Accelerator Safety Envelope

Title of Facility: Prototype Energy Recovery Linac (ERL)

Date of Initial ASE: June 30, 2008

Subsequent Revision Dates:

Version of the SAD that the ASE applies to: Prototype ERL SAD 6-30-08

Signature of Preparer:

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Signature of Collider-Accelerator Associate Chair for Superconducting Accelerator R&D:

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Signature of Collider-Accelerator Department Chair:

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Signature of Nuclear and Particle Physics Associate Laboratory Director:

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Signature of Deputy Director for Operations:

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ASE Contents:

Section 1. Introduction

The ASE Requirements herein define the conditions, safe boundaries, and the administrative controls necessary to ensure safe Prototype ERL 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 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 Prototype ERL operations to ensure that BNL meets regulatory limits established to protect our environment, public and staff/visitors and that those operations are conducted within the assumptions of the Prototype ERL safety analyses documented in the **Prototype ERL SAD, 6-30-08**. BNL Safety Envelope Limits for Prototype ERL 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. Less than 10,000 pCi/L in the BNL sanitary sewer effluent due to liquid discharges from Prototype ERL facilities.

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.[1]

2.7. All emissions from Prototype ERL facilities are managed in accordance with the Air Emissions subject area.[2] 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 Prototype ERL 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 Prototype ERL operations will not exceed the corresponding Safety Envelope Limits discussed in Section 2. These parameters are derived from the safety analyses described in the **Prototype ERL SAD, 6-30-08**. Prototype ERL safety envelope parameters are:

Prototype ERL Beam Limits in Terms of Electron Energy and Beam Power

3.1 Electron energy limit of 3.5 MeV for the super-conducting RF gun.

3.2 The power source of the superconducting gun is limited to delivering 1.2 MW of power to the gun.

3.3 Electron energy limit of 25 MeV for the Prototype ERL ring.

3.4 Electron beam power shall not exceed the equivalent of 10 MW of instantaneous power for the electron beam in the Prototype ERL ring.

3.5 The power source for the five-cell cavity will be limited to delivering a maximum of 60 kW of power to the cavity.

3.6 A beam power of 1.2 MW for a 3.5 MeV electron beam striking the beam dump.

[1] BNL SBMS Accelerator Safety Subject Area, Design Practice for Known Beam Loss Locations.
[2] BNL SBMS Subject Area, Radioactive Airborne Emissions.

Control of Beam Loss

3.7 Beam-loss-monitors, area-radiation monitors and area-radiation survey results shall be used in order to maintain beam loss "As Low as Reasonably Achievable" as defined in the BNL Radiological Manual.

Access Controls

3.8 The Access Controls System shall be functional during operations with beam.

3.9 During the running period, area radiation monitors that are interfaced with the Access Controls System shall be within their calibration date.

3.10 During the running period, the locations of area radiation monitors interfaced with the Access Control System are to be configuration controlled.

Fire Protection

3.11 During periods of beam operation, when access to the primary beam areas is prohibited the installed fire detection and protection 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 or protection system for up to 80 hours with beam operations if the benefit of continuing Prototype ERL operations is judged to outweigh the potential risk of fire damage. Operating procedures shall specify the compensatory actions to be taken during inoperability.

3.12 Prototype ERL 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 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 Prototype ERL 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. Prototype ERL ventilation exhaust fans used to prevent an oxygen deficiency event shall undergo annual testing (not to exceed 15 months).

4.3. Prototype ERL 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).

Section 5: Operations Envelop - Administrative Controls

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

5.1. Minimum Prototype ERL Control Room Staffing

5.1.1. Prototype ERL Control Room: one Trained Operator and one other person shall be on duty when Prototype ERL beam is in operation. During beam operations, one of the two must remain in the Prototype ERL Control Room at all times.

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

5.2. 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).

5.3. Work planning and control systems shall comply with the requirements in the C-A Operations Procedure Manual.

5.4. Environmental management shall comply with the requirements in the C-A Operations Procedure Manual.

5.5. Experiment modification and review shall comply with the requirements in the C-A Operations Procedure Manual.

5.5.1. Each upgrade in the Prototype ERL beam parameters or change of Prototype ERL configuration shall be reviewed before running with beam.

5.6. Annually, the C-AD Accelerator Systems Safety Review Committee shall review Prototype ERL's routine operations and facility for safety.

5.6.1. Prototype ERL may lie dormant for a period greater than one year between runs and does not require a review during the dormancy period.

5.7. Industrial hazards shall be controlled in accordance with the applicable portions of the BNL SBMS Subject Area.

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