LBL- Pub 3019

OPERATIONAL SAFETY PROCEDURES

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MASTER

Building 51B

Heavy-Ion-Spectrometer System

May 1982

LAWRENCE BERKELEY LABORATORY, UNIVERSITY OF CALIFORNIA,
BERKELEY, CALIFORNIA

Prepared for the U.S. Department of Energy under Contract DE-AC03-76SF00098

Signature	Date	
Robert H. Thomas for W. D. Hartsough	1st April 1982	for Director's Office Engineering & Technical Services Division
Tom Elioff Fr Hermann A. Grunder	4/1/82	for Accelerator and Fusion Research Division
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Jensen Young	April 1, 1982	for Environmental Health and Safety
Robert M. Miller	April 1, 1982	for Bevalac Operations

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PREFACE

LBL safety policy (Pub 3000 Appendix E) states that every research operation with a Class A risk potential (DOE 5484.1) should identify potentially hazardous procedures associated with the operation and develop methods for accomplishing the operation safely without personnel injury or property damage. The rules and practices that management deems to be minimally necessary for the safe operations of the Heavy Ion Spectrometer System (HISS) in the Bevatron Experimental Hall (51B) is set forth in this Operation Safety Procedures (OSP).

Everyone who enters the facility area, in whatever capacity, must be familiar with and observe these procedures in spirit and in actions. Each person is expected to act to protect himself or herself from injury and to prevent damage to equipment and material.

A current copy of this OSP and all accompanying supporting documents are to be on file in the Bevatron control room and in the HISS control room and are to be available at all times to all personnel. Additional copies should also be available in other areas as deemed necessary. The initial OSP shall be updated by revisions and amendments as found necessary and prudent during actual operations and within three (3) months of start-up.

This OSP is to be reviewed by responsible representatives of the Director's Office (Engineering & Technical Services Divison), Accelerator and Fusion Research Division, Nuclear Science Division, and Environmental Health and Safety Services, who shall affix their signatures to this document as having reviewed and approved the OSP for the HISS facility.

I. INTRODUCTION

The Nuclear Science Division and the Accelerator and Fusion Research Division are installing a long-term Bevalac Heavy Ion Facility utilizing a spectrometer system to momentum-analyze secondary heavy ion fragments at relativistic energies. In order to provide the requisite high bending power and large acceptance aperture, the spectrometer uses a large superconducting magnet. The pole tips are 2.1m (83 inches) in diameter with a gap height of 1.0m (40 inches). The central field is 3 Tesla maximum D.C. and the magnetic energy is 55MJ. A helium liquefier is located outside and east of the experimental cave at ground level.

The beamline and spectrometer is located in Bldg. 51B as shown on Drawing 19F7125. Experimenters' electronic and work areas are located outside of the shielding as is the helium compressor.

Operational support is provided by personnel from the Mechanical and Electrical Departments plus additional help from Construction and Maintenance Department, Health Physics, EH&S, etc, as required. Chief operations control will be by the Bevalac and the HISS staffs.

Note

The facility was installed and operated for experiments before the Bevatron Vacuum Improvement shutdown beginning July 1981. A temporary OSP was in effect. Since then, the liquefier/refrigerator has been moved from the top of the magnet and its capacity enhanced by the addition of a wet expander. The OSP has been revised to take into account this change as well as the change in personnel.

II. SCOPE

1. Research and support activities within the above-defined areas are governed by the provisions of this OSP.
2. This OSP is to be reviewed within 3 weeks following initial operations at the maximum magnetic field level established during magnetic measurements. Revisions or supplemental procedures to correct any deficiences should be made and the OSP re-submitted within 3 months for approval prior to full operations.
3. Corrective or supplemental procedures should be instituted immediately and not wait for the formally re-submitted OSP.
4. Changes in operations should be accompanied by a review of the OSP to keep the OSP current.
5. The procedures in this OSP are supplementary to the rules and regulations set forth in the LBL "Health and Safety Manual" PUB 3000 and also PUB 3001. They apply to all personnel in the HISS experimental area - research staff, accelerator staff, support personnel and all visitors.

III. HAZARDS IDENTIFICATION

1. Magnetic Field

The design central field is 3 Teslas. At that level, the mid-plane fringe field is estimated to be 0.1 Tesla at a distance of 3m from the center of the pole tip.

2. Electrical

The magnet power supply is rated at 2000 amperes and ±35 volts. The magnetic energy at 3 T will be 55 MJ. The coils are designed to be cryostable. Quench protection is accomplished by opening the circuit from the power supply and discharging the magnet into a 0.2 ohm dump resistor. Normal operation is by programmed ramping.

3. Radiation

Exposure of personnel to radiation hazards falls into the following four categories:

a. primary beam

b. secondary particles or scattered beams

c. induced activity

d. leakage radiation through shields and penetrations and air-scattered radiation through the thinly shielded roof.

4. Cryogenics

The liquid helium system is a closed circuit system with the compressor, gas supply and the refrigerator/liquefier located outside of the radiation shielding. The compressor acoustical level is 90 db at the perimeter of the compressor. The liquid nitrogen system takes its supply from a 5000-gal dewar located external to the radiation shielding and discharges to atmosphere.

5. Oil Flotation Rotating Base

The oil in the system is SAE 20 motor oil and is completely contained in its lipped base. The oil delivery system is low pressure and limited by a relief valve. The rotational drive is through a gear motor.

6. Thin Window

Window size will be 33-3/4" x 135". Material is to be .010" Mylar + 13 oz Dacron sailcloth. Vacuum on one side. Location will be in the downstream side of the magnet gap.

IV. HAZARDS CONTROL

1. Magnetic

a. Warning signal lights will be mounted at entryways and inside the cave and shall be continuously operating whenever the magnet is energized.

b. The areas immediately around the experimental cave will be posted to keep away persons with pacemakers or other life-sustaining devices which may be impaired by the magnetic field.

c. The areas inside the experimental cave, and around the access ways, are to be kept free of all loose magnetic materials.

d. Personnel entering the cave area when the field is on should have no magnetic materials on their persons.

e. Actual magnetic measurements will provide field values for a map of the working areas. In the event personnel entry to the cave is necessary, the magnetic field must be reduced to a value appropriate to the length of stay and/or the task to be performed. Control of the magnet is with the experimenters once the permissive is given by the main control room.

f. Crane operation over the magnet shall be restricted whenever the magnet field is on. The crane cab, with or without load, shall be excluded from an area to be marked by flashing beacon lights. The boundaries will be determined by magnetic measurements.

2. Electrical

a. The magnet leads are enclosed by a transparent cover to protect against hazardous voltage (400 volts) during the time

energy is being dumped into the load resistor.

b. The dump resistor is completely enclosed by a cabinet with special keying to interlock against access to the resistor as long as current is flowing in the magnet leads.

c. The use of the dump resistor is not a normal procedure and is to be considered as an extreme measure as spelled out in the ELECTRIC OPERATING PROCEDURES.

3. Radiation

a. Primary beam
b. Secondary & scattered beams

} Control of these hazards is embodied in a common system described as follows:

The B42 beamline and the experimental area are high-radiation areas whenever the beam is on and therefore are shielded and designated as exclusion areas. Access to these areas is through controlled entry points with standard Bevatron radiation chain-interlocked gates.

"A" gates are controlled and monitored by the MCR which also maintains a log of all entries and exits;

"B" gates are not monitored and are opened only during scheduled experimental shutdown or extreme emergencies.

Before beam can be transferred into the B42 beamline, a search and secure procedure must be carried out. The MCR has the prime responsibility for this operation but on occasions the MCR may delegate this task to the designated experimenters. The request to perform SEARCH & SECURE

will be made by the MCR operator to the designated experimenter. Upon completion of the SEARCH & SECURE, the experimenter will report back to the MCR.

The exclusion of personnel from the shielded enclosure while the beam is on is assured by:

1) The SEARCH & SECURE procedure which closes and latches all entry gates, then sweeps the areas to clear all personnel from within the area;
2) Monitoring and logging by the MCR of personnel entering and exiting through the A-gates during any temporary beam-off period. Only the A-gates are to be used for this traffic;
3) The opening of a B-gate will drop the entire interlock chain and will require another SEARCH & SECURE;
4) Gates and keys are interlocked to prevent beam transfer whenever a gate is opened or a key has been removed;
5) Room illumination changes from white to magenta color to warn that beam is about to come on;
6) Wall-mounted RUN-SAFE switches will break the interlock chain should any person or persons be unknowingly left in a "secured" area when the light changes from white to magenta. A new S&S will be required;
7) Emergency opening of the A-gates can be affected by the opening of the yellow cans and pushing on the emergency latch release. A new S&S will be required.

c. Exposure of personnel to induced activity

Beam dumps, targets, collimators and other components which become radioactive must be clearly labeled according to the on-site monitoring procedures listed in Chapter 21.13 of PUB 3000.

d. Exposure of personnel to neutron leakage radiation

Upper limits on beam power will be determined during initial operation by radiation surveys. Maximum beam power limits (for 40 hours/shift operation) will be based on existing shielding. Engineering controls such as interlocks will assure that maximum power limits are not exceeded.

Every effort will be made to keep radiation exposure to employees and the general public as low as reasonably achievable. As a goal the employee dose equivalent should be kept below 1 rem/year, but in no event should it exceed the DOE 5480.1 limit of 5 rem/year.

4. Cryogenics

a. All systems have been designed and pressure tested as specified by LBL PUB 3001, "Rules and Procedures for the Design and Operation of Hazardous Equipment." Changes and corrections as requested by the Mechanical Safety Committee have been performed.

b. Pressure relief is provided in circuits.

c. Personnel in the compressor area shall wear hearing protection whenever the compressor is operating.

5. Oil Flotation Rotating Base

No hazards injurious to personnel or equipment are envisioned in operations.

6. Thin Window

Size and construction are described on page 6. The sailcloth and mylar construction is a proven technique. Ruptures have been demonstrated to be non-violent in that there is no implosion, so there is no possibility of material or personnel being pulled in by a sudden inrush of air. As an additional protective measure, there will be a solid cover over the window whenever personnel will be working in the vicinity of the window.

V. PROCEDURES (INITIAL START-UP)

1. Experimenters notify the MCR (Main Control Room) that they are ready to energize the HISS Magnet.
2. MCR will make the first announcement over the PA of the intentions to turn on the HISS magnet.
3. A sweep of the experimental cave shall be made to secure all hazards. Responsibility for this sweep shall rest with the MCR appointed person and the experimenter appointed person working as a team.
4. The interlocked doors or gates shall be secured to close off the hazardous areas.
5. The MCR is notified that the sweep has been made and the areas secured.
6. MCR will make the final announcement over the PA system and give the permissive to the experimenter.
7. Experimenters now have the controls.

VI. OPERATING PROCEDURES

1. Access control during the experiment rests with the experimenter.
2. Each shift shall have one person with the sole responsibility for controlling access to the cave area. This same person is also authorized to make the pre-operation sweep whenever necessary.
3. There shall always be a person in the control area whenever there are personnel in the cave area during "Magnet On" time.
4. The buddy system shall be used for entry into the cave area. One person will be the safety observer, positioned in an area removed from the magnet and ready to obtain aid in an emergency.
5. Magnetic material detectors will be located at the access ways to the cave. Persons wishing entry to the cave must undergo this search and thus avoid possible injuries to themselves or damage to equipment.
6. During "Beam On" time, access to the roof will not be permitted.
7. The magnet warning lights shall be operating whenever there is a permissive to operate the HISS magnet.
8. There shall always be an operating intercom system between the cave interior and the experimenter's control area.
9. There shall be an emergency system of clearly marked egress and emergency crash-off button to abort the beam should there be personnel inadvertently left in a "secured" area.

VII. SHUTDOWN PROCEDURES

1. Removal of Hazards

For the duration of shutdowns which exceed a few hours of time, especially when persons other than operator or experimenter personnel are to enter the beam room, all possible hazardous situations must be attended. Voltages and magnet fields are to be shut off or reduced and beam targets and absorbers monitored for excessive radioactivity. Radioactive targets and absorbers will be handled according to the procedures listed in Chapter 21-13/15 of PUB 3000. Assistance in this will be provided by EH&S. No radioactive parts will be removed without first attaching proper labeling to indicate degree of activation and hazard. No radioactive material will be disposed of except by way of EH&S. The thin window cover will be secured in place over the thin window.

VIII. EMERGENCIES

1. General

a. For small emergencies of a very localized nature such as an ashtray fire, a shattered fluorescent lamp, a sprain or bruise caused by a fall or falling object in the experimenter's house, etc, common sense would first call for immediate response by fellow workers in the area. This may involve the use of fire extinguishers, a visit to Medical Services, etc.

b. If the emergency is brought under control immediately, the incident should be reported to the MCR who will advise of further actions.

c. If the emergency is other than minor, do not hesitate; summon help by dialing 5333.

d. Always report any emergencies to the MCR after the emergency situation has been properly taken care of.

2. HOW TO CALL FOR HELP

a. ANY EMERGENCY situation can be reported by using the Laboratory phone system; DIAL 5333. It is important that you identify yourself and that you be specific and accurate in your report with regard to --

(1) The nature of the emergency (gas leak, personal injury, fire, radioactive spill, etc)

(2) The location of the emergency

(3) The severity of the situation

(4) The existence of contributing potential hazards in the area

b. FIRE may be reported by operating one of the many Fire Pull Boxes at the Laboratory. It is well to familiarize yourself with those in or about the area in which you work. If you turn in an alarm by this method, stay at the pull box and meet responding emergency personnel. Give them as much detail as you can. Of particular importance is a report of the status and locations of hazardous equipment in the area and any contributing hazards.

3. SHUT DOWN SOURCES OF ENERGY

a. Valve off bottles of flammable liquids and gases.

b. Trip all breakers in the affected area. Again the magnet power supply is an exception. Unless there is a fire in the power supply or dump resistor area, it may be prudent to leave the power supply on so that energy can be removed from the magnet.

c. A map showing the locations shall be placed in the Main Control Room and the experimenters' control room.

IX. AUTHORIZED PERSONNEL

The following personnel are authorized to make the appropriate response to any need for changes affecting the operations or function of the system or any of the sub-systems.

Accelerator and Fusion Research Division

Bob Miller
Jose Alonzo

Nuclear Science Division

Hank Crawford
Peter Lindstrom

The following persons are to be solely responsible for conducting the sweep operation and also for controlling access to the hazardous areas:

Bevalac

Jim Brannigan
Bob Miller
Harvey Oakley

Experimenter

Hank Crawford Doug Greiner Jim Carroll Osamu Hashimoto
Peter Lindstrom James Symons Shoji Nagamiya

EMERGENCY NAME AND TELEPHONE LIST

Hank Crawford .....845-3566 John Porter 827-1408
Peter Lindstrom ....841-2575 David S. Anderson ..707-447-3184
Doug Greiner .....232-2663 George Newell 522-7556

X. CHANGES

Changes affecting the guidelines and procedures here or in any of the operating manuals and/or procedures are to be duly noted so in this OSP. Amended copies shall be transmitted to all signatories on this OSP. An amended copy shall also replace the official copies in the control room.

XI. REFERENCES

1. Radiation Safety Note BRSP 642-2 -- Statement of Requisite Circuit Functions for Radiation and Beam Safeguard Interlock for HISS (B42) and EPB Channel 2 Beams

2. Radiation Safety Note BRSS 642-1 -- Specification of Beam Backstop Shield for Channel 2 EPB

3. Radiation Safety Note BRSS 642-2 -- Specification of Shielding for Beam 42 (HISS)

4. Cryogenic System -- Operating Procedure BW 4301, M5701

5. HISS Electrical System Operating Procedure

6. A Large Superconducting Dipole Magnet for the Heavy Ion Spectrometer System (HISS) - LBL 11579

7. Magnetic field exposures, provisional guideline recommendations -- letter of 23 Jul 1979 to Dr. K. R. Baker from Dr. Edward Alpen

8. Compressor noise level survey, EH&S -- Memo of 31 Mar 1981 to K. Biscay and R. Force from Vic Montoya

9. Summary of Cryogenic Pressure Relief

10. Thin Window Test Notes