

**Accelerator Safety Envelope**

**Title of Facility: NASA Space Radiation Laboratory (NSRL)**

**Date of Initial ASE: June 15, 2001**

**Subsequent Revision Dates: May 30, 2003, August 13, 2004, June 29, 2007**

**Version of the SAD that the ASE applies to: C-AD SAD, August 2004**

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## Section 1. Introduction

The ASE Requirements define the conditions, safe boundaries, and the administrative controls necessary to ensure safe NSRL operations and to reduce the potential risk to the public, workers and environment.

- 1.1 The reference to the method used by the Collider-Accelerator Department for change control of the ASE is the BNL Subject Area on Accelerator Safety.
- 1.2 A variation beyond the boundaries described in Sections 1, 2, 3, and 4 of this ASE shall be treated as a violation of the ASE and shall be a reportable occurrence, as defined by the BNL [SBMS](#) Subject Area on Occurrence Reporting. A violation is defined as not satisfying a Requirement or its specific Authorized Alternative. C-A Department staff shall make notifications of occurrences according to the requirements in the [C-A Operations Procedure Manual](#).
  - 1.2.1 If a Requirement is not satisfied and it has a specific Authorized Alternative, implement the Authorized Alternate or stop the activity that uses the affected equipment within one hour.
- 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 and environmental safety. 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.

## Section 2: BNL Safety Envelope Limits

This section contains the absolute limits that BNL places on its operations to ensure that we meet the regulatory limits established to protect our environment, public and staff/visitors and that those operations are conducted within the assumptions of the NSRL safety analyses documented in the [C-AD SAD, August 2004](#). Please note that the construction project was referred to as the Booster Applications Facility (BAF) and the operational facility is referred to as the NASA Space Radiation Laboratory (NSRL). BNL Safety Envelope Limits for NSRL operations are:

- 2.1. Less than 25 mrem in one year to individuals in other BNL Departments or Divisions adjacent to this Collider-Accelerator Department accelerator facility.
- 2.2. Less than 5 mrem in one year to a person located at the site boundary.
- 2.3. 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.
- 2.4. Less than 1250 mrem in one year to a Collider-Accelerator Department staff member.

- 2.5. Maximum tritium concentration of 10,000 pCi/L in the BNL sanitary sewer effluent, caused by liquid discharges from NSRL facilities averaged over a 30-day interval.
- 2.6. In order to protect groundwater, if the annual activity concentration of sodium-22 or tritium in leachate is calculated to exceed 5% of the Drinking Water Standard, then a cap shall be used unless BNL Management is convinced otherwise.<sup>1</sup>
- 2.7. All emissions from NSRL facilities are managed in accordance with the Air Emissions subject area.<sup>2</sup> 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.

### Section 3: Corresponding NSRL Safety Envelope Parameters

This section identifies the measurable limitations on critical operating parameters that, in conjunction with the specifically identified hazard control considerations established by the facility design and construction, ensure that NSRL operations will not exceed the corresponding Safety Envelope Limits discussed in Section 2. These parameters are derived from the safety analyses described in the [C-AD SAD, August 2004](#). NSRL safety envelope parameters are:

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

- 3.1. The annual limit on the number and kinetic energy of high-energy nucleons extracted from the Booster SEB system shall be no greater than  $10^{17}$  GeV in one year.
- 3.2. The hourly limit on the number and kinetic energy of high-energy nucleons extracted from the Booster SEB system shall be no greater than  $6 \times 10^{14}$  GeV in one hour.
- 3.3. The hourly limit on the number and kinetic energy of high-energy nucleons entering the NSRL Target Room and beam stop shall be no greater than  $6 \times 10^{14}$  GeV in one hour.
- 3.4. The maximum annual high-energy flux on the NSRL beam stop shall be no greater than  $3 \times 10^{16}$  GeV in one year.

#### Control of Beam Loss

- 3.5. Loss monitoring results and radiation survey results shall be used in order to maintain beam loss “As Low as Reasonably Achievable” as defined in the BNL Radiological Manual.

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<sup>1</sup> BNL SBMS Accelerator Safety Subject Area, Design Practice for Known Beam Loss Locations.

<sup>2</sup> BNL SBMS Subject Area, Radioactive Airborne Emissions.

- 3.6. Beam loss induced radiation within uncontrolled areas is to be less than 0.5 mrem in an hour and for repeated losses less than 25 mrem in a year.
- 3.7. Beam loss induced radiation in a Controlled Area is to be less than 5 mrem in an hour and for repeated losses less than 100 mrem in a year.

### **Classification of Radiological Areas**

- 3.8. Radiological area classifications during operations shall be in accord with requirements in the BNL Radiation Control Manual.

### **Access Controls**

- 3.9. The Access Controls System shall be functional during operations with beam.
- 3.10 During the running period, area radiation monitors that are interfaced with the Access Controls System shall be within their calibration date.
- 3.11 During the running period, the locations of area radiation monitors interfaced with the Access Control System are to be configuration controlled.

### **Fire Protection**

- 3.12 During periods of beam operation, when access to the primary beam areas is prohibited the installed fire detection and suppression systems shall be 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 shall specify the compensatory actions to be taken during inoperability.

- 3.13 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.

#### **Section 4: Engineered Safety Systems Requiring Calibration, Testing, Maintenance, and Inspection**

The systems and requirements for calibration, testing, maintenance, accuracy or inspections necessary to ensure the integrity of the NSRL safety envelope parameters during operations are given in this section:

- 4.1. The Access Control System shall be functionally tested in accordance with requirements in the BNL Radiation Control Manual.
- 4.2. Target Room and Support Building ventilation exhaust fans shall undergo annual testing (not to exceed 15 months).
- 4.3. NSRL fire protection shall undergo annual testing (not to exceed 15 months).
- 4.4. Area radiation monitors shall undergo annual testing (not to exceed 15 months).
- 4.5. Radiological barriers shall undergo annual visual inspection (not to exceed 15 months).
- 4.6. Rainwater barriers for activated soil shall undergo annual visual inspection (not to exceed 15 months).
- 4.7. In the Support Laboratories, Class II Type A biological-safety-cabinet (BSC) HEPA-filter efficiency and cabinet face-velocity-tests shall be 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).

#### **Section 5: Administrative Controls**

Administrative controls necessary to ensure the integrity of the NSRL safety envelope parameters during operations are:

##### 5.1. Minimum Main Control Room Staffing

5.1.1. C-A Main Control Room: one Operations Coordinator and one Operator shall be on duty when NSRL beam is in operation. During normal operations, one of the two must remain in the Main Control Room at all times.

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

##### 5.2. Experiment Area Staffing

- 5.2.1. The minimum experimental area staffing shall be a qualified Collider Accelerator Support (CAS) watch person for NSRL experimental operations with beam.
- 5.3. On-shift operations staff shall be trained and qualified on their safety, operational and emergency responsibilities. Records of training and qualification shall be maintained on the Brookhaven Training Management System (BTMS).
- 5.4. Work planning and control systems shall comply with the requirements in the [C-A Operations Procedure Manual](#).
- 5.5. Environmental management shall comply with the requirements in the [C-A Operations Procedure Manual](#).
- 5.6. Experiment modification and review shall comply with the requirements in the [C-A Operations Procedure Manual](#).
  - 5.6.1. Each experiment in the NSRL Target Room shall be reviewed before running with beam. It is noted that an experiment may lie dormant for a period greater than one year between runs and not require a review during the dormancy period. For experiments that may run more than once within a 12-month period, review shall occur before each singular scheduled run.
- 5.7 Industrial hazards shall be controlled in accordance with the applicable portions of the BNL SBMS Subject Area.