

1. Introduction

This Accelerator Safety Envelope (ASE) governs the operation of the National Synchrotron Light Source (NSLS), including the gun, linear accelerator, booster ring, transport lines, VUV and X-Ray Rings, and beamlines.

Violation of this ASE's Limits listed in Section 2 requires an immediate halt of accelerator operations and notification of Department of Energy-Brookhaven Site Office (DOE-BHSO), Brookhaven National Laboratory (BNL), and National Synchrotron Light Source (NSLS) managements. Reviews will be undertaken and corrective actions developed, scheduled and tracked until all actions have been completed. Notification of BNL and DOE management and the approval of the NSLS management are required to return to accelerator operation.

Sections 3 and 4 require the existence of a number of programs that ensure that the hazard evaluations of the SAD are maintained intact and controlled. Violation of a programmatic requirement listed in Sections 3 and 4 requires an immediate halt of the specific program activity and notification of DOE-BHSO, BNL and NSLS managements. Reviews will be undertaken and corrective actions developed, scheduled and tracked until all actions have been completed. Notification of BNL and DOE management and the approval of the NSLS management are required to restart the activity.

No activity or facility modification may compromise the Safety Assessment Document (SAD) or the ASE. Proposed changes are to be screened for hazards that lie outside the bounds of those considered in the SAD and in the development of the ASE, by implementing the [Unreviewed Safety Issue Process](#). The USI process may result in rewriting portions of the SAD and modifying the ASE. Such revisions require applicable review and approval. Reportable events may also cause the USI process to be initiated.

This ASE document and the companion NSLS Safety Assessment Document, are subject to change control managed by the NSLS Department according to the [Internal Controlled Documents Subject Area](#).

2. Safety Envelope Limits

The operation of the NSLS, including the gun, linear accelerator, booster ring, transport lines, VUV and X-Ray Rings, and beamlines, must be carried out in a manner that ensures that the following safety envelope limits are not exceeded:

- 2.1 The dose equivalent to guests and staff members working in other BNL facilities adjacent to NSLS Building 725 shall not exceed 25 mrem in one year as the result of NSLS operations.
- 2.2 The dose equivalent to NSLS guests, users and staff members working at the NSLS shall not exceed 1250 mrem in one year as the result of NSLS operations.

3. Engineered Safety Systems Requiring Calibration, Testing, Maintenance, and Inspection

- 3.1 Facility interlocks providing radiation protection to accelerator vaults and beam lines shall be designed, tested and maintained in accordance with BNL ESH Standard 1.5.3, [Interlock Safety for Protection of Personnel](#).
- 3.2 Radiation monitors that annunciate locally and in the Control Room shall be placed at locations subject to transient radiological conditions associated with NSLS operations. Responses to radiation conditions identified by this system shall be established in formal procedures in the NSLS Control Room Facility Manual. These monitors shall be calibrated annually and tracked through the NSLS Controlled Measurement and Test Equipment Database.

4. Administrative Controls

- 4.1 During operations, a fully qualified Machine Operator and two fully qualified Operations Coordinators shall be on duty. These individuals shall follow guidelines and procedures documented in the Facility Manuals on file in the NSLS Control Room.
- 4.2 Configuration of radiation shielding and other radiation protection systems shall be controlled via the NSLS [Safety System Work Authorization](#) procedure.
- 4.3 All experiments conducted at the NSLS shall be reviewed and approved using the [NSLS Experiment Safety Review](#) procedure. Any proposed experiment that would require operation outside of the approved SAD and ASE requires additional evaluation and/or revision of the SAD and ASE prior to its operation.
- 4.4 Hazards associated with routine work conducted at the NSLS shall be controlled via the [NSLS Work Planning and Control System Procedure](#).
- 4.5 New beamlines as well as proposed changes in the configuration of existing beamlines shall be evaluated prior to implementation via the [NSLS Beamline Safety Review](#) procedure. Any proposed beamline that would require operation outside of the approved SAD and ASE requires additional evaluation and/or revision of the SAD and ASE prior to its operation.

5. Operating Envelope

The Operating Envelope denotes facility operating parameters or systems with a significant link to safety. Operation within the conditions identified in the Operating Envelope provides a buffer against exceeding the ASE Limits in Sections 2, 3 and 4 above. Operation of the facility in excess of the parameter identified in the Operating Envelope would not constitute a violation of the ASE, as long as other provisions of the ASE are not exceeded. Excursions beyond the levels of the Operating Envelope shall be recorded in the NSLS Operations Log and can be tracked using the [NSLS Nonconformance and Preventive and Corrective Action procedure](#).

5.1 The radiation dose Administrative Control Level to personnel working at the NSLS is 100 mrem whole body dose during the calendar year. Permission to exceed this level must conform to the approvals defined in the NSLS [Administrative Control Level](#) procedure.

5.2 Operations at the NSLS should not exceed the Maximum Electron Beam Energy specified for each of the accelerator components identified below:

- Linac - 150 MeV
- Booster Synchrotron - 1 GeV
- VUV Storage Ring - 1 GeV
- X-ray Storage Ring - 3 GeV

These maximum energies are limited by the installed capability of power systems. Active monitoring of the storage ring (VUV and X-ray) beam energies is displayed.

5.3 Operation of the X17 superconducting wiggler is limited to a critical energy of 22.2 keV as described in the Phase II NSLS Safety Analysis Report, June 1989, BNL 52205. Any proposal to raise the critical energy of the superconducting wiggler will be treated as an Unreviewed Safety Issue requiring radiological surveys (by Radiological Control Technicians) at the higher critical energy during X-ray Ring Studies (or other controlled mode). If it is determined that additional shielding is necessary, this shall be put in place and resurveyed before normal operations is allowed at the higher critical energy. No reviews beyond the NSLS will be required providing the safety limits of the ASE remain unchanged.

5.4 Electron beam currents (I) in the VUV and X-ray rings for a given electron energy (E) should not exceed the mathematical expression C/E^4 , where C=0.46 for the VUV ring and C=19.53 for the X-ray ring, E is the energy expressed in GeV and I is the current in Amps. The following tables give maximum values of I for selected ring energies using this formula. Maximum currents for other values of E not listed in the table but limited by the Maximum Electron Beam Energy can be determined using the expression given above.

Allowable Currents in the VUV Ring for Selected Ring Energies

VUV Energy	0.750 GeV	0.800 GeV	0.850 GeV	0.900 GeV	1.000 GeV
VUV Current	1.454 A	1.123 A	0.881 A	0.701 A	0.460 A

Allowable Currents in the X-Ray Ring for Selected Ring Energies

X-ray Energy	2.000 GeV	2.500 GeV	2.584 GeV	2.800 GeV	3.000 GeV
X-Ray Current	1.221A	0.500 A	0.438 A	0.318 A	0.241A