

2.5.3 NSRL Accelerator Safety Envelope Parameters

1. Purpose

- 1.1 This procedure assigns responsibility for maintaining the Accelerator Safety Envelope Parameters for the National Space Radiation Laboratory (NSRL). These Parameters are based on the [Accelerator Safety Envelope](#) and any relevant USIs documented using [C-A OPM 1.10.1](#), Unreviewed Safety Issues.
 - 1.1.1 Additionally, the NSRL experiments are limited by ESH requirements established by the C-A Radiation Safety Committee (RSC), the C-A Accelerator Systems Safety Review Committee (ASSRC), and the C-A Experimental Safety Review Committee (ESRC). C-A safety-committee requirements are documented in RSC, ASSRC, and ESRC Checkoff Lists in the Main Control Room (MCR). These Checkoff Lists must be completed before allowing reviewed systems to become operational or allowing beam in the NSRL.
- 1.2 Implicit in the notion of an Accelerator Safety Envelope Parameter is that variations in operating conditions are permitted if and only if they do not exceed the defined boundaries. A variation beyond the boundaries described in this procedure shall be evaluated as a reportable occurrence by C-AD management as defined by [SBMS](#) Subject Area on Occurrence Reporting. Notifications of occurrences shall be made according to [C-A OPM 10.1](#).
 - 1.2.1 If a Requirement is not satisfied and it has a specific Authorized Alternative associated with it, then implement the Authorized Alternative or safely stop the activity associated with the Requirement.
 - 1.2.2 If a Requirement is not satisfied and it does not have a specific Authorized Alternative, then stop that activity that uses the affected equipment within one hour.
 - 1.2.3 If an Authorized Alternative is implemented, then this is not a reportable occurrence; however, a C-AD Critique shall be conducted (as required by the BNL ESH Committee) to document the reasons and any recommendations made to reduce the need for implementing the Authorized Alternative in the future to the C-AD Chair.
- 1.3 Emergency actions may be taken that depart from these approved ASE Requirements when no actions consistent with the Requirements are immediately apparent and when these actions are needed to protect the public, worker or environment.

- 1.3.1 These actions shall be approved by the person in charge of facility safety, as defined in the operating procedures, when the emergency occurs and shall be reported to C-AD management within 2-hours.

2. Responsibilities (add items here)

- 2.1 The C-A Department Chairman shall approve all changes to the Accelerator Safety Envelope Parameters (ASEPs).
- 2.2 The following individuals have responsibilities for each of the ASEPs as specified in the beginning of the ASEP:
 - 2.2.1 Associate Chair for ESSHQ
 - 2.2.2 Chair of ESRC
 - 2.2.3 Chair of RSC
 - 2.2.4 Head of MCR
 - 2.2.5 NSRL Liaison Physicist
 - 2.2.6 NSRL Liaison Engineer
 - 2.2.7 On-duty Operations Coordinator
 - 2.2.8 Facility Support Representative (RCD)
 - 2.2.9 Access Controls Group Leader
 - 2.2.10 Maintenance Coordinator
 - 2.2.11 ESH Coordinator
 - 2.2.12 CAS Group Leader
- 2.3 The person in charge that approves Emergency Actions that depart from the requirements of this procedure (see step 1.3.1) shall inform the Department Chair within 2-hours of this decision.

3. Prerequisites

None

4. Precautions

None

5. Procedure

Accelerator Safety Envelope Parameters are established for:

- NSRL Beam Limits in Terms of the Product of Nucleon Energy and Flux
- Control of Beam Loss
- Classification of Radiological Areas
- Completion of RSC, ASSRC and ESRC Checkoff Lists

- Access Controls During Operations With Beam
- Fire Protection
- Staffing
- Calibration, Testing, Maintenance, and Inspection
- Shutdown Periods
- Groundwater Protection, Radiological Barriers and Dose Limits

5.1 NSRL Beam Limits in Terms of the Product of Nucleon Energy and Flux

- 5.1.1 The on-duty Operations Coordinator shall maintain the annual limit on the number and kinetic energy of high-energy nucleons extracted from the Booster SEB system to less than 10^{17} GeV in one year.
- 5.1.2 The on-duty Operations Coordinator shall maintain the hourly limit on the number and kinetic energy of high-energy nucleons extracted from the Booster SEB system to less than 6×10^{14} GeV in one hour.
- 5.1.3 The on-duty Operations Coordinator shall maintain the hourly limit on the number and kinetic energy of high-energy nucleons entering the NSRL Target Room and beam stop to less than 6×10^{14} GeV in one hour.
- 5.1.4 The on-duty Operations Coordinator shall maintain the maximum annual high-energy flux on the NSRL beam stop to less than 3×10^{16} GeV in one year.

5.2 Control of Beam Loss

- 5.2.1 The on-duty Operations Coordinator shall routinely interpret loss monitoring results and RCT radiation survey results in order to maintain beam loss “As Low As Reasonably Achievable” as defined in the [BNL Radiological Control Manual](#).
- 5.2.2 When applicable, the Liaison Physicist for the NSRL shall provide the on-duty Operations Coordinator with procedures that will control beam loss as follows:
- 5.2.2.1 In no case shall beam-loss induced radiation within NSRL uncontrolled areas be greater than 0.5 mrem in an hour and for repeated losses greater than 25 mrem in a year.
- 5.2.2.2 In no case shall beam-loss induced radiation within NSRL Controlled Areas be greater than 5 mrem in an hour and for repeated losses greater than 100 mrem in a year.

5.3 Classification of Radiological Areas

5.3.1 The Liaison Physicist for the NSRL shall not allow changes to radiological area classifications before consultation with the Facility Support Representative, the RSC Chair, and the Associate Chair for ESHQ, or their designates. Changes shall be in accord with the requirements in the [BNL Radiological Control Manual](#).

5.4 Completion of RSC, ASSRC and ESRC Checkoff Lists

5.4.1 The Head of the Main Control Room or designee shall ensure all relevant RSC, ASSRC and ESRC Checkoff Lists are completed and signed by appropriate personnel before allowing beam into the NSRL or beam for NSRL experimental programs.

5.5 Access Controls During Operations With Beam

5.5.1 The Access Controls Group Leader shall ensure that safety-system configuration control and maintenance shall be in accordance with [C-A OPM 4.91](#).

5.5.2 The Access Controls Group Leader shall ensure that area radiation monitors that are interfaced with the Access Controls System are within their calibration date.

5.5.3 The Access Controls Group Leader shall ensure high intensity proton beam is prevented from the NSRL, either by the Access Controls System or by RSLOTO of appropriate critical devices.

5.5.4 The Access Controls Group Leader shall ensure that the locations of area radiation monitors are maintained as defined by the C-A Radiation Safety Committee.

5.6 Fire Protection

5.6.1 During periods of beam operation, when access to the primary beam areas is prohibited the on-duty Operations Coordinator shall insure that installed fire detection and suppression systems are operable.

Authorized Alternative: Within 2 hours of discovery, the Department Chair or designee may allow partial or full inoperability of any fire detection and/or suppression system for up to 80 hours with beam operations if the benefit of continuing NSRL operations is judged to outweigh the potential risk of fire damage. Operating procedures (OPM 3.24) specify the compensatory actions to be taken during inoperability.

- 5.6.2 NSRL magnets and power supplies may be energized if the smoke detection system for the energized area can transmit an alarm to summon the BNL Fire/Rescue Group.

Authorized Alternative: The Operations Coordinator, ESH Coordinator or designee may allow partial or full inoperability of any fire detection system, suppression system or manual alarm station in occupied areas as long as a Fire Watch is posted who can verbally communicate with the BNL Fire/Rescue Group by radio or phone.

- 5.6.3 Personnel may occupy the NSRL if the exhaust fans can be activated either manually or automatically.

Authorized Alternative: If exhaust fan operability in the affected area cannot be restored within one hour, then the on-duty Operations Coordinator, ESH Coordinator or Maintenance Coordinator shall empty the affected area and prevent occupancy until operability is restored.

5.7 Staffing

- 5.7.1 The Head of the Main Control Room shall ensure an adequate number of qualified personnel in the C-A Main Control Room. As a minimum, one Operations Coordinator and one Operator shall be on duty when NSRL beam is in operation. During normal operations, one of the two shall remain in the Main Control Room at all times.

Authorized Alternative: If one of the two on-duty operators is incapacitated, the remaining operator may continue Collider operations as long as manning requirements are restored within two hours.

- 5.7.2 The Collider-Accelerator Support Group Leader shall ensure a qualified Collider Accelerator Support (CAS) watch person is on duty for NSRL experimental operations with beam.

5.8 Calibration, Testing, Maintenance, and Inspection

- 5.8.1 The Access Controls Group Leader shall ensure the interlocks for radiation safety are functionally tested according to the requirements in [BNL RadCon Manual, Chapter 3, Appendix 3A](#).
- 5.8.2 The Access Controls Group Leader shall ensure the area radiation monitors undergo annual testing (not to exceed 15 months).
- 5.8.3 The Liaison Engineer for the NSRL shall ensure the purge exhaust fan for the NSRL tunnel and the Target Room exhaust fan undergo annual testing (not to exceed 15 months).

- 5.8.4 The Liaison Engineer for the NSRL shall ensure fire protection systems undergo annual testing (not to exceed 15 months).
- 5.8.5 The Liaison Engineer for the NSRL shall ensure radiological barriers undergo annual visual inspection (not to exceed 15 months).
- 5.8.6 The Liaison Engineer for the NSRL shall ensure rainwater barriers for activated soil undergo annual visual inspection (not to exceed 15 months).
- 5.8.7 The Liaison Engineer for the NSRL shall ensure Class II Type A biological-safety-cabinet (BSC) HEPA-filter efficiency and cabinet face-velocity-tests are performed *in situ* at the time of installation, at any time the BSC is moved, and at least annually thereafter (not to exceed 15 months).

5.9 Shutdown Periods

- 5.9.1 During shutdown periods, specific safety requirements for the experiments shall be reviewed on a case-by-case basis by the ESRC and approved by the Chair of the ESRC.

5.10 Groundwater Protection, Radiological Barriers and Dose Limits

- 5.10.1 The C-A Associate Chair for ESHQ shall ensure that:

- 5.10.1.1 No individuals in other BNL Departments or Divisions, located adjacent to C-AD facilities receives more than 25 mrem in a year.
- 5.10.1.2 The maximum dose equivalent to a member of the public at the BNL site boundary is less than 5 mrem in a year from C-AD operations.
- 5.10.1.3 Offsite drinking water concentration and on-site potable well water concentration must not result in 4 mrem or greater to an individual in one year from C-AD operations.
- 5.10.1.4 No C-AD staff member receives more than 1250 mrem in a calendar year.
- 5.10.1.5 C-AD operations do not cause tritium concentrations in the BNL sanitary system effluent to exceed 10,000 pCi/liter averaged over a 30-day interval.
- 5.10.1.6 All airborne radioactive emissions from the NSRL facility are managed in accordance with the Radioactive Air Emissions subject area. If emissions are anticipated to exceed 0.1 mrem per

year to the Maximally Exposed Individual, actions will be taken to ensure operations comply with NESHAP requirements including continuous emissions monitoring and permitting.

5.10.1.7 In order to protect groundwater, if the annual activity concentration of sodium-22 or tritium in leachate is calculated to exceed the limits given in the Accelerator Safety Subject Area, then a cap shall be used unless BNL Management is convinced otherwise.

6. Documentation

None

7. References

- 7.1 [C-AD SAD](#)
- 7.2 [Accelerator Safety Envelope for NSRL](#)
- 7.3 [BNL RadCon Manual, Chapter 3, Appendix 3A](#)
- 7.4 [C-A-OPM 1.10.1, "Procedure for Documenting Unreviewed Safety Issues"](#)
- 7.5 [C-A-OPM 4.91, "Configuration Management Plan for the C-A Access Controls System"](#)
- 7.6 [C-A-OPM 10.1, "Occurrence Reporting and Processing of Operations Information"](#)
- 7.7 Letter from M. Holland (DOE-BSO) to M. Bebon dated August 6, 2004, Approval of the Proposed Collider-Accelerator Department Accelerator Safety Envelope (ASE) Modifications.

8. Attachments

None