I. Accelerator Directorate Operations Department Organization and Administration

A. Introduction

The organization and administration of the Accelerator Directorate Beams Division (ADBD) Operations Department ensures that a high level of performance in the accelerator complex and beamline operation is achieved through effective implementation and control of Operations Department activities. Environment, safety, and health are considered as important as productivity when assessing departmental performance. The ADBD Operations Department organization, goals, and group descriptions are maintained in this document. Laboratory, Directorate, Division, and Department policies describe the philosophy of standards of excellence under which the Laboratory is operated. This chapter discusses the assignment of responsibilities, policies, resources, monitoring, and accountability needed in accelerator complex and beamline operations.

B. Discussion

A high level of performance in accelerator complex, beamlines, and related system operations is accomplished by establishing high standards of operations, by communicating operating standards to the working level, by providing established written procedures, by providing sufficient resources to the Operations Department, by ensuring personnel are well trained, by closely monitoring performance in the Operations Department, and by holding workers and their supervisors accountable for their performance in conducting accelerator complex and beamline activities.

The Accelerator Directorate (AD), Beams Division (BD), and Operations Department management establish operating standards and consider input from the working level when appropriate. When the working level is given a sense of ownership over the development of the standards, they will be more willing to support them. These standards define operating objectives, establish expected performance levels, and clearly define responsibility in operations. Standards for operating activities are integrated into Operations Department procedures and programs. Operating standards are communicated to the working level by training workers in operating practices and by supervisory monitoring and

guidance of work involving accelerator complex and beamline operations. Sufficient staffing, equipment, and funding are allocated so that the Operations Department can effectively perform its functions. Performance in Operations is closely monitored by Laboratory, AD, and BD management. Operating reports and goals are also used so that performance can be effectively measured. Operations Department personnel are held accountable for their performance through supervisory counseling, performance appraisals and, when necessary, disciplinary measures.

C. Assignment of Responsibilities

1. Personnel Classifications

The Operations Department is comprised of personnel in the following classifications:

a) Department Head
b) Deputy Department Head
c) Operations Specialist
d) Accelerator Crew Chief
e) Accelerator Operator Senior
f) Accelerator Operator II
g) Accelerator Operator I
h) Duty Assistant
i) Operations Administrator

2. Classification Descriptions

a) Department Head

The Department Head reports to the Beams Division Head. The Department Head is responsible for day-to-day operations. The BD Head appoints the Department Head. The Department Head's responsibilities include the following:

(1) Plan the overall activities and work of the Operations Department in cooperation with other Directorates, Divisions, and Laboratory management in order to develop

an integrated accelerator operations program, with the primary objective being safe and reliable operation.

(2) Provide guidance, direction, and feedback to the Operations Specialists and Crew Chiefs to ensure that the required Run Plan is achieved and that approved operating practices are followed.

(3) Coordinate an effective technical and supervisory training program for Department personnel.

(4) Develop performance standards for members of the Operations Department, make appropriate recommendations to Division management concerning employees showing outstanding or substandard performance, and recommend employees for promotion when warranted.

(5) Promote safe working conditions for employees, ensuring that employees receive required training regarding safety and radiological protection.

(6) Attend scheduled meetings during High Energy Physics (HEP) running including the Run Coordinator Pre 0900 meetings, the 0900 meetings, Ops/ES&H weekly meeting, and the monthly Program Planning (PMG) meetings.

(7) Establish a proper supervisor-employee relationship and provide a suitable working environment in order to encourage Operators to work in a professional manner.

(8) Develop and prepare operating instructions to ensure the safe and reliable operation of the accelerators and beamlines.

(9) Implement Main Control Room (MCR) security procedures as required by Directorate, Division, and Laboratory management.

(10) Staff the Department with trained and motivated personnel.

(11) Establish and implement Departmental goals and objectives.

(12) Ensure that the accelerator complex and beamlines are operating within the applicable operations and safety envelopes.

(13) Arrange for, conduct, and evaluate interviews with Operator candidates and recommend hiring qualified candidates.
(14) Approve monthly staff leave sheets and vacation request.
(15) Prepare budget requests for Division management.
(16) Perform such other duties as may be assigned by Division management.
(17) Maintain Stop-Work authority.

b) Deputy Department Head

The Deputy Department Head reports to the Operations Department Head. The Deputy Department Head is selected by the Operations Department Head and is generally selected from the ranks of Operations Specialists. Their responsibilities include the following:

(1) Function as the Department Head in their absence.
(2) Assist the Department Head in carrying out all departmental duties.
(3) Schedule Operators and Crew Chiefs so that each shift is properly staffed, schedule necessary shift overtime, and approve and maintain a record of on-shift personnel hours worked, vacations, shift trades, and sick leave.
(4) Assist in interviewing candidates for the position of Accelerator Operator I.
(5) Help provide direction to the Operations Specialists and Crew Chiefs to ensure safe and reliable operation.
(6) Maintain current knowledge of overall accelerator status.
(7) Perform such other duties as may be assigned by the Department Head.
(8) Maintain Stop-Work authority.

c) Operations Specialist

There is typically one Operations Specialist for each major accelerator system in the Operations Department. The current major accelerator systems are Proton Source (Pre-Accelerator, Linac, and Booster), Main Injector (Main Injector and Recycler),

Muon Campus, External Beamlines (Switchyard, Meson, MTA, NuMI, and BNB), Controls, Safety, and Training/Documentation. The Specialists report to and are chosen by the Operations Department Head from the ranks of the Operations Crew Chiefs. Their responsibilities include the following:

(1) Act as liaisons between the Operations Department and the Accelerator Machine and Support Departments.
(2) Attend applicable Accelerator Machine and Support Department meetings and provide operations input.
(3) Assist the Operations Department Head in solving operational problems as they arise.
(4) Be on-call to assist the on-shift Crews in solving operational problems as they arise.
(5) Be aware of potential conflicts between Machine and Support Departments' plans and operational requirements.
(6) Assist Accelerator Machine and Support Departments in tracking reliability and trending failures for the respective department.
(7) Assist in training Operators for the Operations Department in their area of expertise.
(8) Assist in interviewing candidates for the position of Accelerator Operator I.
(9) Keep the operating Crews informed of equipment and operating changes in their area of expertise.
(10) Perform such other duties as may be assigned by the Department Head.
(11) Maintain Stop-Work authority.

d) Crew Chief

Under direction of the Operations Department Head or designee, Crew Chiefs manage the safe and efficient operation of the Laboratory's accelerator complex during assigned shifts. They shall maintain a thorough knowledge of all accelerator and beam transport systems as well as relevant subsystems. They shall have extensive experience in all facets of accelerator operations and demonstrate proficiency in diagnosing operational problems to

achieve maximum performance within operating specifications. They shall be responsible for moment-to-moment decisions on the operation of the accelerator complex. They shall lead, train, and assist Operations Crew members (the Operations Crew members consist of Accelerator Operator I's, Accelerator Operator II's, and Accelerator Operator Seniors). They shall maintain a valid driver's license and all essential training. They will work rotating shifts. When fully staffed, there shall be five Crew Chief positions in the Operations Department. They work a five-week rotating shift, arranged such that each Crew Chief works with different Crews throughout the rotation schedule. The Crew Chiefs are selected from the Accelerator Operator II and Accelerator Operator Senior ranks by, and report to, the Department Head. Their responsibilities include the following:

(1) Provide leadership for Operators in the MCR to work harmoniously with other Operators and Accelerator Machine and Support Departments in safely accomplishing the goals for the shift including being responsible for performing all duties in accordance with all environmental, health, and safety regulations and practices applicable to the position.

(2) Ensure that the accelerator complex is operated in accordance with approved operational guidelines by monitoring beam intensities and losses for safe machine operation.

(3) Maintain a respectful, diverse, and inclusive work environment, ensure safe and professional conduct of shift operations.

(4) Coordinate all normal accelerator complex operations and operate and tune the ADBD accelerators and beam transport systems as required by the current operating schedule and safety requirements.

(5) Demonstrate advanced working knowledge and awareness of accelerator systems.

(6) Ensure that tasks given to Operators are carried out in a timely manner.

(7) Demonstrate advanced working knowledge and awareness of equipment status and changes.

(8) Assist Accelerator physicists and support groups in studies and repairs including changes to the Timeline Generator for proper events and adjusting beam intensities.

(9) Ensure that tasks are performed by Operators who possess the requisite skill level for the task.

(10) Serve as Emergency Coordinator at the scene of an emergency until relieved by higher authority or changing out with the on-coming Crew Chief.

(11) Maintain training to meet safety and operational requirements.

(12) Authorize work that may have an impact on accelerator complex operations.

(13) Authorize access to the MCR.

(14) Verify that proper shift staffing levels are maintained.

(15) Maintain a narrative log of shift activities.

(16) Ensure that all required shift documentation is accomplished prior to the end of each shift.

(17) Deliver a briefing to the on-coming Crew Chief and Crew to ensure that a proper shift turnover is accomplished.

(18) Notify the proper Division, Directorate, or Laboratory management of unusual or emergency conditions.

(19) Request technical assistance as necessary to solve operational problems.

(20) Authorize temporary changes to operating modes, as long as they remain within the approved operations and safety envelopes.

(21) Perform an early review of planned activities for the shift to determine whether special precautions are warranted.

(22) Communicate with all on-shift personnel to ensure that they understand the work to be performed.

(23) Provide guidance to the Operators for safe and efficient problem diagnoses and repairs, carry out troubleshooting, and perform appropriate repair of equipment as needed.

(24) Maintain in-depth knowledge of accelerator status.

(25) Coordinate applicable on-shift Operator training.

(26) Periodically evaluate Operator performance on shift.

(27) Perform such other tasks as may be assigned by the Department Head.

(28) Maintain Stop-Work authority.

e) Accelerator Operator Senior

Next to the Crew Chief, the Accelerator Operator Seniors are the most senior members of the on-shift Crew. They have many years of experience and may be asked to fill the role of Crew Chief as necessary. They shall demonstrate thorough knowledge of all accelerators and beam transport systems as well as proficiency in diagnosing problems based on extensive experience in all facets of accelerator operations. When on shift, they shall report to the Crew Chief, otherwise they shall report directly to the Department Head. The Senior Accelerator Operators shall lead training exercises or projects during off-shift periods. Aside from their operational duties, they may be given a project and shall be expected to lead it and carry it through to completion. They shall maintain a valid driver's license and all essential training. The Accelerator Operator Seniors work rotating shift. Their responsibilities shall include the following:

(1) Safely and efficiently operate the accelerator and beamline equipment as directed by the Crew Chief and be responsible for performing all duties in accordance with all environmental, health, and safety regulations and practices pertinent to this position.
(2) Serve as Acting Crew Chief when needed.
(3) Demonstrate advanced working knowledge and awareness of accelerator systems.
(4) Demonstrate advanced working knowledge and awareness of equipment status and changes.
(5) Assist with on-shift training of Operators.
(6) Perform minor equipment repairs as needed.
(7) Diagnose and fix moderately complex problems affecting accelerator performance.
(8) Perform Search and Secures of accelerator enclosures as necessary.
(9) Provide feedback to the Crew Chief on operations that have been performed.

(10) Properly respond to various alarm indications.

(11) Assist the Crew Chief in gathering and maintaining shift activities and repairs in an electronic log including accelerator performance and unusual behavior of equipment.

(12) Assist in coordinating Controlled and Supervised Accesses in the absence of the Duty Assistant.

(13) Assist physicists and Accelerator Machine and Support Departments in studies and repairs.

(14) Maintain training to meet safety and operational requirements.

(15) Maintain the MCR and Operator Rooms in a safe and orderly state.

(16) Maintain a professional atmosphere in the MCR.

(17) Perform such other tasks as may be assigned by the Crew Chief or the Department Head.

(18) Maintain Stop-Work authority.

f) Accelerator Operator II

Accelerator Operator II's are considered the "journeymen" of the on-shift Crews. They shall have demonstrated their mastery of the fundamental principles of accelerator operations by virtue of having passed the written and oral portions of the Operator II tests. They shall demonstrate a basic understanding and troubleshooting of the accelerator complex and subsystems in order to safely operate the accelerator complex. They shall maintain a valid driver's license and all essential training. They will work rotating shifts. When on shift, they shall report to the Crew Chief, otherwise they shall report directly to the Department Head. Their responsibilities shall include the following:

(1) Safely and efficiently operate the accelerator and beamline equipment as directed by the Crew Chief and be responsible for performing all duties in accordance with all environmental, health, and safety regulations and practices pertinent to this position.

(2) Serve as acting Crew Chief when needed.

(3) Demonstrate working knowledge and awareness of accelerator systems.

(4) Demonstrate working knowledge and awareness of equipment status and changes.

(5) Assist with on-shift training of Operators.

(6) Carry out first level troubleshooting and perform minor equipment repairs as needed.

(7) Diagnose and fix routine problems affecting accelerator performance.

(8) Perform Search and Secures of accelerator enclosures as necessary.

(9) Provide feedback to the Crew Chief on operations that have been performed.

(10) Properly respond to various alarm indications.

(11) Assist the Crew Chief in gathering and maintaining shift activities and repairs in an electronic log including accelerator performance and unusual behavior of equipment.

(12) Assist in coordinating Controlled and Supervised Accesses in the absence of the Duty Assistant.

(13) Assist physicists and Accelerator Machine and Support Departments in studies and repairs.

(14) Maintain training to meet safety and operational requirements.

(15) Maintain the MCR and Operator Rooms in a safe and orderly state.

(16) Maintain a professional atmosphere in the MCR.

(17) Perform such other tasks as may be assigned by the Crew Chief or the Department Head.

(18) Maintain Stop-Work authority.

g) Accelerator Operator I

The Accelerator Operator I position is a trainee category. It lasts for approximately the first two years of an Operator's employment. Typically, all new hires in the Operations Department are assigned as an Accelerator Operator I. Operator candidates shall have a Bachelor's Degree or higher in a technical

discipline or have equivalent experience. The main responsibility of an Accelerator Operator I is to learn the fundamental principles of accelerator operation and to complete the Operator II training program. When on shift, they shall report to the Crew Chief, otherwise they shall report directly to the Department Head. They shall maintain a valid driver's license and all essential training. They will work rotating shifts. Their responsibilities shall include the following:

(1) Safely and efficiently operate the accelerator and beamline equipment as directed by the Crew Chief and be responsible for performing all duties in accordance with all environmental, health, and safety regulations and practices pertinent to this position.

(2) Develop and maintain knowledge and awareness of equipment and operational methods through the On-the-Job-Training (OJT) manuals.

(3) Become familiar with and gather a basic understanding of accelerator systems.

(4) Actively partake in on-shift training with more experienced Crew members.

(5) Carry out first level troubleshooting and perform minor equipment repairs as needed.

(6) Perform Search and Secures of accelerator enclosures as necessary.

(7) Provide feedback to the Crew Chief on operations that have been performed.

(8) Properly respond to various alarm indications.

(9) Assist the Crew Chief in gathering and maintaining required shift documentation.

(10) Assist in coordinating Controlled and Supervised Accesses in the absence of the Duty Assistant.

(11) Assist physicists and Accelerator Machine and Support Departments in studies and repairs.

(12) Maintain training to meet safety and operational requirements.

(13) Maintain the MCR and Operator Rooms in a safe and orderly state.

(14) Maintain a professional atmosphere in the MCR.

(15) Perform such other tasks as may be assigned by the Crew Chief or the Department Head.

(16) Maintain Stop-Work authority.

h) Duty Assistant

The Operations Department has a Duty Assistant position in order to assist in administrative tasks. The Duty Assistant is not fully trained as an Operator. This person works Monday through Friday during day shift only. The Duty Assistant reports to the Operations Department Head. The responsibilities of this individual include the following:

(1) Serve as a liaison between the Operations and ES&H Division.

(2) Assist in coordinating Controlled and Supervised Accesses into the accelerator and beamline enclosures.

(3) Manage day-to-day administrative tasks.

(4) Coordinate administrative tasks with other AD administrative personnel.

(5) Assist the Department Head in maintaining departmental training records.

(6) Prepare travel for Operations personnel.

(7) Perform such other tasks as may be assigned by the Department Head.

(8) Ensure that the MCR and Operators are properly stocked with necessary PPE, equipment, and tools.

(9) Maintain Stop-Work authority.

i) Operations Administrator

The Operations Administrator position assists in administrative aspects of the Operations Department along with the Duty Assistant. This includes special projects and general upkeep of the department. This person works Monday through Friday during day shift only. The Operations Administrator reports to the Operations Department Head. The responsibilities of this individual include the following:

(1) Assist in Duty Assistant or Specialist projects.

(2) Maintain a general working knowledge of the accelerators and beamlines.

(3) Manage day-to-day administrative tasks.

(4) Develop and maintain technical documentation both digital and physical, including training material.

(5) Maintain training to meet safety and operational requirements.

(6) Assist the Department Head and Duty Assistant in maintaining departmental training records.

(7) Perform such other tasks as may be assigned by the Department Head.

(8) Maintain Stop-Work authority.

D. Guidelines

1. Operations Department Policies

Any policies specific to the Accelerator Directorate, Beams Division, and Operations Department are maintained in the Required Reading database accessible from the Operations homepage at https://operations.fnal.gov/ and in the Operators Individual Training Summary accessible from https://www-esh.fnal.gov/pls/default/itp.html. As policies change, the new policy is distributed to all current Operators by way of these two digital spaces.

Operation of the accelerator complex and beamlines must comply with all of the Laboratory ES&H standards. Printed hard-copy versions of policies and procedures may be placed at convenient locations frequented by Operations Department personnel to be used as references. A copy of the following manuals and procedures are also available online:

a) Fermilab ES&H Manual (FESHM) at

b) https://eshq.fnal.gov/manuals/feshm/

c) Fermilab Radiological Control Manual (FRCM) at https://eshq.fnal.gov/manuals/frcm/

d) Fermilab Quality Assurance Manual (QAM) at https://eshq.fnal.gov/manuals/qam/

e) AD/OPS Conduct of Operations

f) AD Specific ES&H Procedures (ADSP) at https://ad.fnal.gov/hq/AD_AP.html

g) AD/OPS Specific Departmental Procedures (ADDP) at https://operations.fnal.gov/ops/addp.html

h) AD Administrative Procedures (ADAP) at https://ad.fnal.gov/hq/AD_AP.html

Job descriptions outline Operator responsibilities per Operator classification. These descriptions are issued by the Human Resources Department and are available at https://hr.fnal.gov/employment/job-descriptions/.

2. Material and Personnel Resources

When fully staffed, the Operations Department has an approved shift staffing level of Operators, composed of a mixture of Accelerator Operator I, Accelerator Operator II, and Accelerator Operator Senior grades; there are five such Crews, rotating around-the-clock on a five-week schedule. Each Crew is supervised by a Crew Chief; there are five individuals in this grade, also rotating on a five-week schedule. The Crew Chief schedule is offset from that of the Crews such that each Crew Chief works with several of the operating Crews over the course of a rotation. In addition, there are staff-level Operations Specialists who assist in monitoring activities for specific accelerator complex and beamline areas. The Operations Department Head is responsible for supervising the activities of all the staff and shift personnel, and for carrying out the Laboratory's operating Run Plan. The Operations Department Head is assisted in these tasks by a Deputy Department Head. There is also a Duty Assistant and Operations Administrator, who reports to the Operations Department Head, and they assist, manage, and coordinate day-to-day tasks.

Department management encourages staff development by allowing Operators to continue their education by attending college, attending the United States Particle Accelerator School (USPAS), and by taking additional training at the lab. This helps with retention as well as preparing the Operators for other positions at the lab as they open.

During periods when the accelerators and beamlines are not operating, the number of on-shift Operators is typically reduced to three or four; this allows two people—in observance of the two-person rule—to investigate problems, while leaving one or two individuals in the MCR to monitor the overall situation in the accelerator complex and beamlines.

The Operations Department also receives technical support from members of the Accelerator Machine and Support Departments and various experiments. Members of these support groups are available for call-in around-the-clock to assist with problems. Each support group provides a call-in list, which is maintained digitally and in hard copy form.

The Operations Department has areas set aside for the storage of equipment, PPE, and tools which the Operators may need to safely complete their tasks.

3. Monitoring of Operating Performance

Operating problems are consistently documented and evaluated. The primary methods used to assess whether the accelerator complex and beamline performance objectives are being met are the analysis of downtime and operations statistics and feedback from the user community. Based on these assessments, corrective actions are taken to improve Operations Department performance. Frequent direct observation of Operations activities by supervisors and management is a standard operating procedure.

Operating goals are set up by the Department management and used as a tool for involving the Operations Department and relevant support groups in improving operating performance and measuring operating effectiveness. In a very general sense, the goals can be stated as:

a) Safely operate the particle beam.

b) Minimize the beam and experiment downtime due to a system failure.

c) Maximize the time of beam delivered to an experiment at its requested intensity.

d) Maximize the time of data taken at the experiments.

e) Maintain safe access and work procedures.

These goals are measurable, realistic, and challenging. These goals are achieved by following the operating plan and procedures established for the accelerator complex, beamline, and each experimental facility.

Once a month, the Laboratory's Program Planning Office holds the "Proton PMG/All Experimenters' Meeting," to which a representative from each running experiment is invited. Members of the Accelerator Directorate Headquarters, and Accelerator Directorate Operations Department, the Particle Physics Division, Computing Division, and the ES&H Division are also able to attend this meeting. Each experiment reports on problems encountered during the previous week and makes requests for the upcoming week. Minor problems or confusion about running priorities are often resolved at this meeting.

There are regularly scheduled meetings held during the week at 0900 during the HEP and Shutdown modes of operation that is open for anyone to attend. These meetings detail the previous 24-48 hours of operation. The days or frequency of these meetings may be changed as necessary.

Crew Chief and Crew performance are monitored by the Department Head and Operations Department Staff members. Periodic meetings with Crew Chiefs and with operating Crews are held as needed to discuss accomplishments, problem areas, and possible corrective actions.

4. Accountability

Members of the Operations Department are accountable to the Department Head, who in turn is accountable to the Division Head. The management system is designed to minimize the effect of human performance failures, however some errors do occur. Operations errors are normally corrected through individual counseling; more serious

errors may demand an oral or written reprimand. Repeated, deliberate disregard for Laboratory policy can result in discipline including suspension without pay or termination. Laboratory policies can be found at https://policies.fnal.gov/.

Management actively recognizes personnel who make notable safety improvement actions, operational improvements, or have ideas on how to improve safety. The Performance Appraisals and employee promotions take operational and safety performance into consideration.

5. Management Training

The Laboratory offers an in-house supervisory development course to which all Operations Department management staff are sent, and Crew Chiefs as operations considerations permit. In addition, personnel can enroll in management training at an accredited college or university.

6. Planning for Analysis of Hazards and Safety

Planning for changes in operating modes, proposed studies, or maintenance periods involves a member of the ES&H Division, who advises on potential ES&H impacts of the activity. Normally, this is done during the regular meetings. Special meetings may be called whenever the AD Operations or ES&H Division Heads feel they are needed.

Changes in the operational mode are documented in the MCR Electronic logbook (Elog) and emphasized by the Crew Chiefs during the shift change briefing. Critical safety procedures, such as switching out the 13.8 Kilovolt electrical system or locking off hazardous power supplies prior to Supervised Accesses into the accelerator or beamline enclosures, are performed by means of a checklist. The response to other situations with a potential safety impact, such as responding to a fire or a reported cryogenic emergency, are detailed in the Emergency Response Procedures located at https://operations.fnal.gov/ops/addp.html.

Planning for safety and hazard analysis is addressed in FESHM Chapters. In addition, Operators receive hazard awareness training for various areas around the Laboratory. The ES&H Division provides guidance and support to the Operations Department whenever operational safety questions arise.

Operators and the Duty Assistant check the training of anyone wanting to access the accelerator complex and beamline enclosures by means of a key logging program in the MCR. If an individual does not meet the required training qualifications for a requested key, authorization is required by the appropriate ES&H Division personnel before they are permitted to receive the key.

7. Controlling Access to Electronic Operations Documents

Access to procedures, policies, and other Operations documents are password protected using the Laboratory Services Password.

The Operations Department Head approves new and revised procedures before they are posted.

II. Shift Routines and Operating Practices

A. Introduction

Standards for the professional conduct of Operations personnel are established and followed so that Operator performance meets the expectations of Laboratory management. This chapter describes the shift practices used to ensure that the operating Crew is cognizant of the status of all areas of the accelerator complex and beamlines. It describes the monitoring necessary to detect abnormal trends so that proper corrective action may be initiated. It emphasizes that the on-duty Crew Chief maintains authority and responsibility for the safe conduct of all accelerator complex and beamline operations through adherence to the guidelines established by Directorate and Department management. Topics covered in Chapter III, Control Room Activities and Chapter IV, Communications complement this chapter.

B. Discussion

Professional conduct and good shift practices result in appropriate attention to accelerator complex and beamline conditions.

Effective accelerator complex and beamline equipment monitoring is necessary to detect abnormal conditions or adverse trends so that appropriate action can be taken before equipment malfunction occurs. Notifying supervisors or appropriate personnel promptly of unusual or unexpected situations helps ensure that proper attention is given to changing and off-normal conditions. All Operations Department personnel should understand equipment status so that activities can be controlled and coordinated. Good shift practices are prioritized over a desire to complete assigned tasks quickly.

An effective operating program has Operations personnel following the proper industrial and environmental safety, radiological protection, and quality assurance practices. Safety procedures are designed with these qualities in mind in order to create an effective operating program.

It is the responsibility of the on-shift operating Crew to safely operate the accelerator complex and beamlines through adherence to operating procedures, technical specification requirements, and sound operating practices. The authority for accelerator complex, beamline, and experimental facility operations are vested in the on-duty operating Crew Chief and transferred only through formal turnover to a qualified Operator.

During all modes of accelerator operations, the on-duty Crew Chief or designee maintains authority and responsibility for all beamline operations. If a special test, event, or abnormal condition arises during accelerator operations, personnel are aware that the responsibility and authority to determine operating conditions rests fully with the on-duty Crew Chief.

C. Guidelines

1. Status Reports

During all modes of operation, changes in the status of accelerator complex and beamlines components are normally communicated to the on-shift Operators and Crew Chief through console status indicators and/or by the personnel performing changes. After investigation, the Crew Chief or designated Operator decides whether to activate the call-in list or, depending on the severity, inform department-level personnel.

The alarms systems and individuals at the experiments will inform the on-duty Crew Chief of problems. After investigation using proper procedures, the individuals or emergency coordinators will ensure that appropriate personnel are contacted.

2. Safety Practices

Operations Department personnel comply with the provisions of the FESHM, FRCM, and the ADDP Emergency Response Procedures. These procedures are kept online.

Operators are trained in and will comply with the electrical safety procedures that are contained in NFPA 70E.

3. Operator Tours

Walking tours of remote areas are made when situations arise which cannot be thoroughly investigated via the computer system. In addition, Operators visit many areas of the accelerator complex in the normal course of operation. During stand-by periods, or when the controls system is not fully operational, the operating Crews may be explicitly directed to tour specific areas of the accelerator complex and beamlines at specified intervals. Operators shall report any abnormal conditions and take action to correct the conditions.

Prior to commencing a new HEP run, or after any extended shutdown of the accelerator complex and/or beamlines, the Run Coordinators and machine experts prepare an inspection and test program to be conducted by machine experts and on-shift Operators. This is augmented by tests carried out or requested by the various system departments, as well as the ES&H Division.

4. Round/Tour Inspection Sheets

Round sheets are not used as a form of AD Operations Department monitoring. The controls system and FIRUS are the main ways of alerting Operators to problems such as fire alarms, devices out of limits, changes in device status, etc. Both systems monitor different types of indications and are independent of each other, providing information that would normally be covered by round sheets. The accelerator complex and beamlines are monitored with a system of alarms and limits that are a part of the Accelerator Control system NETwork (ACNET). Critical alarms are emphasized through the use of a computer-synthesized verbal announcement. A general application program called the "parameter page" has provisions for displaying command settings (D/A), read backs (A/D), maximum and minimum values, and basic status; a more specialized "status page" is available for critical components. A color code convention is used to indicate whether a device is within normal operating parameters, is outside the set limits, or otherwise not communicating correctly with the control system.

5. Personnel Protection

All Operations Department personnel are regularly trained in proper accelerator complex and beamline safety procedures and radiological protection practices and abide by the safety provisions of the FESHM. Safety and radiation procedures, including the As Low As Reasonably Achievable (ALARA) philosophy, are emphasized during new Operator training; part of the evaluation process for promotion to Operator II is an oral and written review of the Operator's knowledge of all relevant Laboratory safety procedures.

6. Response to Indications

Prompt action is always taken by Operations in response to indications that may have an impact on the safe and/or reliable operation of the accelerator complex and beamlines. If the problem cannot be readily solved, the Crew Chief may choose to activate the call-in list or,

depending on the severity, report it to the department-level personnel using the on-call list. Operators should believe instrument readings and treat them as accurate unless proven otherwise. Unusual readings are investigated and not ignored. Test equipment that is malfunctioning will be flagged and serviced.

7. Resetting Protective Devices

When a protection device trips, an attempt is made to understand the cause before resetting the trip. In the event of several radiation trips, the cause of the problem must be understood before re-enabling the tripped devices. In the event of a well-understood trip that cannot be immediately repaired, and resetting the trip would not present a safety hazard, procedures are in place to allow a reset of the trip. Any unexplained trip of the accelerator complex and beamlines safety system requires consultation with the ES&H Division before a reset is attempted.

8. Authority to Operate Equipment

The Crew Chief is in charge of all activities relating to operation of the accelerator complex and beamlines. The Crew Chief is responsible for ensuring that each Operator assigned to a task is properly trained in that task. Any work requests received while the accelerator complex and beamlines are operating which might impact safe or efficient operations must be approved by the Crew Chief.

During emergencies, Operators are permitted to take immediate actions for worker, public, and environmental protection without requiring advanced approval. Supervisors are informed promptly of the situation as time permits during or after an emergency.

9. Shift Operating Bases

The MCR is the base of accelerator complex and beamlines operation activities. The MCR is equipped with all equipment necessary to safely operate the facility. The MCR is conveniently located in the center of the operational accelerator and beamline complex.

Shift turnover consists of a briefing of the incoming Crew and Crew Chief which occurs in a nearby meeting room. The off-going Crew Chief or designee gives this briefing. Afterwards, the incoming Crew meets with the off-going Crew inside the MCR.

10. Potentially Distractive Written Material and Devices

The Crew Chief decides if there are any distracting influences in the MCR that need to be removed. Management will provide guidance to the Crew Chief on potentially distracting materials and devices.

III. Control Room Activities

A. Introduction

This chapter addresses the important elements of Main Control Room (MCR) activities that are necessary to support safe and efficient accelerator complex and beamlines operation. The MCR is the coordination point for all important accelerator complex and beamline activities.

B. Discussion

Activities in the MCR must be businesslike and maintain a professional atmosphere conducive to safe and efficient operation of the accelerator complex. In addition, the Operators should not be overburdened with administrative responsibilities. Access to the MCR is limited such the Operators are not distracted from properly operating and maintaining the accelerator complex and beamlines.

C. Guidelines

1. Control Room Access

The MCR is a posted "Restricted Area." MCR access should be limited to those persons on official business only. Access to accelerator complex and beamline controls stations, known as consoles, is restricted to authorized personnel and control may be revoked by the Crew Chief at any time at their discretion. Use of these consoles by other Department workers is only allowed with the consent of the Crew Chief. Entry into the MCR area containing the consoles can only be granted by Operations Department management or Crew Chiefs. The on-shift Crew Chief has the authority to enforce removal from the MCR of any person who is disruptive or hindering the operation of the accelerator complex or beamlines.

2. Professional Behavior

All personnel inside of the MCR display professional and disciplined behavior. All non-work-related discussions are kept to a

minimum. The Crew Chief ensures professional behavior from persons in the MCR.

3. Monitoring Status Postings

Software programs running on the controls system, ACNET, continuously monitor the status of operational accelerator complex and beamline devices and systems. The controls system generates on-screen indicators as devices go out of limits. Abnormal statuses are displayed on monitors centrally located throughout the MCR. Operators continuously monitor these displays and respond to devices operating out of limits; distinctive audio tones are sounded when alarms from various areas of the accelerator complex and beamlines are generated. Important status indicators are accompanied by a computer-synthesized verbal announcement and require Operator acknowledgment.

4. Control Room Operator Ancillary Duties

Operation of the accelerator complex and beamlines is, in most cases, the only duty assigned to on-shift Operators. Other duties assigned to on-shift Operators do not interfere with their ability to maintain efficient accelerator complex and beamline operation and monitoring. If administrative tasks need to be performed, the Crew Chief designates an Operator to manage them when operational conditions permit while other Operators continue monitoring the accelerator complex and beamlines.

5. Operation of Control Room Equipment

The Department Head ensures that members of the on-shift Crews are adequately qualified and trained to operate the accelerator complex and beamlines. The on-shift Crew Chief ensures that inexperienced Operators are supervised by trained Operators while operating the accelerator complex and beamlines.

IV. Communications

A. Introduction

This chapter describes the important aspects of the communications plan used in the accelerator complex and beamlines. Reliable communication methods are used to deliver operating and emergency information within the accelerator complex and beamlines. Oral (face-to-face), telephone, radio, public address (PA) announcements, and special sounds (horns and bells) are examples of communications used by the Operations Department.

B. Discussion

Since accurate communications are essential to the safe and efficient operation of the accelerator complex and beamlines, providing guidance in the proper use of various forms of communication is necessary. This includes repeating instructions to ensure accuracy of transmission and confirmation of verbal instructions. Standardized terminology and the use of a phonetic alphabet are other means of ensuring that verbal communications are understood.

C. Guidelines

1. Emergency and Operational Communications Systems

Methods are implemented to ensure that all Operators are promptly alerted to accelerator complex, beamline, and experimental facility emergencies. The MCR monitors the Laboratory's 113 emergency paging channel. The MCR is equipped with an emergency receiver dedicated to receiving verbal messages from the Security Operations Center. The Security Operations Center, as well as a NOAA Weather Alert radio, informs the MCR of weather activity whenever hazardous conditions are predicted. In addition, a FIRe and Utility System (FIRUS) monitor is installed in the MCR to provide the Operators with an immediate indication of fire and various other trouble alarms within the accelerator complex, beamlines, and experimental facilities. A dedicated base station located on the Crew Chief’s desk is used to communicate with Operators in the field. Operators in the field (where telephone

communications may not be possible) either carry handheld radios or depend on the vehicle radios. The MCR also has a separate two-way radio system which is used to contact the Infrastructure Services Division when needed. Cellular phones are carried by department-level personnel for contact in actual emergencies. Emergency communications equipment is periodically tested.

2. Public Address System

Operators have access to the accelerator complex paging and tornado warning PA system. The Crew Chief and Duty Assistant control use of the PA system for tunnel paging during maintenance activities. Not every beamline service building or enclosure is equipped with a PA system, but each service building and enclosure will have a Sitewide Emergency Warning System (SEWS). In order to reach people in these areas for non-emergencies, buildings and enclosures have landline phones or personal cell phones are an option.

3. Contacting Shift Operators

Operators in the field can be contacted by phone (landline and/or cell phone), vehicle radios, or handheld radios. Operators in the MCR can be reached at the designated phone numbers for the MCR.

4. Radios

Portable radios (handheld and vehicle) are used as a primary form of communication between Operators in the accelerator complex and beamlines. They are also a critical part of emergency response. However, two-way radios are not allowed to be used in accelerator complex service buildings that are so posted because they disrupt sensitive monitoring systems. All Operations Department vehicles are equipped with two-way radios which are on a private channel to the MCR.

5. Abbreviations and Acronyms

Abbreviations and acronyms are standardized by years of accelerator complex and beamline operating experience. These acronyms are used throughout procedures and general communication.

6. Oral Instructions and Informational Communications

The Crew Chief decides whether instructions should be in written form or if oral communication will suffice. Safety-related information and special instructions from system departments are required to be entered in the MCR Elog. Entries made in the MCR Elog include fields to tag personnel and automatically include the author of the post.

V. Control of On-Shift Training

A. Introduction

The guidelines of this chapter relate to control of training activities by Operations Department personnel. On-shift training is conducted so that the trainee satisfactorily completes all of the required training objectives and receives maximum learning benefit from this experience. On-shift training is that portion of an Operator qualification program where the trainee receives on-the-job training with as much supervised hands-on experience in operating the accelerator complex and beamlines as possible.

B. Discussion

Trainees operating the accelerator complex and beamlines are carefully supervised and controlled so that mistakes are not made by unqualified personnel and so that trainees' time on shift is used effectively. Instruction on related equipment is usually included during this training. The Crew Chief, being the on-shift supervisor for trainee-level employees, ensures the following aspects of training activities are upheld:

1. On-shift training adheres to established training programs so that instructional uniformity will be maintained.
2. On-shift instructors/evaluators are qualified for the activities they perform to ensure both correct operation and quality training.
3. Qualified Operators supervise trainees so that unqualified personnel do not make mistakes that could impact safety.
4. The Operations Department Head approve the training program so that it will best meet Operations' needs.
5. On-shift training is appropriately documented.

C. Guidelines

1. On-Shift Training Programs

On-shift training is conducted in accordance with formally defined training programs that specifically identify items the trainee must accomplish on shift. Each new Operator is given a training guide which outlines the training they are to receive during the beginning period of employment, lasting approximately 24 months. There are a series of reference works which introduce concepts of the accelerator complex, beamlines, safety, and the control system. Operators attend in-person training concerning radiation and conventional safety, hazard recognition, emergency procedures, fire extinguisher use, CPR, Search and Secure Procedures, and explosive gas safety systems. Classes in other subjects such as electrical safety, confined spaces, lock and tag procedures, etc. are given as required. In addition, AD Staff members periodically give lectures on accelerator physics, engineering, and controls topics that the Operators are encouraged to attend. Some of these lectures are recorded for viewing in the future and kept in an online video library on the Operations homepage which is maintained by the Operations Department. Hands-on training is an essential part of the training program and new Operators are encouraged to accompany experienced Operators while they look into actual problems. Understanding of these various topics is tested periodically by Operations Department Staff members, Crew Chiefs, and other Operators.

2. On-Shift Instructor Qualification

Qualified Operators who have knowledge and experience in the specific equipment or system conduct on-shift training for trainees. One or two experienced Operators are assigned to each Crew. They, in coordination with the on-shift Crew Chief, are in charge of on-shift training.

3. Qualified Operator Supervision and Control of Trainees

New Operators are always supervised by more experienced Operators. Whenever trainees operate equipment, a qualified Operator serving as an on-shift instructor will observe and guide the trainee to ensure the trainee does not make an error that could adversely impact operations or safety. Trainees are shown proper operating procedures

and monitored multiple times to ensure they understand the procedure and its purpose.

4. Use of Trainees to Support Operating

The Crew Chief, with the help of qualified, experienced Operators and system experts, monitors the members of the Crew and decides when a new Operator is sufficiently trained to be trusted carrying out an assigned procedure or task without direct supervision. Some of a new Operators' training must be formally approved before the Operator is allowed to carry out certain procedures.

5. Operator Qualification Program Approval

All Operator training programs are approved by the Operations Department Head.

6. Training Documentation

The Operations Department maintains records of what training Operators have received and the most recent training date. New Operators receive training manuals and system OJT manuals for all areas of the accelerator complex and beamlines. Training resources include books, manuals, videos, OpsWiki, self-tests, and trips to service buildings, experimental halls, and beamline enclosures in the field. Each member of the Operations department has a training file consisting of completed OJT manuals, Specialist walk-arounds, and Operator II written and oral exam results. Successful completion of these walkarounds and exams (and subsequent promotion to Operator II) signifies the end of the formal new Operator training period. Training techniques, videos, and documentation are continually under review and updated as required.

7. Optimal Number of Trainees

The number of new Operators on any given Crew varies over time. Ideally, there is no more than one beginning Operator I (i.e., less than six months in service) on any one Crew when possible.

8. Suspension of Training

Training may be suspended in the event of any occurrence that could adversely affect the safety of personnel, accelerator complex, experimental halls, and/or beamlines.

VI. Investigation of Abnormal Events, Conditions, and Trends

A. Introduction

This chapter covers the important aspects of an abnormal event investigation program. There are few events that occur in accelerator complex, beamline, and experimental facility operations that require any type of formal investigation. Simply turning off the beam switch or removing power to a faulty component can mitigate the vast majority of operating incidents.

B. Discussion

A thorough investigation ensures all significant aspects of an abnormal event are identified. Near-miss investigations can help identify detrimental conditions that, if left uncorrected, can impact Laboratory operations.

A manager has overall responsibility for the event investigation process. However, the manager may delegate specific tasks in the investigation process to other personnel as appropriate.

Two important outcomes of the event investigation are the identification of the root cause and assignment of corrective action to prevent recurrence. Other outcomes include verification of the proper operation of lab equipment, completion of all necessary notifications, and adherence to all regulatory requirements. Operations personnel recognize their obligation to assist in performing thorough investigations.

C. Guidelines

1. Events Requiring Investigation

Events that prevent the normal operation of the accelerator complex, beamlines, experiments, or support systems may be investigated to some level. An on-shift investigation will be conducted as per Operations Department Head instructions with corresponding entries in the MCR Elog. The Laboratory's practice for investigating events is within FESHM Chapters. It provides guidance for the on-shift Crews of occurrences that might require a report to the DOE.

2. Investigation Responsibility

Operational problems are investigated by the on-shift Operators, under the direction of the Crew Chief; if they cannot resolve the problem, a system expert is called in to assist. Actual or potential safety problems, or incidents involving personnel injury are investigated by the Laboratory ES&H Division. The Operations Department will assist as requested. The ES&H Division is responsible for coordinating the investigation of Beams Division incidents which are reportable under FESHM Chapter guidance.

3. Investigator Qualification

AD management has determined that on-shift Operations personnel are qualified to respond to and assist at all emergency responses, but they do not have the training necessary to determine the root cause of the incident. AD management will determine the necessary investigator qualifications on a case-by-case basis and the investigators shall be trained in facility systems and operations.

4. Information to be Gathered

The individual in charge of the investigation determines what information needs to be gathered. The Operations Department provides as much information as possible from all available sources documenting the state of the accelerator complex, beamlines, experimental facilities, or system in question when the event occurred. The Operations Department may also provide names of individuals and sources for additional information on the incident. In the case of emergencies, the Emergency Response Procedures will provide guidance in the types of information that should be gathered by the on-shift Crew.

5. Event Investigation

The most senior person instigating the investigation sets the guidelines for how detailed the investigation is to be, and what the final result of the investigation should produce (i.e., written report, recommendations, etc.).

6. Investigative Report

The person in charge determines how detailed the report needs to be. Most operational problems are documented by entries in the downtime log and the MCR Elog.

7. Event Training

The ES&H Division cooperates with the Operations Department in developing and carrying out drills dealing with emergency situations that might reasonably be expected to occur during machine operation. BD Operations, ES&H, Security, and Fire Department personnel conduct a post-drill review. Part of a new Operator's training is learning how to react to these abnormal situations.

8. Event Trending

During the 0900 meetings, any repetitive failures or trends toward more frequent failures are noted and plans are formulated to reverse the trend.

9. Acts of Sabotage

Any suspected act of sabotage is reported to Site Security. Management determines whether continued operation is justified or if a shutdown is advisable.

VII. Notifications

A. Introduction

To ensure that the Laboratory is responsive to environmental, health, and safety concerns, appropriate personnel must be notified in a timely manner when necessary. This chapter provides guidelines that ensure uniformity, efficiency, and thoroughness in these notifications.

B. Discussion

Events that require notification of off-site personnel can occur. It is essential that information be gathered and transferred in a systematic, controlled method. Operator training defines responsibilities and requires adequate documentation be used to control the process and ensure that the notification process is effective.

C. Guidelines

1. Notification Processes

The on-shift Crew Chief normally decides when to activate a call-in list; Operations Department policy dictates that the Department Head must be notified when the accelerator complex and/or beamlines have been down for longer than 2 hours.

Call-ins to correct malfunctioning equipment are considered a standard operating procedure. A member of Operations who is unable to work a shift as scheduled must notify the Crew Chief. The Crew Chief should then notify the Department Head and Deputy Department Head.

2. Notification Responsibility

The Crew Chief is responsible for ensuring that those individuals listed on the appropriate call-in list have indeed been notified, that an entry has been made in the MCR Elog, and that any time requirements for notification are followed. Other members of the on-shift Crew may place the actual calls, but the results must be logged. Operators are

responsible for notifying the appropriate individuals if they are unable to report for a scheduled shift.

3. Names and Phone Numbers

A categorized list of names and phone numbers is available online at https://www-bd.fnal.gov/cgi-mcr/callin.pl to use for making calls. This book is broken down by both department and equipment, contains names of primary and alternate personnel, and the associated phone numbers for each person. A phone directory of AD personnel and support groups is available in the controls system, which allows phone number access from service buildings or experiments equipped with ACNET terminals. Some unlisted phone numbers must be connected through the Fermilab Operator.

4. Documentation

The documentation of notification or attempts at notification is kept in the MCR Elog.

5. Communication Equipment

The MCR is equipped with multiple phone lines and a direct phone line with duty personnel to provide quick notification of problems. Local paging systems in the buildings provide another form of communication. The phones have an alternate power source in the event of a power failure, and one phone is on a non-Laboratory exchange so that if the Laboratory communications facilities go down, the MCR will still be able to make off-site phone calls. Along with the phone system, a series of hand-held radios, base stations, and vehicle mobile radios are also available.

VIII. Control of Equipment and System Status

A. Introduction

This chapter provides an overall perspective on control of equipment and system status. The operating Crew is aware of how equipment and systems function for operational purposes. Administrative controls are established to handle configuration changes resulting from maintenance, modifications, and testing activities. The downtime log and the MCR Elog are used as primary resources for compiling and transmitting status information. Proper authorization is required prior to operating mode changes or performing work related to safety equipment. Specific topics are additionally covered in the complementary chapters including Chapter IX, Tagouts; Chapter X, Independent Verification; Chapter XI, Logkeeping; and Chapter XII, Shift Turnover.

B. Discussion

It is imperative that equipment and systems be properly controlled. Not only must the operating Crew be aware of how equipment and systems function for operational purposes, but they must also establish and maintain the proper component, equipment, and system configuration per design and technical specifications.

C. Guidelines

1. Status Change Authorization and Reporting

System and support department personnel are required to notify the MCR prior to making any modifications that would alter the operating configuration of the accelerator complex or beamlines. If operations will be affected for an extended period due to work, the Crew Chief may consult with department-level personnel and the Run Coordinator before permitting the work. The ACNET controls system alarms program notifies the operating Crew of changes in the status of any of the monitored accelerator complex or beamlines components. Changes in the operating mode of the accelerator complex or beamlines are recorded in the MCR Elog and communicated during the shift-change briefing.

2. Equipment and System Alignments

Computer "restore" files are used to place the accelerator complex and beamlines in a baseline configuration for startup. Beam line experts and physicists provide the initial values for accelerator complex and beamline devices. "Saves" of operating conditions can be made at any time, as can full or selective "restores." Up to one hundred files of operating conditions can be saved to local storage. A full “save” of operating conditions is normally made at least once every 24 hours while the machine is operating.

Restoration of safety related systems following maintenance involves functional testing of their capability.

3. Equipment Locking and Tagging

A system of MCR-controlled locks exists to lock out equipment considered by the ES&H Division to present an electrical hazard during Supervised Accesses into the accelerator complex or beamline enclosures. Supervised Accesses are those where the enclosure has been surveyed and posted for radioactivity and Configuration Control electrical lockout performed. Entry requirements are less stringent than those for Controlled Access because most of the radiation and electrical hazards have been mitigated. Written checklists for Configuration Control electrical lockout are used to ensure that the proper power supplies are locked off before Supervised Accesses are permitted and unlocked prior to machine startup. This Configuration Control electrical lockout procedure is not a substitute for the lockout/tagout procedures required of individuals working on specific pieces of equipment, but rather intended to provide an additional level of safety for individuals in the general area of these devices.

4. Operational Limits Compliance

New operational limits, or changes to old limits, are noted in the MCR Elog and are emphasized during shift-change briefings. The ACNET controls system application programs and Beam Budget Monitor enforce some limits. A set of binders containing the *Beam Safety Envelopes*, *Operating Limits,* and *Run Conditions* are kept in the MCR to aid the Crew Chief in determining whether a proposed change to the accelerator complex timeline might violate the operating or safety envelope.

5. Management of Equipment Deficiencies and Maintenance Activities

The MCR Elog and downtime log are used to log and track problems. ES&H Division, system, and support department personnel are informed of malfunctioning components or systems under their control. Instances of machine downtime are recorded in a computerized downtime log. Completed repairs are updated in the AD Electronic Worklist and are tested as required. The Department Head is informed of lengthy downtimes and recurring problems. During machine and beamline operations, periodic meetings are held to discuss problems and timely repair plans.

6. Maintenance Work Authorization and Documentation

Proposed work (other than necessary repairs to keep the accelerator complex and beamlines operating) is listed in the AD Electronic Worklist and must be approved by the AD Run Coordinator, Machine Coordinator, and the ES&H Division before work is allowed to proceed.

Maintenance work is planned to be done on designated days after discussion with Machine and Support Departments. The Crew Chief has access via the AD Electronic Worklist to view the list of authorized tasks. The MCR controls the keys to enclosures and may have additional information about areas to be accessed.

7. Equipment Post-Maintenance Testing and Return to Service

System and support department personnel are responsible for testing equipment after completing scheduled work and before declaring the device operational. The ES&H Division personnel may require additional testing, especially after work on a critical device. These tests are completed and logged in the MCR Elog by the on-shift Crew or Crew Chief. During startups after an extended downtime period, or when major modifications have been made to a portion of the accelerator complex or beamlines, machine experts perform tests on all major components to ensure that they function correctly, and the results are documented.

8. Alarm Indicators

Alarm indicator screens are an integral part of each console location in the MCR. The Controls System and FIRUS provide various

forms of indicators for a number of different systems. Operator awareness of alarm conditions is enhanced by the use of color-coding and by audible announcements. Indications are then investigated and actions are taken according to operating conditions.

If an alarm indication is determined to be unreliable, Operators document the condition in the MCR Elog and contact system experts. Given consultation with system experts, the Operators will take appropriate actions to monitor conditions while the alarm is unreliable.

9. Control of Temporary Equipment Modifications and Temporary Systems

Temporary control or modifications are noted in the MCR Elog. They are passed on to the next Crew and Crew Chief during the shift turnover briefing. Once the device or system has been restored to its normal state, another MCR Elog entry is made. Modifications to some systems such as safety, cryogenics, run conditions or operating limits, and flammable gas systems are more formally documented and are approved by the ES&H Division, Operations Department Head, and Division Head.

10. Configuration Control and Distribution of Engineering Documents

The ES&H Division or appropriate Machine and Support Departments are responsible for their equipment and system documentation. If the Operations Department needs a drawing or document, the engineer or physicist in charge of that system is consulted to ensure that the most up-to-date version of the documentation is being used.

IX. Lockouts and Tagouts

A. Introduction

This chapter describes the important elements of a lockout/tagout program at Fermilab known as LOTO. Activities related to the control of hazardous electrical energy meet the requirements of the implementation of OSHA and NFPA standards. If there is a potential for injury during operation, maintenance, or modification activities due to inadvertent activation of equipment, a lockout/tagout program is used. The lockout/tagout program provides for verification of the removal-from-service and restoration-to-service of safety-related and other important accelerator complex and beamlines equipment. Additional aspects of equipment control are addressed in the complementary chapters including Chapter VIII, Control of Equipment and System Status and Chapter X, Independent Verification.

B. Discussion

Lockout/Tagout is used to control equipment that is removed from service during maintenance activities. Errors in the lockout/tagout process must be prevented to ensure a high degree of personnel and equipment safety. In addition, it is necessary to correctly administer the lockout/tagout program so that the condition and integrity of important accelerator complex and beamline components and systems are maintained. An effective lockout/tagout program should include: the placement of a lockout and/or tagout apparatus on an energy-isolating device to indicate that the device and the equipment being controlled may not be operated until the lockout/tagout apparatus is removed; detailed administrative procedures; uniquely identifiable locks and tags; appropriate control over tagout preparation, approval, placement, and removal; and adequate documentation.

C. Guidelines

1. Lockout/Tagout Use and Procedures

Situations requiring the use of LOTO Procedures are delineated in the Fermilab ES&H Manual (FESHM) and are to be followed by all Fermilab personnel. In accordance with the FESHM, there are various

conditions that, if not met, require a specific written LOTO Procedure. If required, FESHM has a chapter that provides guidelines for writing a LOTO Procedure. If a specific written procedure is not required, the FESHM includes steps for the standard LOTO Procedure.

2. Protective Materials and Hardware

The FESHM lists the lock and tag materials, brief descriptions, and stock numbers. Each member of the AD Operations Department is assigned a "red" personal lock with one key and a "Danger – Do Not Operate" tag with space for employee identification to be used whenever they must perform a LOTO Procedure.

3. Lockout/Tagout Program

The AD LOTO program is detailed in the Accelerator Directorate ES&H Procedures (ADSP) Manual located at https://ad.fnal.gov/hq/AD_AP.html.

ADSP details the policy for the use of Configuration Control locks. The lockout of electrical equipment that provides power to exposed electrical components within the enclosure is one of the qualifications which must be met prior to allowing Supervised Access into that enclosure; this lockout is achieved with the use of the Configuration Control locks. The Configuration Control locks are used for Operations Department Configuration Control electrical lockout only. The locks used in Configuration Control are not intended to provide electrical safety for personnel working directly on the electrical supplies or components. This can only be provided by following the LOTO Procedures, which requires an individual to place their own lock and/or tag on the source of the AC power.

4. Application of Lockout/Tagout

The FESHM and ADSP include instructions that the person actually performing the work shall attach a lock and/or tag and shall, by conclusive test, verify that the source of energy has been isolated from the equipment and that no energy can be delivered from an alternative source.

The person who placed the lock and/or tag must remove it. If that person cannot be reached, and it is necessary to operate the equipment, the BD Head or designee must authorize removal in writing,

as indicated in FESHM. In the situation where equipment is on the Operations Department Configuration Control electrical lockout list, removal of Configuration Control locks is authorized by the on-shift Crew Chief once the affected enclosure(s) has been Search and Secured and the electrical safety system reset.

5. Lockout/Tagout Approval and Notification

While the accelerator complex and beamlines are operating, all work performed on beamline components is reported to, and approved by, Operations Department personnel and the AD Run Coordinator. During experimental running, all work inside the experimental halls is approved and coordinated by the designated experimental coordinator at the experiment prior to access. This person then notifies the on-shift Crew Chief when the access is required.

6. Testing or Positioning of Equipment or Components

The person doing the work verifies that the equipment is in an operable condition when the lock or tag is removed. In the case of critical devices, the ES&H Division specifies operational checks or tests to be made before the equipment is returned to service. These tests are documented in the MCR Elog and appropriate signatures are obtained if required. Checks on other equipment may be made at the discretion of the person doing the work or the on-shift Crew Chief.

7. Periodic Inspections

Equipment necessary for the operation of the accelerator complex and beamlines must be returned to service prior to the end of a scheduled maintenance period. Other equipment may be allowed to remain down for a very limited time (e.g., while awaiting delivery of a part) provided that a working backup is in place if required. However, the primary equipment is expected to be placed back into service as soon as possible. The FESHM includes instructions for periodic inspections.

8. Caution Tags

Use of "Configuration Control (Danger, Caution, Warning, and Notice)" tags are specified in FESHM. Standard Configuration Control (Danger, Caution, Warning, and Notice) tags are available from the Fermilab stockroom. These tags are separate from the “Danger – Do Not Operate” tags used in LOTO.

9. Training and Communication

BD Operations Department personnel are required to take the Fermilab “Lockout/Tagout Level 2” training every two years. In addition, for machine LOTO Procedures, Operators must first complete training for the specific machines. Once trained, they are required to review and train on the procedures every year.

10. Outside Contractors

All outside contractors are required to follow the guidelines laid out in FESHM in regard to using their own lockout and tagout program when performing work for the Laboratory.

11. Group Lockouts and Tagouts

Multiple lockout/tagout devices accommodating several locks are available from the Fermilab stockroom.

X. Independent Verification

A. Introduction

An independent verification program provides a high degree of reliability in ensuring the correct position of components such as valves, switches, and circuit breakers. This chapter describes the important aspects of an independent verification program. Other chapters complement the equipment status control programs and appropriate investigations including Chapter VIII, Control of Equipment and System Status; Chapter IX, Lockouts and Tagouts; and Chapter VI, Investigation of Abnormal Events, Trends, and Conditions.

B. Discussion

Independent verification is the act of checking a component's position independently of activities related to establishing the component's position.

Not all components require independent verification because the possibility of mis-positioning may be unlikely or because the effect of a mis-positioning may not be significant to safe and reliable Laboratory operation. Therefore, it is important to identify those components that must be independently verified. One method of verification is to compile devices into lists of alarms and limits, positions, read-backs, and settings that are continually verified via software.

Independent verification recognizes the human element of component operation: Any Operator, no matter how proficient, can make a mistake. This concept is stressed in an independent verification program so that Operators' confidence in the ability of their peers will not reduce attentiveness to the verification tasks. Operators understand the importance of the independent verification program and address this task with a high level of personal integrity and discipline.

C. Guidelines

1. Components Requiring Independent Verification

Virtually all of the adjustable accelerator complex, beamline, experimental, and system devices are independently verified through the controls system. All adjustable components of the accelerator complex and beamline safety system are verified through both hardware and software. Systems that present significant personnel hazards (flammable gas, large cryogenic systems, systems with significant stored energy, etc.) are reviewed by an independent safety panel prior to installation and are inspected after any modifications or extended accelerator or beamline shutdown.

2. Occasions Requiring Independent Verification

Systems verified through the controls system and the safety system are verified continuously during operation. Systems are also independently verified just prior to machine start-up after an extended maintenance period.

3. Verification Techniques

The adjustable accelerator complex, beamline, and safety system devices are continuously verified by means of applications program software.

Positions of valves and moveable components such as scrapers and collimators have micro switches to verify their "in" or "out" status.

The main magnet power supplies have physical barriers in their switch cabinets to enforce the proper "make before break" procedure.

Capture-key systems are used in the switchgear of 13.8 kilovolt systems, normally manipulated by the operating Crews.

All radiation-related and safety system devices have redundant "hardware" and "logic" loops to verify that they are in the proper state. An enclosure Search and Secure Procedure and the presence of all enclosure enter keys in the key tree, either in the MCR or remote key tree, verifies that all personnel are out of the accelerator complex and beamline enclosures prior to machine start-up. The correct Search and Secure Procedure is enforced by the logic loop which will not allow the safety system to be reset if the procedure is completed incorrectly.

Access door positions are monitored by redundant micro switches, infrared, or magnetic proximity switches.

The AD "two-person" Controlled Access rule is enforced by interlocked access boxes on opposite sides of entry points, placed far enough apart so that one person cannot simultaneously engage both boxes. Enclosure enter keys are stored in "capture key trees" in the MCR and some remote access points. Key logout is done through a computer database system that checks for required training and certification. Devices on the electrical and radiation safety systems are interlocked to the enclosure enter key trees so they will turn off if a key is removed while the machine is running.

"Sequencer" programs are used for complex accelerator setups, such as turning on/off accelerator machines. These sequencers normally perform an adjustment, then perform a test to verify that the adjustment was successful, or temporarily halt after the adjustment for Operator verification before the sequence proceeds.

Personnel from the various Machine and Support Departments, in consultation with the on-shift Crew Chief, occasionally monitor the functioning of equipment in their systems while the machine is operating.

XI. Log Keeping

A. Introduction

The Operations Department records include a narrative log of the accelerator complex and beamlines status and of all events as required to provide an accurate history of accelerator complex and beamline operations. This chapter describes the features needed in the Operations logs to ensure that the data necessary to provide an accurate history of accelerator complex and beamline operations is recorded.

B. Discussion

Operating logs are established for all shift positions in order to fully record the data necessary to provide an accurate history of accelerator complex and beamlines operation. Events are recorded in a timely fashion in order to ensure the accuracy of the entry. The scope, type, and format for all log entries is determined such that the information required by management is properly entered into the logs. This includes documentation of actions taken, activities completed, transfer of information among Operators, and data necessary for event reconstruction.

A review schedule for the operating logs is established to ensure that entries are adequately maintained and that Operations personnel are aware of the information contained in the logs. Administrative controls are established to ensure all of the operating logs are readily available for a sufficient period of time to allow for the transfer of information among the Operators. Although Operations Department personnel also make entries into system-specific logbooks (i.e. Muon), review of these logbooks is not a required part of the shift change briefing.

C. Guidelines

1. Establishment of Operating Logs

Logbooks have been kept in the MCR since the accelerator complex began operating in 1972. Originally, they were in the form of handwritten logs, now the narrative record of all significant shift activity is kept in the MCR Electronic logbook (MCR Elog) under the Operations tag. Although all Operators may make entries in the MCR Elog, it is the Crew Chief's responsibility to ensure that entries in the MCR Elog are maintained and properly reflect the activities of their shift. System and machine specific logbooks are not considered Operations logs.

2. Timeliness of Recordings

Information is to be promptly recorded in the MCR Elog. Each entry in the MCR Elog is automatically time-stamped. It is the Crew Chief's responsibility to ensure that Crew members report and/or record events in a timely manner. If circumstances dictate that an entry cannot be made immediately into the MCR Elog, one should be entered as soon as the Crew Chief or an Operator is available. The purpose is to record information before the details of the event are forgotten.

3. Information to be Recorded

All information pertaining to the safe and efficient operation of the accelerator complex and beamlines, names of the on-shift personnel, special instructions, activation of call-in lists, unusual incidents, general machine operating performance, and an end-of-shift summary are written in the MCR Elog. Examples of items to be recorded are:

a) Facility mode changes.
b) Abnormal facility configurations.
c) Status changes of safety-related or other major equipment.
d) Starting and completion of studies or tests.
e) Shift changes.
f) Significant information concerning emergencies, abnormal, or unexpected events.

4. Legibility

Due to its nature the MCR Elog is always legible and easily duplicated.

5. Entry Modification

Once an entry has been completed, the MCR Elog does permit the entry to be modified for a period of time. This is to allow corrections and clarifications to be made to the entry. Within this edit window, an entry may also be Hidden which will make it only viewable to the entry creator and those with special permissions, like department management. Even though entries may be Hidden, they can never truly be deleted from the MCR Elog. If a correction must be made outside of this edit window, corrections and/or clarifications can be added by using the Comment feature.

6. Log Review

The Operations Department Head reviews the MCR Elog. In most cases, anyone on the Laboratory site with login permissions may review the MCR Elog from a remote location at any time.

7. Document Retention

All entries completed in the MCR Elog are permanently stored in computer files that are maintained by AD Controls Department personnel.

XII. Shift Turnover and Assumption of Responsibilities

A. Introduction

Shift turnovers provide on-coming Crews with an accurate picture of the overall status of the accelerator complex and beamlines. This chapter describes the important aspects of good shift turnover and complements the guidelines of Chapter II, Shift Routines and Operating Practices, and Chapter III, Control Room Activities.

B. Discussion

Shift turnover is a critical part of accelerator complex and beamline operation. It is essential that operating personnel perform turnovers such that an effective transfer of information takes place.

On-coming personnel conduct a comprehensive review of appropriate written and visual information before responsibility for the shift position is transferred. The Operations Department shift schedule provides a one-half hour overlap to accommodate a suitable transfer of information.

Shift turnover includes a thorough review of relevant documents describing important aspects of accelerator complex and beamline status as well as the AD Run Coordinator plans. These reviews are then accompanied by a discussion between the outgoing and on-coming personnel.

C. Guidelines

1. Shift Crew Briefing

The on-coming Crew is given a briefing in a designated briefing room covering what has occurred since they were last on shift. The primary source of information during this briefing is the contents of the MCR Elog. This briefing should be as intensive as necessary for the on-

coming Crew to understand important history, present status, and planned events. Some examples of topics to cover are:

a) Facility operation mode and status.
b) Key and access parameters.
c) Limiting conditions for operations, either normal or abnormal.
d) Any temporary procedures or conditions in place.

2. Document Review

On-coming personnel conduct a review of appropriate written (logs, records) and visual (equipment, console) information before assuming responsibility for the shift position. Outstanding problems or situations are noted in the Hot Item Book. A review of the ACNET alarms screen and various parameter and applications pages are conducted so Operators are familiar with the current operating conditions. On-coming personnel are also briefed on any new information not directly related to machine operation. Save files of all operating conditions are normally made at least once per day as a precaution against a major failure occurring during succeeding shifts; these files are to be reviewed in the event of a question or problem.

3. Discussion and Exchange of Responsibility

Following the shift turnover briefing, the on-coming Operators report to the MCR and go to their assigned console if station assignments have been made by the Crew Chief. The out-going Operator at that station then briefs the on-coming Operator on details regarding the status of the accelerator complex, beamlines, and systems. The on-coming Operator should ask pertinent questions to develop an understanding of the situation. If any part of the accelerator complex or beamlines are operating in an unusual mode or configuration, or when an operational adjustment is in progress at shift change time, the out-going Operator must ensure that the on-coming Operator is fully aware of the situation.

XIII. Required Reading

A. Introduction

Proper use of Required Reading by Operations Department personnel ensures that appropriate individuals are made aware of important information related to their job assignment. This chapter describes an effective Required Reading program.

B. Discussion

It is not always necessary for all Department personnel to read every document; however, it is essential that each individual receive the information relevant to their position. The method designates which documents should be read by who and when. Personnel are required to understand the assigned material and when Required Reading material is not understood, appropriate questions are directed to supervisors.

C. Guidelines

1. Identification of Material to be Distributed via Required Reading

Personnel from the Operations Department and the various ES&H Division, system, and support departments generate various types of documentation which describes changes in machine operating procedures. Once the documents are deemed necessary by Operations Department management, all relevant personnel receive copies of these documents on their digital Required Reading file. Once a document is in the personnel's file, they will need to read and sign off on the document.

New Operators are required to read several policy and ES&H manuals. These Required Reading documents are listed on their file in the Required Reading program.

2. Identification of Personnel Required to Read Required Reading Documents

Not every document added into the Required Reading database is required to be read and signed off by everyone in the Operations Department. The Operations Department Head determines which Operations Department personnel must read a document once it is submitted and it will be added to the personnel's file in the Required Reading program. All personnel who have the document added to their file in the Required Reading program are expected to read these documents at their first available opportunity. Completion of the reading assignments is verified quarterly by the Operations Department Head and the Duty Assistant.

3. Documentation

The documents are stored in the BD Document Database, ES&H Train database, or on the Operations Department website. The Operations Duty Assistant maintains control over the Required Reading program which includes files that track which documents personnel have read and signed, both currently and in the past. The Required Reading program keeps historical files from former Operations Department personnel as well.

4. Review

The contents of the Operations Department Required Reading program are periodically reviewed and updated by the Operations Department Head.

XIV. Timely Instructions/Orders

A. Introduction

There shall be established and implemented practices establishing timely written direction and guidance that communicates short-term information and administrative instructions from Operations management to Operations personnel. More information in Chapter XV, Technical Procedures, and Chapter XVI, Operator Aids complements this chapter.

B. Discussion

The constantly changing requirements of accelerator complex and beamline operations necessitate implementing directives for instructions/orders that distribute information to Operations personnel in a timely manner. Due to shift schedules, providing this information to Operators deserves special attention. To ensure this information remains constant, periodic reviews are used to remove outdated information.

C. Guidelines

1. Content and Format

Directives for timely instructions/orders include instructions on the need for and when to perform specific measurements, tests, evaluations, documentation, or related activities. The directives contain information regarding announcement of policy information and similar administrative information. Special activities, administrative directions, special data collection requirements, plotting parameters, and other similar short-term matters can also be included in the directives. Directives will be clearly written and dated in the MCR Elog by the Operations Department Head, BD Run Coordinator, or designee and verbally emphasized during the shift turnover briefing. Administrative messages are normally issued to Department personnel via email. These directives may not be used to change operating procedures, emergency procedures, run conditions, or operating envelopes.

2. Issuing, Segregating, and Reviewing Timely Instructions/Orders

Timely instructions/orders are issued and written in the MCR Elog by the Operations Department Head, BD Run Coordinator, or designee whenever necessary to communicate instructions to the shift personnel. Short-term instructions/orders are posted in the MCR Elog. Daily instructions/orders that are postponed or prolonged are also recorded in the MCR Elog. Reviews of long-term orders are made periodically by Operations Department management and Crew Chiefs. It is the Crew Chief's responsibility to review all shift instructions/orders early in the shift. Occasionally, special instructions or requests for Operator action are entered by system personnel, however these need the prior approval of the Operations Department Head or designee and may be countersigned by them.

3. Removal of Timely Instructions/Orders

Directives of timely instructions/orders in the MCR Elog are not valid for more than 24 hours (or until the next regularly-scheduled workday, in the case of weekends or holiday); orders intended to be in effect for longer than this are usually issued as formal memos signed by the AD Head, BD Head, ES&H Division personnel, or Operations Department Head and specifically state the length of applicability. Orders that are no longer applicable or are outdated are closed out by the Crew Chief. If unsure of the validity or status of an order, the person who issued the order may be consulted. The Operations Department Head or designee should periodically review the directives to ensure only applicable and current orders remain in effect.

XV. Technical Procedures

A. Introduction

Technical procedures are written to provide specific direction for operating systems and equipment and for conducting safety-related operations during normal and abnormal emergency conditions.

Technical procedures provide appropriate direction to ensure the accelerator complex and beamlines are operated within design bases and are effectively used to support safe operation. Procedures are separated into emergency, safety, departmental, and administrative classifications. Each type requires a different level of sign-off, review, training, and related formality. Content in Chapter XIV, Timely Instructions/Orders, and Chapter XVII, Operational Aids complement the information in this chapter. This chapter describes the important aspects of operations technical procedure development and use.

B. Discussion

Studies have shown that procedures are a key factor affecting Operator performance. The probability of Operator error increases greatly with the use of poorly written procedures. In addition, deficient procedures, and failure to follow procedures, contribute to many significant operational events. Appropriate attention is given to writing, reviewing, and monitoring technical procedures to ensure the content is technically correct and the wording and format are clear and concise. Although a complete description of a system or process is not needed, technical procedures are sufficiently detailed to allow personnel to perform the required functions without direct supervision. Consistency in procedure format, content, and wording is essential to achieving a uniformly high standard of performance. Operators are not expected to compensate for shortcomings in procedures such as poor format or confusing, inaccurate, or incomplete information. Instead, technical procedures are written so that they can be easily used without increasing the probability of mistakes occurring.

During the course of accelerator complex and beamline operations, technical and operational requirements change and better methods of

performing work develop. To ensure that procedures in use provide the best possible instructions for the activities involved, periodic review at the Department Head's discretion and feedback of information are essential.

Properly controlled and readily available technical procedures promote their use and ensure Operations activities will be conducted in the manner intended. The Department Head and Duty Assistant conduct a quarterly review of Operator training and ensure that all Operators are up to date on their knowledge of technical procedures.

C. Guidelines

1. Expectations for Procedure Use

The use of written procedures by Operators, where necessary, is the expectation of Operations Department management. Examples include Lockout/Tagout of accelerators and Emergency Response Procedures. The Operators shall perform the procedures as written. If the procedures cannot be executed as written, work shall be stopped and Operations management shall be notified.

2. Procedure Development

Laboratory and ES&H Division personnel assist in developing safety and emergency procedures. Most accelerator complex operation is done via the ACNET controls system. Applications required for running are either developed in-house by the AD Operations Department or a request is generated to the ACTD (Accelerator Complex Technology Division) Accelerator Controls Department or the appropriate system department for the desired program. With this controls system, the majority of operational tasks do not require written procedures given the control, review, and documentation methods in production and use of various ACNET programs. The process for procedure development is as follows:

a) Directives include a process for procedure development, including format, clear language, and clear standards.

b) Directives designate a senior manager responsible for procedure development.

c) Directives include a process for completing and documenting procedure review and approval of both hard-copy and electronic procedures.

d) Directives specify that procedures will provide administrative and technical direction to effectively conduct the operation, using detail appropriate to the complexity of the task, the experience and training of the Operators, the frequency of performance, and the significance of the consequences of error.

e) A procedure revision table is added to the procedures to ensure documentation of the reason behind the update of a procedure.

3. Procedure Content

Accelerator Directorate Administrative Procedures (ADAP) has specified a standard format for all Division and Departmental Procedures.

Procedures have a specific purpose and provide a safe and efficient way of carrying out the purpose. Procedures that do not meet these qualifications or are not accurate are reviewed and corrected as necessary.

Emergency procedures comply with the Laboratory and AD safety policy. The review process includes approval from designated members of relevant departments. The content of a procedure is as follows:

a) Procedure scope and applicability are readily apparent.

b) Procedures for multiple equipment trains are clearly distinguishable from each other.

c) Emergency procedures are clearly distinguishable from normal operating procedures.

d) Procedures incorporate appropriate information from applicable source documents including design and safety standards.

e) Prerequisites and initial conditions are clearly specified.

f) Tools, equipment, and materials are specified.

g) Hold points requiring independent verification or approval are clearly indicated.

h) Procedure language is clear, definitions are explained, and detail is appropriate for the Operator's skill, experience, and training.

i) Procedure format standards:

1) One action per step.

2) Warnings, Notes, and Cautions are clear, do not contain actions, and precede the applicable step.
3) Warnings, Notes, Cautions, and headings appear on the same page as the applicable step.
4) Critical steps include signature/initial/checkoff blocks with only one action per block.

j) Procedures are technically and administratively accurate, instructions and information are correct, referenced documents are correctly identified, and instructions for transferring between procedures are clear.

k) Procedures contain explicit parameters and do not require mental arithmetic to determine acceptability.

l) When procedures use or refer to other procedures or steps, they are clearly identified with the exact identification to prevent confusion in transferring to or from them.

m) Procedures specify the restoration or shutdown steps for equipment following tests or other operations.

4. Procedure Changes and Revisions

Safety and emergency procedures are periodically reviewed to determine if changes are required. Operating and emergency procedure manuals are classified as controlled documents.

ADAP specifies how changes to Division and Departmental Procedures are handled. Process for procedure changes are as follows:

a) Once procedures are created or revised, it is reviewed by the Operations Department Head, System Experts, and ES&H personnel as necessary.

b) Procedure changes intended for permanent use are documented and stored in the BD Document Database and/or on the Operations Department website and are readily available for Operator reference.

c) During the use of a procedure, if the Operator discovers any problems with the procedure, the procedure is paused and Operations Department management is contacted.

d) A procedure revision shall be created when changes remain in effect for extended periods or when permanent changes are made.

e) Procedure revisions shall be created when there are permanent equipment modifications or replacements and implementing changes for temporary equipment modifications.

f) Procedure creation and revision is examined by system experts to determine accuracy and system experts may use walkthroughs (procedure execution with actual or simulated scenarios) to validate procedure changes and revisions.

5. Procedure Training

Once a procedure is created or revised it will be added to the Operator's Required Reading file. The Operators are informed by Operations Department management of the new/revised procedure in their Required Reading file. Operators will read the new/revised procedure at their first available opportunity.

Operators are required to review and understand all AD emergency procedures so that the correct response can be undertaken immediately.

6. Procedure Approval

The BD Head approves changes to safety procedures. The Operations Department Head approves changes to emergency procedures.

7. Procedure Review

Safety procedures are periodically reviewed by the ES&H Division to ensure viability. Operating procedures are reviewed on a regular basis. Additionally, they are informally reviewed each time they are used. When difficulties arise when applying the procedure, or there are incorrect outcomes through its use, the problems are noted by the operating Crew or Crew Chief and reported to the Operations Department Head who may decide if a rewrite of the procedure is necessary. Uncontrolled copies are regularly reviewed when used or the controlled copy is reviewed and new copies are updated as needed.

8. Procedure Availability

Any written procedures are digitally stored on the Operations Department website and/or the BD Document Database. The online procedure copies are controlled and available for Operator reference. Once printed, they are no longer controlled copies.

9. Procedure Use

Operators are required to review and understand all AD emergency procedures, so that the correct response can be undertaken immediately. Procedures are available to Operators via the AD Operations website and on the BD Document Database. Where mobile response is necessary, vehicles are equipped with a laminated copy of the BD/OPs Emergency Response Procedures that contain flow chart versions of response procedures for reference.

During emergency conditions, Operators may take necessary action to place the facility in a safe condition and protect equipment, personnel, the public, and the environment without first initiating a procedure change.

Operators shall report to Operations management any procedures which are deficient.

XVI. Operator Aids

A. Introduction

Posted information for Operator use provides information helpful to Operators in performing their duties. This chapter describes the important aspects of an Operator aid program.

B. Discussion

Operator aids provide an important function in the efficient operation of the accelerator complex and beamlines. Operator aids may come in many forms and should not be confused with experimenter aids. Operator aids may include copies of procedures (portions or pages), system drawings, curves and graphs, handwritten notes, and information tags. It is important to make sure that these types of postings reflect the most current information available and that they do not supersede or conflict with any other controlled procedures or information.

C. Guidelines

1. Management Approval

All Operators are permitted and encouraged to develop an Operator aid, however the Crew Chief or Operations Department Head must approve all Operator aids prior to posting. The person approving the aid must ensure the aid is necessary and correct. The approval (signature or initials and date) should be noted on the aid. Operator aids that alter procedures may not be approved; instead, appropriate procedures should be changed to incorporate the necessary information. Individuals other than Operations personnel may place Operator aids. Experimenter aids (notes, comments, reference material, etc.) that do not affect Operations may be posted by anyone and do not need to meet the requirements placed on Operator aids. Operator aids are not to be used in lieu of Danger or Caution tags; they should not be used to perform any safety function.

2. Use of Operator Aids

Operator aids should be viewed as a convenience to the individual using them, not a requirement. In most cases, Operator aids act as

reminders of information that might otherwise be overlooked. They provide guidance that is not procedural in nature. Operator aids may supplement approved procedures, but they should not be used in lieu of approved procedures or to perform any safety function.

3. Posting of Operator Aids

Operator aids may be posted in the MCR, service buildings, or enclosures. Operator aids must be located in close proximity to where they would be expected to be used, however, Operator aids may not obscure indicators or controls. Operator aids must be sturdy and securely mounted.

4. Documentation of Operator Aids

Often, Operator aids are mocked up on the spot for temporary use. Documentation is included in the MCR Elog or Hot Item Book to keep track of certain postings while other Operator aids are stored digitally in a commonly accessible place. Postings include a date and signature or initials.

5. Review of Operator Aids

Operator aids are reviewed regularly and reviewed at each use. The Crew Chief may update or remove Operator aids as needed given the changing state of accelerators. Operators and other staff may also update or remove postings as long as the Crew Chief has also been made aware.

XVII. Component Labeling

A. Introduction

This chapter describes the important aspects of an accelerator complex and beamline labeling program. While the Operations Department is not responsible for equipment labeling, Operations personnel do provide feedback to the ES&H Division, system, and support departments as to the effectiveness of the existing labels. A well-established and maintained equipment-labeling program helps ensure Operations Department personnel are able to positively identify equipment they operate.

B. Discussion

A good labeling program, understood and maintained by accelerator complex and beamline personnel, will enhance training effectiveness and help reduce Operator and maintenance errors resulting from incorrect identification of equipment.

The labeling program will continue throughout the life of accelerator complex and beamline activity. Because equipment labels will be continually misplaced or damaged, an ongoing labeling program exists that allows for personnel to identify components needing labels, identifies a person or persons responsible for making new labels, and ensures the new labels are correct and placed on the proper equipment. In addition to equipment, doors to rooms are labeled so personnel can identify the room and, if applicable, the equipment inside.

C. Guidelines

1. Component Labeling

All equipment built by the Accelerator Machine and Support Departments is labeled according to existing Laboratory conventions. Commercially built equipment is labeled by the manufacturer. Emergency locations (fire extinguishers, fire alarms, Halon pull boxes, etc.) are labeled in a standard industrial format. Circuit breaker panels are labeled to designate the circuit from which they are fed and what devices they feed. All adjustable accelerator complex and beamline components are identified by a unique name in the control system

database. Devices on the Configuration Control electrical lockout list have distinct labels both on the supply and on the power disconnect switch.

2. Label Information

The amount of information necessary on a label varies according to the complexity of the equipment to which it is attached and the use for which it is intended. In general, label names for devices in the AD controls database conform to the ACNET parameter name for those devices. Other labels generally follow the established Laboratory naming convention, system standards, experiment-specific conventions, or they follow the beamline naming convention for beamline components.

3. Label Placement

Labels are placed on the equipment to which they apply, as long as the label will not be obstructed and it will not interfere with equipment operation. Otherwise, the labels are placed as close to the device as possible and securely attached. They are placed in areas where they can be easily seen and read. The labels are oriented for easy reading. The labels are made of durable materials compatible with the material to which they are attached.

4. Administrative Control of Labels

BD Operators note and report missing labels during routine activities. In general, the ES&H, system, or support department personnel responsible for maintaining a particular piece of equipment are also responsible for replacing the label on it.

APPENDIX A

Functional Analysis

Accelerator Directorate Operations Department

Conduct of Operations

Terminal Objective:

To provide safe and efficient operations and assist in maintaining all accelerator complex and beamline systems within the Accelerator Directorate.

Subordinate Objectives:

1. To staff the Main Control Room (MCR) with an appropriate number of Operators, with the requisite skills, to carry out the Laboratory's research program and the Division's operations, maintenance, and upgrade activities.

2. To maintain coordination with Laboratory and Division management, system and support departments, and physicists, so that the operation of the accelerator complex and beamlines are carried out in an appropriate manner.

3. To assist Laboratory and Division management in scheduling both running and maintenance periods.

4. To coordinate emergency response and compliance with safety procedures during off-hours.

5. To provide a training program so that new Operators can quickly become familiar with operational procedures and provide a method to monitor and evaluate a new Operator's progress.

6. To maintain documentation on system downtimes, unusual occurrences, and shift activities.

7. To maintain a call-in list of various system experts to be used during off-hour problems or emergencies.

8. To perform equipment lockouts prior to accesses into the accelerator and beamline enclosures.

9. To control access into AD accelerator and beamline enclosures.

10. To perform all AD Operations activities with a level of professionalism and formality sufficient to meet the standards set forth in the Conduct of Operations.