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Photon Sciences Directorate Policies and Requirements Manual

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Prepared by: **L. Stiegler**
Approved by: **Andrew Ackerman (Deputy ESH Manager)**

1. INTRODUCTION

This document details the procedures for work planning and environment, safety, and health (ES&H) review of experimental operations at the Photon Sciences. All science is subject to ES&H review and must be approved by the ES&H staff before proceeding. Photon Sciences is committed to minimizing the risks to employees, visitors, the public, and the environment associated with both accelerator and experimental operations. For additional information, you may read [BNL SBMS Subject Area Work Planning and Control for Experiments and Operations](#).

2. EXPERIMENT SAFETY REVIEW PERSONNEL

2.1 The PS Experimental Review Coordinator (ERC) is the primary contact for ES&H review of experiments and is authorized to approve experiments at Photon Sciences. The ERC is designated by the PS ES&H Manager or deputy manager.

The ERC has the discretion to assemble a committee with appropriate expertise to review individual experiments that present unusual risks. That committee may be comprised of technical experts from within the department and from outside Photon Sciences.

2.2 The NSLS Operations Coordinators assure that only approved experiments at NSLS are allowed to proceed and assist Users in the proper conduct of experimental operations. They are the primary contact for all ES&H concerns on the NSLS Experimental Floor

3.0 General Safety Requirements

All work at the Photon Sciences is reviewed for Environmental, Safety, and Health (ES&H) concerns. The experimental program requires special attention as it involves a varied population of visitors who study and use many diverse materials. Guests are trained and oriented before beginning work at the beamlines or in the laboratories. They are expected to act responsibly and to understand that NSLS is a shared facility and may require precautions that do not apply at their home institutions. The following general requirements help ensure the safety of all workers:

- Stored glass bottles larger than 1000 ml are not allowed unless specific permission is obtained from ESH staff. Stored plastic bottles or glass bottles with protective plastic sleeves larger than 1000 ml are allowed.
- Limit quantities of hazardous liquids to < 250 ml at beamlines
- Minimize the quantity of potentially hazardous material brought to the NSLS to that required by the experiment.

- Sample preparation involving corrosives require access to an emergency eye wash and shower, and may be required to be done in a laboratory
- Utilize exhaust systems to control personnel exposures or avoid accumulation of combustibles.
- Provide secondary containment to control spills.
- Assure compliance with Brookhaven National Laboratory training and medical examination requirements.
- Provide protection from physical hazards, such as noise, magnetic fields and lasers
- Test and assure proper grounding of electrical equipment.
- Assure proper personal protective equipment (PPE) and controls for handling of radioactive materials, chemicals and nanomaterials.
- Evaluate and control stored energy concerns.

4.0 Experimental Safety Review

All experimental proposals are reviewed by the ERC before operations begin. Experimenters are required to report their intended activities both at the beamline and in the laboratories to the ERC to allow for an appropriate risk assessment and to determine what measures may be necessary to control their operations. There are two main mechanisms for reviewing experimental work; the Safety Approval Form (SAF) through the PASS system, and the Experimental Safety Review (ESR) for general laboratory use. An experimenter may use one or both of these systems, and some overlap may occur. An SAF alone may be adequate when no lab use is required, i.e. bringing prepared non-hazardous samples for analysis, or protein crystallography. An ESR may be adequate for laboratories that have routine sample preparation or analysis. Experiment descriptions in the SAF frequently describe sample preparation and beamline operations together. The experiment and lab operations, and room number, should be described in the SAF so that the ERC can verify that appropriate controls are in place (i.e. fume hood, eye wash and shower).

5.0 Sample Preparation/Laboratories

Each space designated as a “Laboratory” space is required to assign a Lab Steward. An alternate Deputy Lab Steward is optional. Stewards and Deputy Stewards must read and accept their Roles, Responsibilities, Accountabilities, and Authorities (R2A2’s) annually within the BNL Training Management System (BTMS). The basic rules for laboratory use are found in Attachment 1. Some beamlines have dedicated lab space, and some labs are available for General Users. A list of Lab Stewards and ESRs can be found on the PS ESH web page.

The Lab Steward in conjunction with the Experimental Review Coordinator, develop an Experimental Safety Review (ESR) Form. The ESR contains information on the equipment in the lab, the materials generally used, the general types of operations, and the waste generated. All operations in the lab are expected to be covered by the ESR. Any work that falls outside of the ESR requires ESH evaluation, which may be covered by the PS Procedures and Requirements Manual (PRM), the PS Job Risk Analyses, and the NSLS Safety Approval Forms (SAF’s).

A Lab Request Form may be required to ensure the Lab Stewards have reviewed all work in the lab; that all work has been evaluated for ESH concerns through work planning, and that all personnel are aware of the controls. The Lab Request Form is available on the web ESR page, and must be submitted to the Lab Steward prior to lab use. The Lab Request Form informs the Lab Steward of the equipment/space requested, the start and end dates, the materials used, and the contact information for the lab user (s). The Lab Stewards retain the Lab Request Forms for one year.

ESRs are approved by the Experimental Review Coordinator and must be reviewed and re-issued each year.

6.0 Beamline Experimental Safety Approval Forms (SAFs)

6.1 Filling out the SAF

The information necessary for ES&H review of experiments at the beamline is collected on the [NSLS Experiment Safety Approval Form \(SAF\)](#)

6.1.1 An SAF must be submitted at least one week prior to the start of each experiment. The NSLS requires that all experiments be adequately planned and evaluated for ES&H concerns and that adequate time be allotted for

input from the ERC. Experimenters planning experiments that present unusual risks (See Section 6.1.3.3) and that require special procedures or equipment should contact the NSLS ERC as early as possible to avoid delays and assure sufficient time to develop appropriate controls. Approvals for SAF's expire in one year at which time the SAF must be resubmitted and reviewed once again.

6.1.2 The SAF may be changed if needed. New ideas may arise during the course of an experiment that require last minute additions of new materials and equipment. All significant changes must be reported to an NSLS Operations Coordinator. The Operations Coordinator will help decide whether additional review is needed and will make any changes to an approved SAF. Most changes are easily accommodated and should not result in significant delay. Changes that will require additional review include:

- a. Addition of new materials that present different risks than those already listed.
- b. Addition of new equipment that presents different risks than those already listed.
- c. Significant changes in the quantity of materials originally reported.
- d. Significant changes in experimental procedures.
- e. A change of beamline to be used.

6.1.3 The NSLS SAF contains fields designed to collect sufficient information for evaluation of ES&H concerns associated with each experiment. All fields on the form must be completed by an Experimenter with responsibility for conducting the experiment. The form is intended to be self-explanatory. Additional information for the use of selected fields is included below.

6.1.3.1 List of Experimenters

Only those individuals who will be working at the NSLS should be listed here. All those listed must complete the NSLS registration, orientation, and training and must complete the Beamline Operation and Safety Awareness (BLOSA) orientation conducted by the beamline Local Contacts. Additions to this list may be requested by anyone listed but require approval of an NSLS Operations Coordinator before being entered on the SAF.

6.1.3.2 Materials to be Used:

All materials pertinent to the experiment are to be listed here along with the quantity brought to the NSLS and the location of storage while at the NSLS. A column is also provided for the ERC to check when material containers must be included in the BNL Chemical Management System (CMS). The following minimum criteria are used to determine the need for inclusion to the CMS program (i.e. containers must be bar-coded and information input to the BNL database):

- a. Any material that will remain at the NSLS at the completion of the experiment and not returned to the Experimenter's home institution when he or she returns home.
- b. Any single container that exceeds one liter in volume.
- c. All ethers and furans.
- d. All compressed gas cylinders containing research gases (excluding inert gases) that will not be returned to the Experimenter's home institution.

6.1.3.3 Task and Hazard Analysis

This is where Experimenters are expected to describe the details of their experiment. Experimenters are expected to plan their activities and document needed controls in this section of the form. If sample preparation or lab use is required, the operations and Lab number to be used should be listed here. Any pressure vessels or devices being brought to the NSLS must be listed in this section so that the appropriate review can be completed.

Experiments involving any of the following hazards require special review, and may take extra time to implement the necessary controls and approvals.

- A) Etiological Agents, Select Agents and Toxins, and Recombinant DNA (See Attachment 2)
- B) Live animals or human subjects, or human bodily material (See Attachment 3)
- C) Transuranic Materials (See Attachment 4)
- D) Nanomaterials (See Attachment 5)
- E) Visible Light Hazards (See Attachment 6)

Discussions with the [NSLS Experimental Review Coordinator](#) regarding any of these materials should begin well in advance of the anticipated experiment date.

6.1.3.4 Wastes

This section is included to assure that Experimenters anticipate, report, and seek to minimize the wastes generated by their experiment. A column is provided for the ERC to identify wastes considered hazardous that must be disposed through the BNL Hazardous Waste Management Facility.

6.1.4 The NSLS SAF is an important document used to collect information and to support operation at the beamlines. An outline of the mechanics of how the form is used follows:

6.1.4.1 Submission of an NSLS SAF initiates review of each experiment. That review is an interactive process that may include discussion between the ERC and the Experimenters conducting the experiment and may require additional written support material prior to approval. Any sample preparation being done at NSLS should be described in the SAF, and the Lab Steward must be contacted to request Lab space.

6.1.4.2 The ERC will determine if additional safety controls or training is needed. For example, experiments generating hazardous or radioactive wastes will require a person designated as responsible for the wastes and completion of a BNL web-based training program ([Hazardous Waste Generator \(HP-RCRIGEN3\)](#)). Such additional requirements will be communicated by the ERC to the experimenter and to the local beam line contact via email.

6.1.4.3 Approved forms remain active for one year at which time the SAF must be resubmitted for review.

6.1.4.4 Experimenters, ready to begin an experiment, must contact an Operations Coordinator to have the beamline enabled. The Operations Coordinator will only enable the line and allow the experiment to begin if an approved SAF is on file. The Operations Coordinator will confirm that any special requirements established by the ERC have been met, and will post the SAF at the beamline where it will remain for the duration of the experiment. At the completion of the experiment, the Experimenter must again contact the Operations Coordinator who will come to the beamline, collect the SAF, and disable the beamline.

6.2 SAF Field Verification

The NSLS experiment review program contains a graded approach to field verification that Experimenters adhere to any requirements established during ES&H review of experiments. We expect our Users to conduct their experiments in a conscientious and honest manner and to report unexpected occurrences. The ERC determines which experiments require added attention. Field verification is accomplished in the following manner.

6.2.1 All experiments involve interaction between the Experimenters and an Operations Coordinator. The Operations Coordinators know the facility and BNL policies and are a good source of information to the Users. They read any comments noted on the SAF and assure that appropriate information is given to the Experimenter.

6.2.2 There is a check box on the SAF that indicates, “Approved, requires notification.” If the ERC checks that box, the Operations Coordinator will allow the experiment to begin and will notify the ERC that the Experimenters have arrived and have started their experiment. This allows the ERC to keep aware of which experiments are in progress and to determine if an inspection of the experimental set up is required. This approach to verification is used for recurring experiments and for those that the ERC determines require added attention beyond interaction with the Operations Coordinator.

6.2.3 There is a check box on the SAF that indicates, “ERC review required”. If the ERC checks this box, the Operations Coordinator will not enable the beamline and will not allow the experiment to begin until first contacting the ERC. This approach to verification is used for experiments that present unusual risk and that the ERC determines require exceptional attention to detail before operations begin.

7.0 Beamline Hazard Analysis

Safety review of beamline hazards is accomplished by performing a Beamline Hazard Analysis. Each beamline has certain hazards or hazardous activities that may be present with or without the experimental program running (i.e. changing a diffractometer, filling a detector with LN₂, changing compressed gas cylinders). A review of each beamline is done yearly to capture any ES&H concerns and evaluate required controls. The beamline local contact is responsible for reviewing the Beamline Hazard Analysis annually and ensuring Experimenters are familiar with allowable activities and hazard controls at their beamline. The Beamline Hazard Analysis can be found [here](#).

Laboratory Rules

GENERAL

1. **Area PPE requirements are listed outside the labs.** Wear **PPE required by the AREA PLACARD, or by the ESR or SAF** when handling **HAZARDOUS** materials. Place the plastic chain across the doorway when using chemicals to inform others that lab coats are required for entry.
2. **Eating and drinking is PROHIBITED in the laboratory. DO NOT** work alone when handling **HAZARDOUS** chemicals.

EMERGENCY

3. **REPORT** all accidents and chemical spills in 725 to the Control Room x2550. For other areas, call x2222.
4. **FAMILIARIZE** yourself with the location of the nearest: eye wash station, safety shower, fire extinguisher, spill control station, and building exit.

CHEMICAL and WASTE MANAGEMENT

5. **DO NOT** dispose of **ANY** chemicals down the sink drain. Contact Tom McDonald x4483 for help with disposal of **HAZARDOUS WASTES**.
6. **DO NOT** store hazardous waste in a laboratory unless you have previously designated the laboratory as a **“SATELLITE HAZARDOUS WASTE ACCUMULATION AREA”** with Tom McDonald x4483.
7. **DO NOT** store hazardous chemicals near any **ENVIRONMENTAL RELEASE POINTS** (sink, drain, etc.).
8. **STORE** all liquid chemicals in secondary containment trays.
9. **LABEL (name, beamline)** and **DATE** all of your chemicals. Secondary containers must have a label with NFPA codes.
10. **DO NOT** store incompatible chemicals together.
11. All **CARCINOGEN HANDLING MUST** be done inside a designated area. Decontaminate the area when finished.
12. All **PEROXIDE FORMING CHEMICALS** must be posted with a date received, date opened and concentration test dates. **TESTING** must be performed every 6 months, and chemical must be disposed after expiration date or 24 months (i.e. Diethyl Ether, Furans, Isopropyl Ether, Picric Acid, Tetrahydrofuran, Vinyl Acetate; see Working With Chemicals Subject Area - <https://sbms.bnl.gov/standard/17/1700t011.htm>)
13. **MATERIAL SAFETY DATA SHEETS** can be found at the following WEB Site:
http://www.bnl.gov/esh/shsd/cms/main_i.htm
14. Any chemical or research gas cylinder brought into the NSLS which will be stored here **MUST** be **BAR CODED**; contact a member of the CMS Team x2862.
15. All gas cylinders shall be **CAPPED** when not in use and **STORED** in the gas storage area located outside of the West roll-up doors.

Questions? Lori Stiegler x5366, Brian Heneveld x6399, Bob Chmiel x8141, Tom McDonald x4483 or Gabrielle Wilson x7328

Attachment 2

Etiological / Select Agents or Toxins

BNL guidance for dealing with hazardous biological materials is provided in the [Biosafety in Research](#) Subject Area. Additional NSLS information is provided below. Etiologic Agents (BSL 2 or Select Agents) are defined as:

- a. Non-regulated, i.e. a viable organism or its toxin, which causes, or may cause, human disease but is not listed in a biosafety regulation (e.g. Pfisteria, scrapie), or
- b. Regulated, i.e. a viable organism or its toxin, which causes, or may cause, human disease as listed in a biosafety regulation.
- c. For additional information see Appendix A of 42 CFR 72, "[Additional Requirements for Facilities Transferring or Receiving Select Agents.](#)"

Proposals to use Select Etiologic Agents or Toxins at the NSLS will require an extended review and may also require registration with the CDC or other agencies. This registration and NSLS approval may take several months to complete. In order to conduct Etiologic Agent/toxin research at the NSLS, use the BNL Institutional Biosafety Committee [Select Etiologic Agent or Toxin Form](#) to determine if your agent/toxin is listed and proceed according to the instructions, in collaboration with the NSLS Experiment Review Coordinator.

An [NSLS Technical Basis for Biosafety Level 2 \(BSL2\)](#) experiments has been established.

[NSLS Biosafety Requirements](#) shall be followed for conducting BSL2 experiments.

[Special Microbiological Practices for Biosafety Level 2 Microorganisms](#) shall be used in the conduct of BSL2 experiments (note that these precautions will be taken in addition to [Standard Microbiological Practices for Biosafety Level 1 Microorganisms](#)).

There is no capability within the NSLS to handle BSL3 or BSL4 work.

Recombinant DNA is defined:

- a. Molecules that are constructed outside living cells by joining natural or synthetic DNA segments to DNA molecules that can replicate in a living cell; or
- b. Molecules that result from the replication of those described in (a). See the [NIH Guidelines for Research Involving Recombinant DNA Molecules](#).

Proposals to use Recombinant DNA at the NSLS will require an extended review and may also require registration with the CDC or other agencies. This registration and NSLS approval may take several months to complete. In order to conduct Recombinant DNA research at the NSLS, use the [Recombinant DNA Form](#) to determine your Experiment Category and proceed according to the instructions, in collaboration with the NSLS Experiment Review Coordinator.

Attachment 3

Human or animal subjects, or human bodily material

Animals:

Animal research requires the approval of the Institutional Animal Care and Use Committee (IACUC). This applies to every experimenter doing research with live vertebrate animals at BNL, independent of their appointment or relationship to BNL. Protocols must be developed in accordance with the BNL requirements in the [Animal Research Subject Area](#).

Human Subjects or Human Bodily Materials

Human bodily materials can include, cells, blood, urine, tissues, organ, hair, nail clippings, teeth, etc. Most experiments involving these can be declared 'exempt' from extensive review by the Office of Research Administration. See the [Human Subjects Research Subject Area](#) and the [Human Research Protection Program](#) for more information on applying for exemptions.

Attachment 4

Trans-uranics

Trans-uranics (TRUs) are defined as those elements with atomic numbers greater than 92 starting with Neptunium (atomic no. = 93) and upward. Discussions regarding any of the issues below should be held with the [NSLS Experimental Review Coordinator](#) well in advance of the anticipated experiment date.

[Technical Basis for NSLS Trans-uranic Quantity Limits](#) has been established.

[Trans-uranic Safety Requirements](#) shall be followed for conducting TRU experiments.

Attachment 5

NANOSCIENCE REQUIREMENTS

Attachment 6

Visible Light Hazards

Bending magnet and insertion device VUV beamlines and X-ray beamlines without beryllium windows have the capacity of transmitting visible light. This visible light should be considered hazardous to the human eye. Bringing direct or reflected visible light outside of the beamline or end station vacuum onto the floor (e.g., for alignment) shall be planned and controlled through the use of an [NSLS Safety Approval Form \(SAF\)](#). Controls shall consist of, at a minimum:

- An approved SAF for this experiment
- The alignment area shall be enclosed by yellow/black caution tape and postings (black lettering on yellow background) saying:
CAUTION - Visible Light Hazard
- Only those persons listed on the SAF shall be allowed within the taped area
- A backstop shall be provided for the visible light beam
- No unattended operations shall be allowed (i.e., no Pink Cards)
- Any configuration changes shall first be reviewed and approved by the Experiment Review Coordinator before the experiment may proceed

