operate electron microscopes) and *Assisted Users* (people who will need others to operate a microscope) work under the direct supervision of an EMC group member, an instrument *Operator*, or an EMC-approved instrument *User*. *Operators* may use instruments during all hours, including nights and weekends, and may serve as supervisors to *Trainees*. *Operator* status requires demonstration of a high degree of proficiency and authorization from the responsible EMC staff member. Requirements for attaining *Operator* status will be made available upon request. Other instrument-specific privileges of *Users* and *Operators* can be found on the Lists of Qualified Operators & Users that are posted on the microscope laboratory doors.

5.2 Key Personnel

Scientific Contact

The CNM assigns a staff scientific contact to each user proposal. The scientific contact's responsibilities include, introducing you to persons who will support the conduct of your work, ensuring that you get an adequate orientation to the facilities in which you will work and the User Work Approval (UWA) for your project, and facilitating needed revisions to the UWA for your work.

Process Custodian

The process custodians have responsibility for managing equipment, training users, and authorizing your work for individual processes. You should contact them if you have technical questions about the process. They are identified in the SOPs.

Laboratory Supervisor

The laboratory supervisor is responsible for maintaining their laboratory space, maintaining "common" equipment, and ensuring needed supplies are in stock. You should report problems with any laboratory, including low supply levels, to the assigned laboratory supervisor.

5.3 Laboratory Attire

The following attire is not permitted in laboratory space:

- Shorts
- Sleeveless shirts
- Sandals or open-toed shoes

The EMC will provide you with a disposable lab coat, which should not be worn outside the laboratory wing. Do not bring your own lab coat.

The EMC provides approved safety glasses and splash goggles; however, you may use your own safety glasses or goggles if they satisfy ANSI Z87 requirements.

5.4 Training Requirements

Required Core Training

The required training for the EMC consists of the following courses:

- o EMC101, EMC Users Orientation (this course); required annually
- o ESH100U, ANL User Facility Orientation (for non-Argonne employees ESH223U, Cyber Security Program Training (or ESH223 for Argonne employees); required annually
- o ESH377, Electrical Safety Awareness (only required of Argonne employees)
- o ESH574, Chemical Waste Generator (only required of Argonne employees who generate hazardous wastes or waste oils while using EMC resources)

Instrument Training Procedures

Prior to being provided training on instruments, prospective users must complete the EMC core curriculum, complete other required Argonne courses, and sign the User Work Approvals (UWA) that are pertinent to their work prior to instrument training. Each prospective TEM/SEM user must participate in an initial instrument-specific training session given by an EMC group member. The prospective user then becomes a *Trainee* and may operate the instrument only under the direct supervision of an *Operator* or an EMC-approved *User* while gaining proficiency. When the supervising *Operator* or *User* is satisfied that the *Trainee* could pass a qualifying examination, an appointment should be made with the responsible EMC staff member to observe the *Trainee*. If the EMC staff member is satisfied that the *Trainee* demonstrates adequate proficiency, the person is granted instrument *User* status. Each instrument has different requirements concerning what "proficiency" means. Those requirements will be made clear to *Trainees*.

5.5 Reserving Time on Instrument Calendars

Users and *Operators* of particular instruments are allowed to login to on-line instrument calendars (with a few exceptions) for the purpose of reserving time on those instruments.

5.6 Computing Facilities

The EMC provides resources for image processing and analysis, including commercial software for image simulation and modeling. It also has software for off-line processing of EELS and EDXS data that is acquired on its instruments.

6. Specimen Preparation Facilities

The EMC maintains an array of specimen preparation capabilities that are available to all users. While individuals are generally expected to carry out their own specimen preparation, EMC group members are available for consultation (expertise and guidance only). The EMC Specimen Preparation Laboratory (room DL126, building 212) is used for the preparation of specimens for FIB, TEM, SEM, and light microscopy in EMC.

Before researchers start any work in DL126, they must:

- Consult with the laboratory supervisor.
- Read and sign their UWA including specimen preparation work.
- Read the *User's Guide to the EMC Specimen Preparation Laboratory*. The Guide summarizes the lab practices, including the use of personal protective equipment, that are required of laboratory users.

7. Other User Obligations

- Acknowledge the use of these resources in all of your publications and presentations using the following words: "*Use of the Center for Nanoscale Materials, including resources in the Electron Microscopy Center, was supported by the U. S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. DE-AC02-06CH11357.*"
- Report all publications resulting from work at the CNM's EMC to the CNM User Office.
- Acknowledge EMC staff. EMC staff frequently make major contributions to the research of users through planning and execution of experiments, analysis and interpretation of data, or through collaboration and assistance in the research. Users are expected to appropriately acknowledge and/or include EMC staff members as co-authors.
- The CNM asks users each September to participate in the Department of Energy's User Satisfaction Mini-Survey. This survey is transmitted via email.
- Complete an end-of-project survey to provide feedback. This survey is also provided via email to the PI.
- Contribute a two-page User Activity Highlight upon completion of the project. The template will be provided by the CNM.
- Be aware that certain information including your name, institutional affiliation, and project title will be publicly disseminated in the DOE Office of Science user facility user projects database at <http://science.energy.gov> at the end of the fiscal year.
- Be aware that you will have 30 days from your UWA expiration date to copy or move electronic data to non-CNM-owned equipment.

8. EMC Policy on Working Alone and Working Off-Hours

The following explains who may work alone in the EMC laboratories and under what circumstances. Although you may have permission by EMC to work alone, it is a good idea to make sure that someone always knows where you are working.

8.1 Definition of "working alone"

Argonne considers *working alone* "a situation in which a worker is not in the immediate proximity of others, cannot be seen or heard by another person, and contact with another worker is unlikely." This situation may happen during normal working hours as well as off-hours. Persons who use the EMC Specimen Preparation Laboratories may be in this situation as well as those who use electron microscopes.

8.2 Activities forbidden by those working alone

EMC forbids working alone in EMC laboratories when:

- Mixing corrosives (acids and bases) to form a working solution.
- Working with liquid helium.

8.3 Working alone during EMC's normal working hours (07:00-17:30, Monday-Friday)

Microscope *Users* and *Operators* may 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 may work alone according to their work control documents.

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

Only microscope *Operators* (not *Users* or *Trainees*) may work alone in the electron microscope rooms off-hours. Persons who want to work off-hours in the EMC Specimen Preparation Laboratory DL126 must first demonstrate safe laboratory practices to the Laboratory Supervisor for each piece of equipment and must follow the SOP. To gain access to building 212 to use the EMC off-hours, you must ask the Building Manager, Tim Keen (2-2425), to activate your badge for off-hours access. If you do not have a picture badge, you will need to ask the Building Manager for a building pass. The use of a sign-in/out sheet is also required.

8.5 Sign-in/out sheet

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

8.6 Laboratory Closure

The CNM prohibits its employees and users from working on-site when Argonne management has closed the Laboratory in response to holidays, inclement weather or emergencies affecting the site.

8.7 Maintenance Periods

In order to ensure CNM reliability and minimize negative impacts on availability to users, the facility has consolidated maintenance into three one-week maintenance periods per year. Some laboratories or capabilities may be closed during these periods; notices will be sent in advance but you are advised to contact your CNM/EMC scientific contact before scheduling a visit during these periods. The specific dates for these periods, which are used to perform preventive maintenance on the scientific instruments and the facility's operating infrastructure systems, are listed on the [CNM website](#) and are announced via the user community email distribution list.

9. Floor Plans of Buildings 216 and 212

This section contains floor plans for building 216, the ground floor of building 212, and the EMC facilities within building 212 (see subsequent pages for the plans).

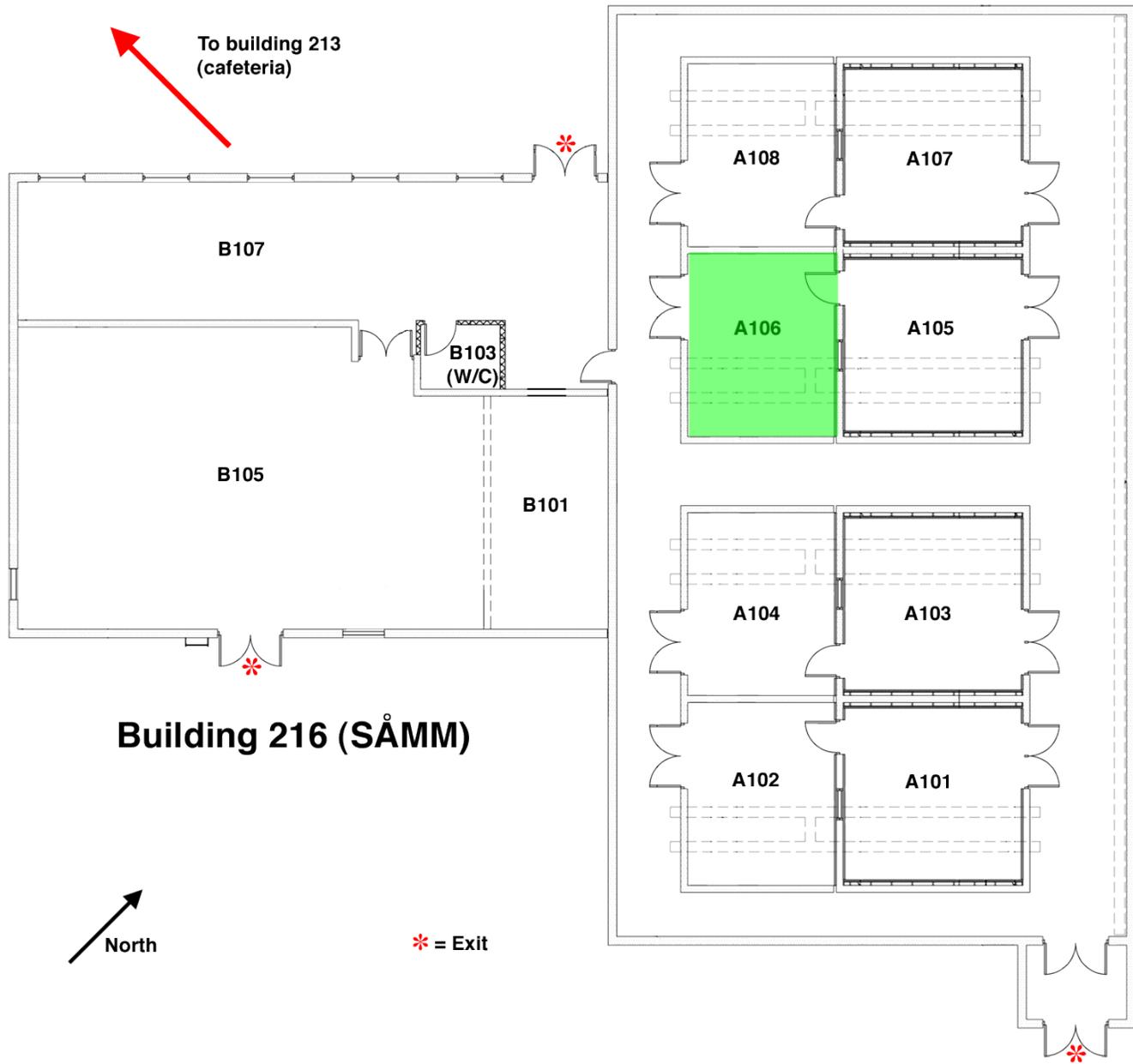
Note these areas that are marked on the 216 and 212 floor plans:

- Building and facility exits are marked on the floor plans with red stars.
- The tornado shelter areas are colored green.

Note these additional areas that are marked on the 212 floor plan:

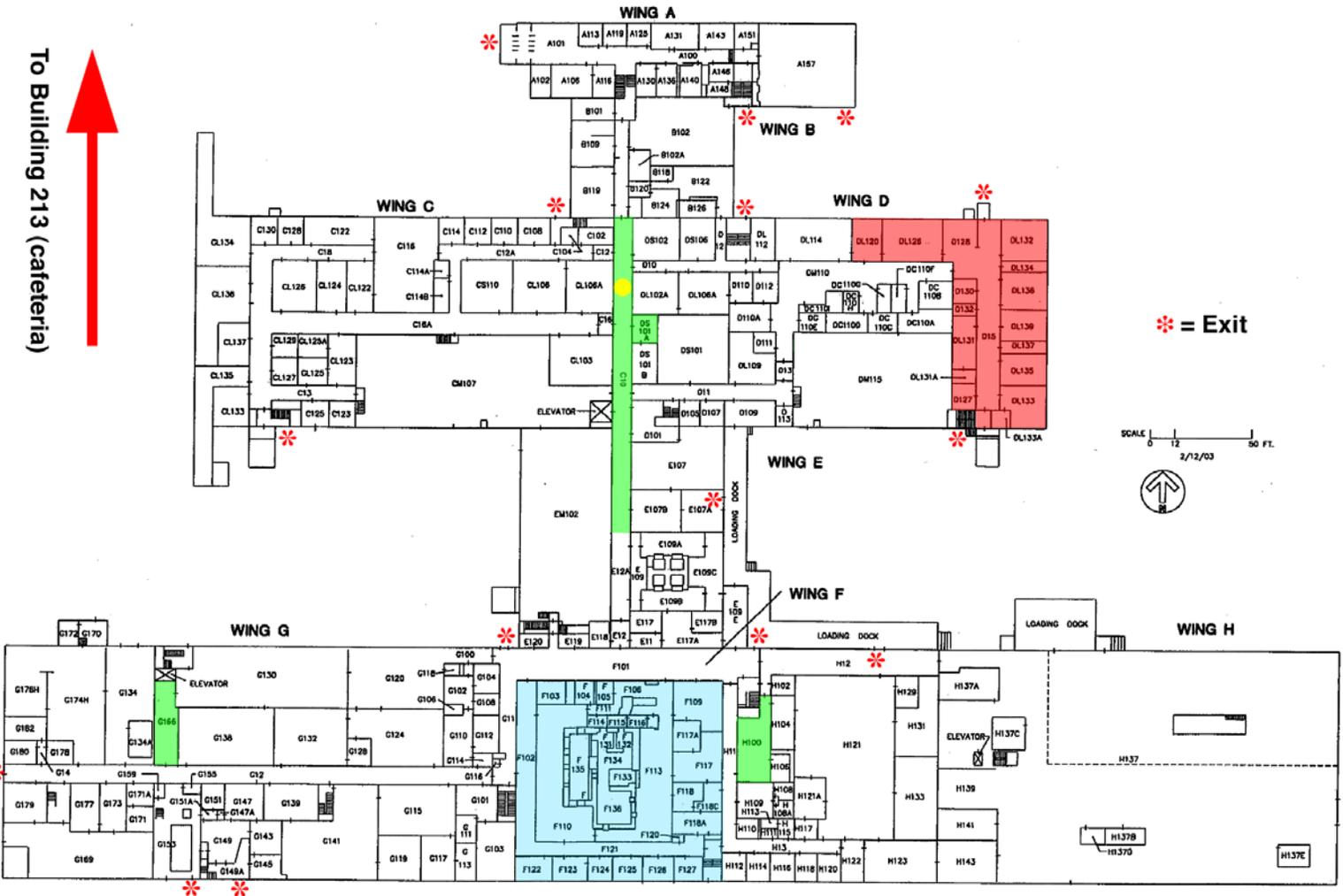
- The yellow dot in the C10 corridor near room DS101A shows the most likely location of EMC group members during a tornado. It is the area users are expected to assemble when a warning is issued.
- The Alpha Gamma Hot Cell Facility (AGHCF) is colored blue.
- The EMC facilities are colored red.

Building 216 floor plan (Sub-Ångstrom Microscopy and Microanalysis Laboratory)



Building 212 ground floor plan

To Building 213 (cafeteria)



Building 212 floor plan (AEM Facility)

