Revisions Prepared By:	Originally Prepared By:	Approved By:
M. Buckley	W.R. Casey	A. Ackerman

*Approval signatures on file with master copy.

The only official copy of this file is the one on-line in the NSLS ESH website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the NSLS ESH website.

1. PURPOSE

Protection for employees, visiting scientists and outside contractors exposed to high hazard energy potential shall be achieved through comprehensively designed, fully functional interlock systems and operational procedures. NSLS staff and users are required to follow the "NSLS Interlock Rules" given in Attachment 1 below. A complete description of NSLS interlocks is provided in Attachment 2: "Radiation Safety Interlocks at the NSLS."

1. SCOPE

2.1 Interlocks shall be provided for all equipment or locations where the potential exists for exposure to high levels of radiation or other hazardous energy sources if the equipment were inadvertently operated with personnel in the potentially exposed area. Interlocks shall be installed where these hazards are not adequately protected by other means (i.e. barricade or lockout). When interlocks are required, they shall be designed in accordance with BNL Interlock Safety for Protection of Personnel requirements within SBMS.

2.2 High Radiation Areas and Very High Radiation Areas shall have interlock systems that meet the requirements of BNL Radiological Control Manual and BNL Interlock Safety for Protection of Personnel requirements within SBMS.

2.3 Laser systems requiring interlocks shall comply with SBMS Laser Safety Subject Area and BNL Interlock Safety for Protection of Personnel requirements within SBMS.

2.4 RF and microwave energy systems requiring interlocks shall comply with RF and Microwave Safety subject area and BNL Interlock Safety for Protection of Personnel requirements within SBMS.

2.5 Analytical x-ray facilities shall comply with the BNL Radiological Control Manual and BNL Interlock Safety for Protection of Personnel requirements within SBMS.

2.6 Miscellaneous electrical equipment shall comply with Electrical Safety subject area and BNL Interlock Safety for Protection of Personnel requirements within SBMS.

3. RESPONSIBILITIES

3.1 The Heads of Operations for the LINAC/Booster, VUV ring, X-ray ring, and SDL are responsible to ensure that operations of their facilities are conducted only when all interlock systems are fully functional and tested within the 6 month requirements. The NSLS Safety Officer is responsible to ensure that beam lines for the X-ray storage ring are operated with interlock systems that are fully functional and tested within the 6 month requirements.

3.2 The NSLS Safety Officer, in conjunction with the appropriate operations manager and the NSLS Interlock Working Group, shall define appropriate interlock requirements for NSLS radiation and laser systems.

3.3 The NSLS Interlock Engineer shall ensure that the technical documents for NSLS interlock systems are accurate and current, and shall supervise the installation of all NSLS radiation and facility laser interlock systems.

3.4 Construction, modification, maintenance, repairs, and testing of radiation and facility laser interlock systems may be done only by or under the direction of the NSLS Interlock Group, the NSLS Interlock Engineer, the NSLS Deputy Safety Officer, or QA Manager.

3.5 The NSLS Deputy Safety Officer or QA Manager shall schedule and conduct tests for radiation protection and laser interlock systems as defined in BNL Interlock Safety for Protection of Personnel requirements within SBMS, and maintain test records.

3.6 The NSLS Interlock Working Group shall review all new construction and modification of NSLS interlock systems and ensure that the level of protection and reliability is appropriate for the hazards and consistent with NSLS and BNL requirements. The Working Group shall document its reviews using the NSLS General Review Form and the EMS, FUA, and SAD/ASE Checklist for NSLS Reviews. Any changes in the Checklist will result in a memo from the Interlock Working Group Chairman to the NSLS ESH/Q Manager.

3.7 The NSLS Interlock Working Group shall refer to the NSLS ES&H Committee for all interlock systems that involve design features, equipment, or protective functions which are outside of established practice at the NSLS to determine if independent technical review is needed.

4. DOCUMENTATION REQUIRED

4.1 Written functional descriptions of radiation interlock systems shall be included in the NSLS Safety Assessment Document. These descriptions shall include the hazards protected against, the means of protection, the responses of the system in normal operation, and responses to the system to fault conditions.

4.2 All circuit schematics and PLC ladder diagrams shall be maintained by the NSLS Design Group, and control of these documents shall be in accordance with the NSLS QA program.

4.3 Written test procedures in sufficient detail to ensure complete functional testing of interlock systems shall be developed and maintained by the NSLS QA Manager.

5. CONFIGURATION CONTROL

5.1 Modification, maintenance or repair work on radiation or laser interlock systems shall be done only under the control of an NSLS Safety System Work Permit as provided in NSLS "Safety System Work Permit" procedure, LS-ESH-PRM-3.4.1b. An exception to this requirement is during initial construction of an interlock system, before the interlock system is connected to a correlated interlock chain (e.g. an x-ray beamline before it is connected to x-ray ring interlock chain), and before it is connected to control a radiation source.

5.2 Interlock connections to external devices such as power supplies or RF switches for the purpose of control of a radiation source shall be marked as part of the interlock system with "Do Not Disturb" warnings and contact information.

6. INTERLOCK TESTS

6.1 All radiation protection interlock and facility laser interlock tests shall be conducted in accordance with a written test procedure and documented. Proper safeguards must be in place prior to commencing interlock testing that can have an effect on personnel safety.

6.2 All radiation protection and laser interlocks shall be tested within the 6 month interval specified in BNL Interlock Safety for Protection of Personnel requirements within SBMS and the BNL Radiological Control Manual.

6.3 Following the successful test of a radiation protection or facility laser interlock system, a notice of next required test date shall be prominently displayed so that operation managers and operations personnel are aware of interlock test status.

6.4 If a system fails a test or is nonfunctional for other reasons, the radiation source shall be disabled by LOTO or other effective means unless continued operation is approved by the Department Chair (see 7.2).

6.5 In the event that a 6 month test requirement cannot be achieved for a radiation or laser interlock system, the responsible Operations Manager and Safety Officer shall review the issue and confer with the NSLS ESH/Q Manager. Extensions beyond the 6 month test date shall not occur without approval of the BNL Radiological Control Division Manager for radiological interlock systems and the BNL Laser Safety Officer for Class IV laser interlock systems.

7. Interlock By-passing

7.1 Accelerators, beam lines, and lasers shall not be operated with the protective function of interlocks by-passed or defeated except as provided in 6.2. Any attempt to bypass the interlock system except during authorized interlock testing is prohibited. Bypassing door switches, defeating Kirk locks, or deliberately leaving someone in an interlocked hutch, and similar actions are prohibited even when the accelerators are shut down and there appears to be no immediate risk. These violations are treated seriously and could lead to dismissal or loss of research privileges at the NSLS. Anyone who is in the position to prevent such actions is obligated to do so.

7.2 In the rare event of a need justifying the operation of a facility with the interlock by-passed or non-functional, a written procedure must be established which details administrative controls that provide for personnel safety. The procedure must be approved by the NSLS Department Chairman or designee after consultation with the RCD Facility Support Representative for radiological interlock systems and the BNL Laser Safety Officer for Class IV laser interlock systems. The BNL Interlock Safety for Protection of Personnel requirements within SBMS must be met.

Attachment 1

NSLS INTERLOCK RULES

The safety of everyone at the Light Source depends on the integrity of the radiation protection interlock systems. For this reason, the rules governing modification or bypassing of these systems are very restrictive. This is made very clear in the safety orientation for users when they come to the NSLS. The following statement is made in the NSLS Facility-Specific Safety Orientation CBT.

Any attempt to bypass the interlock system is prohibited. Such actions as bypassing door switches, defeating Kirk locks, or deliberately leaving someone inside an interlocked hutch may lead to loss of research privileges and/or expulsion of the offender from the NSLS. Anyone who is in the position to prevent such actions is obligated to do so.

Interlock systems which provide radiation safety at the NSLS shall not be defeated or modified in any way except during interlock testing or as described below. Leaving a person inside an interlocked radiation area is considered to be a defeat of the interlock. This rule is strictly enforced and applies even when the accelerators are shut down and there appears to be no immediate danger. Violation will result in serious disciplinary action.

On the rare occasion when it is necessary to operate an accelerator, beam line or laser with the protective functions of an interlock over-ridden, the following condition must be met:

A written procedure must be provided covering the nature of the bypass or defeat. This must include the alternative protective measures to be used to provide equivalent safety. The procedure must be approved by the NSLS Department Chairman or designee after consultation with the RCD Facility Support Representative for radiological interlock systems and the BNL Laser Safety Officer for Class IV laser interlock systems. The requirements in BNL Interlock Safety for Protection of Personnel requirements within SBMS must be met.

Interlock system maintenance and modification is rigidly controlled. This work may be done only by designated interlock technicians, and requires an NSLS Safety System Work Permit which must be posted at the work location. The Work Permit specifies the safeguards which must be in place to avoid any danger that might result from the work. After maintenance or modification, a functional test by authorized NSLS personnel is required before the interlock system is returned to service.

Attachment 2

Radiation Safety Interlocks at the NSLS

Document Review Frequency	
3	Years

Review signatures on file with master copy of controlled document

LIGHT SOURCES DIRECTORATE REVISION LOG

Document Number:	LS-ESH-PRM-1.5.3
Subject:	Interlock Safety

Rev	Description	Date
3	Original Document	08/01/00
4	Inserted all available Web links, revised references as necessary, added Interlock Working Group reporting forms.	03/23/01
5	• Section 2.1 modified to define responsibilities of operations managers to operate with currently tested interlock systems • Section 2.2 modified to define responsibilities of Safety Officer and Operations Managers for interlock design requirements • Section 2.4 modified to define responsibilities of Quality Representative for scheduling and documenting interlock tests • Section 5 added to define interlock testing requirements. • Section 6 added to define requirements for interlock bypassing.	7/25/01
6	Added Attachment 2: "Radiation Safety Interlocks at the NSLS"	08/05/02
7	Minor editorial changes reflecting change in titles. No change in technical requirements or responsibilities.	08/21/05
8	• Removed all references to previous BNL ES&H Standards and replaced with SBMS requirements. • Clarified acronyms • Changed several titles to reflect current program. • Added lasers to configuration control requirements in section 4.1 and added wording for exceptions. • Removed all references of Safety Work Authorizations and replaced with NSLS Safety System Work Permit. • Added a sentence in section 6.1 to address safeguard requirements prior to testing. Added extension requirements for Class IV laser interlock testing.	3/27/2009

The only official copy of this file is the one on-line in the NSLS ESH website. Before using a printed copy, verify that it is the most current version by checking the document issue date on the NSLS ESH website.