

HPCAT Safety Plan

Version 7.0

June 1, 2007

CAT Director: Ho-Kwang Mao

Ho-kwang Mao

[Signature]

01 June 07

[Date]

HPCAT Safety Plan

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Section 1 CAT Safety Policies

1.0 Purpose

HPCAT is committed to ensuring that all CAT activities are conducted in a safe and environmentally sound manner. This plan describes the CAT's safety program which is implemented to fulfill this commitment

1.1 Scope

To ensure that all CAT activities are conducted in a safe and environmentally sound manner, this plan defines: (1) The standards to be followed by the CAT, and (2) the responsibilities within the CAT organization.

1.2 References

All activities at Argonne National Laboratory - East (ANL-E) will conform to the requirements of the documents listed below, except as provided for by variances or APS procedures. All of the following are available through the CAT Safety Coordinator.

1. ANL-E Environment, Safety and Health Manual
www.aim.anl.gov/manuals/eshman
2. APS User Policies and Procedures relating to environment, safety, and health issues
www.aps.anl.gov/Users/General_Reference/Policy_Procedures/cat_esh.htm
3. ANL-E Hoisting and Rigging Manual
www.aim.anl.gov/manuals/hoist/index.html
4. ANL-E Hazardous Materials Transportation Safety Manual
www.aim.anl.gov/manuals/tsm/index.html
5. ANL-E Waste Handling Procedures Manual
www.aim.anl.gov/manuals/whpm/index.html
6. HPCAT Safety Plan
Hard Copy – Bookshelf top outside E-005
Soft Copy – <\\Hpcat21\Data\users\HPCAT\SAFETY>

1.3 General Policies

All HPCAT construction, commissioning and operation activities will be conducted so that effective measures are taken to protect the health and safety of all HPCAT staff, members, users, contractors and the public, as well as to minimize accidental damage to property and the environment. The HPCAT Council and Safety Coordinator fully understand that HPCAT activities at the APS will not be allowed to proceed if they are considered unsafe or do not comply with established safety procedures. HPCAT will also comply with the requirement of the APS to review and approve the safety aspects of all the experimental programs and activities on the beamlines in advance of their execution.

- 1) Failing to conform to this plan may result in sanctions and/or the loss of access to the APS and CAT facilities.
- 2) Any person has the authority to stop activities that are unsafe or environmentally unsound.
- 3) The CAT will comply with current version of the APS Policy and Procedure for configuration control of shielding systems. No safety system under configuration control is to be modified without CAT **and** APS approval. (Refer to the APS User Policies and Procedures for the complete policy and procedure).
- 4) The CAT will cooperate with the APS to facilitate the oversight responsibilities of the APS, ANL and the DOE.
- 5) The HPCAT will implement an experiment safety review program. The program will be kept current with the relevant APS policies and procedures, including those set forth in Technical Updates, User Policies and Procedures, and AOD Division Director memoranda covering the subject.
- 6) Experimenters shall identify to the CAT the potential hazards associated with their activities and hazardous materials to be used in experiments at the APS, and no experiment shall proceed without a CAT approved and posted APS Experiment Safety Approval Form (ESAF).
- 7) New or modified equipment and un-reviewed activities must be approved by the CAT Director, or designee, prior to energizing the equipment or the start of work. Before any change in the CAT's operations that might reasonably be thought to increase the risk of significant adverse impact on the APS facilities, the environment or any person, is begun, the CAT will obtain the written approval of the APS Operations Division Director, or designee.
- 8) The CAT will maintain a list of current safety assignments (Appendix A) and will update this plan to keep it consistent with scope of CAT activities. The assignment list will be reviewed at least annually and the plan biannually with updates provided to the APS Deputy Associate Laboratory Director.

1.4 CAT Specific Procedures and Policies

See Appendix C.

1.5 Standard Operating Procedures (SOP) List for HPCAT
See Appendix D.

Section 2 - CAT Safety Organization & Responsibilities

The CAT Director has line responsibility for safety for all CAT activities at ANL and for ensuring that this plan is implemented. The Director is also responsible for evaluating and responding in a graded manner to nonconformances with this plan.

The CAT Safety Coordinator reports to the CAT Director and is responsible for implementing and overseeing conformance with this safety plan. The CAT Safety Coordinator is to ensure that the CAT has access to the ANL-E ESH Manual and the other identified standards and to assist CAT members and users in meeting the requirements of these standards.

The CAT Electrical Safety Coordinator is appointed by the CAT Director and is responsible for electrical safety and ensuring compliance with ANL electrical safety standards in all of the CAT's facilities. The Electrical Safety Coordinator is to be aware of ANL ESH Manual defined electrical safety requirements as typically attained through completing ANL electrical safety and LOTO training.

The CAT Chemical Safety Coordinator is appointed by the CAT Director and is responsible for chemical safety, including chemical waste management, and ensuring compliance with ANL and OSHA chemical safety standards in all of the CAT's facilities. The Chemical Safety Coordinator is also responsible for the CAT's proper use of the ANL Chemical Management System. The Chemical Safety Coordinator is to be aware of ANL ESH Manual defined chemical safety requirements.

The CAT Transportation Safety Coordinator is appointed by the CAT Director and is responsible for overseeing the safe transportation of materials to and from the CAT and ensuring compliance with ANL transportation safety standards. The shipping coordinator is to be aware of ANL transportation requirements as well as APS specific shipping and receiving requirements. The Transportation Safety Coordinator will remain current in the APS transportation safety course (ESH387Z, DOT HazMat for APS Small Quantities).

The CAT Laser Control Area Supervisor is appointed by the CAT Director and is responsible for overseeing the safe operation of lasers and ensuring compliance with ANL and OSHA laser safety standards in all of the CAT's facilities. The Laser Control Area Supervisor is to be aware of ANL ESH Manual defined laser safety requirements.

The CAT Experimental Safety Review Coordinator is appointed by the CAT Director and is responsible for conducting hazard evaluations of experimental activities, and specifying required control measures, and approving such activities where specified controls have been implemented.

The CAT Hoisting and Rigging Coordinator is appointed by the CAT Director and is responsible for the safe operation and maintenance of hoists.

The CAT Lab Coordinator is appointed by and accountable to the HPCAT Director. They are responsible for managing the day-to-day safety concerns in the areas for which they are responsible.

Such concerns include:

- ▶ conducting required inspections and tests,
- ▶ arranging for required maintenance and repairs,
- ▶ ensuring that required equipment is available,
- ▶ providing orientations to facilities and procedures,
- ▶ reporting nonconformance to HPCAT management

The HPCAT Radiological Sample Coordinator is appointed by and accountable to the HPCAT Director. The person holding this role is responsible for helping HPCAT ensure that researchers understand and comply with applicable HPCAT, APS, and Argonne National Laboratory policies and procedures relating to the management of radioactive materials. The person holding this role is also responsible for:

- ▶ carrying out or arranging for required inspections and tests,
- ▶ serving as the HPCAT point of contact with the APS and ANL personnel responsible for supporting and conducting surveillance of use of radioactive materials,
- ▶ ensuring that required equipment is available,
- ▶ providing orientations to facilities and procedures,
- ▶ reporting nonconformance with expectations to HPCAT management.

Appendix A - Safety Assignments & ESAF Approvers

Appendix A.1 - HPCAT Safety Assignments

Date: June 1, 2007

Assignment	Person assigned
CAT Director	Ho-Kwang Mao
CAT Safety Coordinator	Eric Rod
CAT Electrical Safety Coordinator	Eric Rod
CAT Chemical Safety Coordinator	Hanns-Peter Liermann
CAT Transportation Safety Coordinator	Veronica O'Connor
CAT Laser Control Area Supervisor	Yue Meng
CAT Experimental Safety Review Coordinator	Guoyin Shen
CAT Hoisting and Rigging Coordinator	Eric Rod
CAT Lab Coordinator	Hanns-Peter Liermann
CAT Radiological Sample Coordinator	Hanns-Peter Liermann

Appendix A.2 - HPCAT Personnel with Experiment Safety Approval Authority

As Director of HPCAT, I authorize the following personnel to conduct hazard evaluations of experimental activities, to specify required control measures, and approve such activities where specified controls have been implemented. (Upon updating this form, the CAT will provide a copy of the revised form to the APS Deputy Associate Laboratory Director).

1. Guoyin Shen
2. Yue Meng
3. Paul Chow
4. Hanns-Peter Liermann
5. Haozhe Liu
6. Ho-Kwang Mao
7. Stanislav Sinogeikin
8. Wenge Yang

CAT Director: Ho-Kwang Mao

<u>Ho-kwang Mao</u>	<u>01 June 07</u>
Signature	Date

Appendix B - Standard Procedures Used by HPCAT

HPCAT has evaluated the hazards that will be encountered in its operations, and, to mitigate these hazards the CAT will follow the unmodified APS Standard Procedure Guides listed below.

1. APS User Safety Guide (ANL/APS/TB-23).
2. ANL ES&H Manual.
3. APS Policies and Procedure for User Shop Access
4. APS Policy and Procedure 3.1.21 Revision 0 User Electrical Equipment Inspections May 26, 2006

Appendix C - HPCAT Specific Procedures and Policies

HPCAT has evaluated the hazards that will be encountered in its operations, and, to mitigate these hazards, the CAT has developed and will follow the procedures listed below. The titles of the procedures should be self-explanatory.

1. Operating Procedures for Laser Facilities:

- HPCAT will comply and uphold the policies as outlined in the APS User Safety Guide (ANL/APS/TB-23) and the ANL ES&H Manual for its personnel and for the user community.
- HPCAT will aim at having as many of its laser installations as possible classified as class I to reduce all laser associated risks reduced to absolute minimum and simplify laser use procedures.
- All users of HPCAT laser installations rated above class II will be required to (i) take the ESH120 Laser Safety course, (ii) have an up-to-date laser eye examination record on file at HPCAT **and** at the ANL Medical Department, (iii) read, sign and comply with the HPCAT Laser Controlled Area Safety Regulations.
- Standard Operating Procedures will be written for all laser systems. These will be posted at or near these facilities, and observance of these will be enforced by the LCA supervisor and/or the SC and/or the CAT Director. These SOP documents will be kept up to date.

2. Storage and handling of radioactive samples:

- No loading of radioactive samples into high-pressure cells at Sector 16 is permitted. Cells will arrive pre-loaded from the users institution. Containment, transport and local storage will be as per the current regulations in effect.
- Two locked and adequately labelled storage cupboards will be used in laboratory “E030 West”, one for MBA accountable materials, one for other radioactive samples.
- Transport of the high-pressure cells between the storage and experiment areas will be carried out in accordance with the current regulations in effect. Should the experimental area be unattended when a high-pressure cell is in place, the station door will be locked using a padlock and chain and the key will be in the possession and under the responsibility of the user team leader or his/her deputy. If cells have to be stored for any length of time when the experimenters are not on site, e.g. storage when awaiting transportation, these will be padlocked in station BM-D and the key will be the responsibility of the CAT RSC.

3. Shipping and handling of energetic material:

Shipping of energetic materials has to be conducted according to DOT regulations described in exemption DOT-SP 8451 (31st Revision, see Appendix A for the 1st page or http://hazmat.dot.gov/sp_app/special_permits/docs/08000/SP08451.pdf for the full document). This exemption clearly states that explosive materials below 25 g can only be shipped commercially in a steel pipe that is nipple closed at both ends (see “7. SAFETY CONTROL MEASURES” in DOT-SP 8451). These steel pipes can be purchased commercially from e.g.

Safety Management Services, Inc. (SMS) (http://www.smsink.com/products_shipping.html) and will not be provided by HPCAT, or APS/ANL. Regarding shipping papers for these materials, DOT-SP 8451 paragraph 4 states that the EX number of the material does not need to be posted on the package if any of the following paragraphs of 49 CFR apply: 172.320, 173.54(a), 173.56(b), 173.57 and 173.58.

All users of HPCAT have to follow these regulations unless they can provide an exemption that releases them from these regulations. If materials are shipped to HPCAT in any other way than stated in exemption DOT-SP 8451 the user will be required to purchase and organize the shipping of the energetic material back to their respective home institution. If an exemption from these regulations exists, they need to be filed with staff responsible for chemical safety at HPCAT, 8-10 weeks prior to delivery of the sample to HPCAT. HPCAT will forward the documents to APS safety and ANL Shipping. ANL Shipping will then ask to become party to such exemption.

Step by step instructions/guideline for shipping energetic materials from respective home institution to HPCAT at APS/ANL, after the home institution has become party to an exception described above.

- 1) Submit ESAF (Experimental Safety Assessment Form) 2 weeks prior to experimental starting date.
- 2) Notify HPCAT safety officer about upcoming experiment and shipment of energetic materials.
- 3) Pack energetic materials according to DOT regulations (see “7. SAFETY CONTROL MEASURES” in DOT-SP 8451) and submit package to preferred carrier (e.g. FedEx). Ship material to the following address:

**H. P. Liermann
c/o Building 46, Hazardous Materials Receiving
Argonne National Laboratory
9700 South Cass Ave.
Argonne, IL 60439**

4) After submitting of energetic shipment to carrier user will forward shipping information (tracking number) to HPCAT safety officer. The safety officer will notify ANL shipping of in bound shipment of energetic material and forward shipping information (tracking number) to ANL shipping department (Note: Overnight delivery requests are frequently delayed by one or two day and hence the container should be shipped at least 4-5 days prior to the experimental starting date.)

5) Upon arrival of shipment at ANL, ANL Receiving Department will inform APS safety and HPCAT safety officer of the arrival of energetic shipment. APS safety will arrange transport of energetic shipment container to HPCAT preparation lab (Bldg. 434E, Rm. 030) where the container will be locked in a steel cabinet until users arrive for their experiments.

Quick reminder on how to pack energetic materials

(Note: These are only guidelines/reminders that HPCAT staff wrote up when packing the materials under Jeff McGhee’s supervision (ANL shipping). In order to pack energetic

material one needs to be supervised by a shipping expert from the home institution that is DOT certified to handle and pack explosives):

- 1) The energetic material should be packed in 1 g quantities in separate vials.
- 2) Each sample vial should be separated from one another by tissue paper so that the vials can not come in contact with each other.
- 3) The DAC and the plastic container that holds the vials should also be wrapped in tissue paper and the tissue paper should be made antistatic, i.e. we spray fabric softener in a solution of 1:10 on it.
- 4) Each package should be wrapped in bubble wrap.
- 5) The pipe nipples should be closed with a wrench.
- 6) MSDS of all materials and the DOT exemption DOT-SP 8451 should be included in the box.
- 7) Use the FedEx Pouch to post all the names of all the materials to the outside of the wooden box.

Current status of handling of secondary explosive materials at HPCAT, APS:

The staff at HPCAT currently follows the explosive safety guidelines established by APS which are based on Chapter 4.11 of the ANL ES&H Manual (see Appendix B, or http://www.aps.anl.gov/Safety_and_Training/Experiment_Hazard_Classes/hc067.html).

Appendix A:

DOT-SP-08451 - for complete version see:

http://hazmat.dot.gov/sp_app/special_permits/docs/08000/SP08451.pdf).

Appendix B

Explosive Safety – General Notes 5/21/2007 - also see

http://www.aps.anl.gov/Safety_and_Training/Experiment_Hazard_Classes/hc067.html

1. An experiment safety review must be performed.
2. The ANL-Fire Department (630-252-6136) would need to be informed of the experiment.
3. An inventory list of the explosive material would need to be sent to ANL Security, ANL Fire Department, the ANL Explosive Safety Specialist (Greg Dely, 630-252-6440), PFS - Safety & Emergency Systems and APS Building Management (Bob Whitman, 630-252-6020). This list must include the type of explosive material, name of material, volume, weight or quantity, location, responsible party w/alternate, manufacturer of material, and lot numbers or serial numbers. The above ANL groups must also be notified upon removal of the explosive material from ANL premises (All functions described in Section 3. are preformed by APS Safety Personal).
4. The responsible person of the explosive material must determine the hazardous properties and toxicity of the material using the manufacturer's MSDS or other information sources.
5. The explosive material must be protected from excessive temperatures, electrical sparks, ignition sources, etc. In the case of lightning or an approaching storm, then operations involving explosive material must be discontinued.

4. HPCAT SOP for Preparation of Beryllium Gaskets in Laboratory E030, Bldg 434E, and cleaning of diamond anvil cells contaminated by broken Be gaskets

(Version 1.5, 5/31/07, P. Liermann)

1. Introduction

This is a Standard Operation Procedure to prepare and load Be gaskets for diamond cell experiments in room E030. The dimensions of the Be gasket are 0.5 mm in thickness and 3 mm in diameter. After pre-indentation, the thickness of the inner part of the gasket is usually less than 50 micrometers. The main work conducted under this SOP is drilling of a hole with the diameter of 10 – 100 microns at the center of the indented area. Drilling is conducted under a turpenoid liquid in an EDM and involves removing Be of the order of 10^{-5} g. Finally, the gasket needs to be positioned in a diamond anvil cell and loaded with the sample.

2. Hazards

Beryllium is highly toxic, inhalation of the dust resulting in berylliosis.

3. Controls

3.1. Indentation of Be gaskets

Indentation of a Be gasket has to be conducted in the designated fume hood located in room E030. Because there is a chance that the gasket breaks during indentation, the user is required to enclose all openings of the diamond anvil cell with kapton tape. If the gasket breaks during indentation the cell needs to remain in the fume hood and cleaned from any Be gasket fragments and dust as described under “3.4 Cleaning of broken Be gaskets”.

3.2. Drilling of Be gaskets

The drilling of the Be gaskets will be conducted inside the fume hood in room 030 (Please move the drilling machine into the fume hood). The drill bits used for drilling Be are clearly marked “FOR BERYLLIUM”, and will be only used for drilling Be gaskets. A clearly marked brass container that can be inserted into the EDM drilling machine will be used to hold the Be gaskets and the turpenoid liquid. The operator has to wear latex gloves and goggles at all times during the operation. The Be gasket will be drilled under a turpenoid mixture inside the brass container. The turpenoid is used to prevent any beryllium from becoming airborne.

After drilling, the brass holder will be removed from the drilling machine and the wasted turpenoid will be poured into a clearly marked waste container with double containment. The brass insert will be rinsed with iso-propanol. Latex gloves and tissue papers used during the drilling process will be disposed in an extra container in the fume hood. The waste containers will be disposed properly when full by the chemical safety officer. Used Be gaskets will also be disposed in a container with double containment located in the fume hood.

3.3 Loading of Be gaskets and handling of Be loaded DAC in experiment stations.

Aligning of the Be gasket in the diamond anvil cell will be conducted in the designated fume hood located in room 030. The fume hood contains an extra microscope that has been designated for indenting and loading of Be gaskets. When aligning and loading the Be gasket in the diamond anvil cell latex gloves need to be worn. The gloves are necessary to prevent skin exposure to beryllium. All tools used to load the Be gasket are marked with purple nail polish. These tools need to remain in the fume hood at all times and can only be handled with latex gloves.

Because occasionally a Be gasket can break during the experiment and multiple Be fragments as well as Be dust can contaminate the experimental station all openings in the Be loaded diamond anvil cell need to be taped with kapton. The enclosure of the DAC with kapton will limit any possible contamination to the inside of the DAC. If the Be gasket does break during the experiment the user needs to stop the experiment and transfer the diamond anvil cell into the fume hood located in room 030. A qualified staff/user will then clean the contaminated diamond anvil cell as described in section “3.4 Cleaning of broken Be gaskets”.

Any gloves and tissue paper that was used during the loading process has to be disposed as waste and will be temporarily stored in the plastic container provided. The container will be disposed and handed over to chemical waste management by the chemical safety officer at the beginning of each run or when ever they are filled up.

3.4 Cleaning of broken Be gaskets.

When a diamond anvil cell is contaminated during indentation of the Be gasket or the experiment itself due to the breaking of the Be gasket the caption enclosed diamond anvil cell needs to be transferred into the fume hood in room E030 and will be decontaminated by a qualified staff/user.

In order to clean the contaminated diamond anvil cell the staff/user needs to follow the procedure outlined below:

- a) Staff/user needs to wear latex gloves, chemical safety glasses, dust mask and lab coat.
- b) The area where the diamond anvil cell we be decontaminated needs to be laid out with large tissue paper that can be removed after decontamination. This is to minimize further contamination of the fume hood.
- c) Remove all kapton tape and watch out for Be fragment. All Be fragments should be immediately transferred in the provided container.
- d) Rinse the diamond anvil cell and the diamonds with iso-propanol over the recycling container to remove any lose Be partials and dust.
- e) Swipe all surfaces of the diamond anvil cell and the diamonds with a tissue paper that was soaked in iso-propanol.
- f) Examine the diamond culets under the microscope for any remaining Be gasket fragments and remove them with a fine grid sand paper. If the diamonds are broken beyond repair, remove the diamond from the seat and dispose it in the plastic container.
- g) Dispose all tissue paper, gloves and dust mask into the provided plastic container and label container Be waste.

4. Authorized Personnel

4.1. Personnel qualified for indenting, drilling, and loading of Be gaskets.

Personnel authorized to indent, drill and load Be gaskets need to take the Beryllium Hazard Awareness Class ESH211 or comparable class (if offered by home institution) and should have training by the chemical safety officer his/her designee, which includes signing a statement that the user understands and agrees to abide by this SOP document.

4.2. Personnel qualified for indenting, drilling, and loading of Be gaskets.

Personnel authorized to clean Be contaminated diamond anvil cell need to meet the requirements stated under *4.1.* and, in addition, take class ESH246 “Safe Handling of Carcinogens”. In addition the personal need to be trained by the chemical safety officer or his/her designee in decontaminating of diamond anvil cell.

- 5. Sector Orientation:** A Sector Specific Orientation will be given to all new users and staff, renewable after two years.

Appendix D - Standard Operating Procedures List for HPCAT

1. Beryllium SOP Version 1.5
2. Energetic Material Shipping and Handling Version 1.5
3. Pressure Measurement Unit (outside IDB, Sector 16) SOP
4. Lasers in Laser Controlled Area (inside IDB, Sector 16) SOP
5. Raman System in Lab E020B, Bldg 434E SOP
6. Air Cooled Ar Laser in Lab E020, Bldg 434E SOP
7. Air Cooled Ar Laser in Hutch IDD, Sector 16 SOP
8. Air Cooled Ar Laser in Hutch BMD, Sector 16 SOP