

PPPL	Princeton Plasma Physics Laboratory	PROCEDURE	ESH-025 Rev 2 page 1 of 16
Subject: Operations Hazard Classification Criteria and Safety Certification System	Effective Date: 5/7/19	Initiated by: Head, ES&H Department	
	Supersedes: Rev. 1, 9/8/17	Approved: Deputy Director for Operations	

MANAGEMENT SYSTEM

Management System (Primary): 09.00 ESH and Integrated Safety Management (ESH)
Management System Owner: Head, ES&H Department
Management Process: 09.09 ES&H - Operations Hazard Criteria and Safety Certification
Process Owner: Head, ES&H Department
Subject Matter Expert (SME): Head, ES&H Department

APPLICABILITY

This procedure applies to all experimental operations and projects at PPPL.

INTRODUCTION

The purpose of this procedure is to classify operations (i.e., projects or experimental devices) as to their hazard level, to indicate the required controls actions to be performed for each hazard level, and to specify the required authority levels for approvals. This procedure also establishes a system to require, issue, review, and control Safety Certificates. The Safety Certification System provides a formalized, standardized means of assuring independent review and authorization of High Hazard operations designated in accordance with this procedure. In addition, this procedure provides the methodology for implementation of PPPL Policy P-111 for designated Accelerators consistent with the DOE Accelerator Safety Order (DOE O 420.2C). Reviews and authorizations conducted under this procedure are in addition to NEPA reviews and certifications required by procedure ESH-014.

SCOPE

Hazard Classification is required for all operations (i.e., experimental devices). Safety Certificates are required for all operations which have been designated by the responsible Department Head to be High Hazard. These Safety Certificates will be issued by the ES&H Executive Board (ES&H/EB) and maintained under configuration control by the responsible Project Manager or Principal Investigator. The Safety Certificate constitutes PPPL approval to conduct a High Hazard operation within the Safety Envelope and constraints indicated therein. Designated nuclear facilities per 10CFR830 and DOE-STD-1027, and designated Accelerators per DOE O 420.2C and P-111 require DOE approvals for commissioning and operations. For High Hazard, nuclear facility, and Accelerator operations, the ES&H/EB will appoint an Activity Certification Committee (ACC) to review the proposed operation.

Final hazard classifications, along with all required approvals and documentation as stated in this procedure shall be completed prior to implementation of any new operations. For High Hazard and Accelerator operations, proposed changes to an operation, new information, or discovered conditions that may impact an approved safety analysis or safety envelope must be evaluated using the Unreviewed Safety Issue (USI) process described in this procedure.

REFERENCE DOCUMENTS

DOE Order 225.1B	Accident Investigations
DOE O 420.2C	Safety of Accelerator Facilities
DOE G 420.2-1A	Accelerator Facility Safety Implementation Guide for DOE O 420.2C (https://www.directives.doe.gov/directives-documents/400-series/0420.2-EGuide-1a)
DOE-STD-1027	Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports
10 CFR 830 Subpart B	Nuclear Safety Management, Safety Basis Requirements
O-021	ES&H Executive Board Charter
O-022	Safety Review Committee Charter
ESH-014	NEPA Review System
P-111	Accelerator Safety Order Implementation
ENG-055	Conduct of Operations
PPPL Lithium Safety Program document	

DEFINITIONS & ACRONYMS

ACC Activity Certification Committee. The ACC is appointed by the ES&H Executive Board Chairperson to review the readiness of a High Hazard, nuclear facility, or Accelerator operation (or other hazard level operation, if deemed desirable) to safely conduct its mission. The ACC will consist of at least two (2) members who are not part of the operation's line organization and have knowledge and experience commensurate with performing the necessary reviews, and may include external members, as judged by the ES&H Executive Board Chairperson in consultation with the Department Head responsible for the operation and the Head of ES&H.

Accelerator An Accelerator is a device employing electrostatic or electromagnetic fields to impart kinetic energy to molecular, atomic, or sub-atomic particles and capable of creating a "radiological area" as defined in 10CFR835. Accelerator facilities include associated roads within site boundaries, plant and equipment utilizing, or supporting the production of, accelerated particle beams and the radioactive material created by those beams to which access is controlled to protect the safety and health of workers, the public or the environment. Per 10CFR835, radiological areas include "radiation areas", "high radiation areas", "very high radiation areas", "contamination areas", "high contamination areas", and "airborne radioactivity areas". Note that the definition of nonreactor nuclear facility in 10CFR830 states that Accelerators and their operations are not included; therefore, Accelerators are not subject to the requirements of 10CFR830 and DOE-STD-1027.

Accelerator Operations Those activities of an Accelerator and any associated Accelerator facilities that are bounded by the Safety Assessment Document (SAD). Accelerator operations (and post operations) include the production, dispensing, analysis, movement, processing, handling and other uses, and storage of radioactive material within the Accelerator facility.

Accelerator Readiness Review (ARR) An ARR is a structured method for verifying that hardware, personnel, and procedures associated with commissioning or routine operations are ready to permit the activity to be undertaken safely. See Attachment 8.

Accelerator Safety Envelope (ASE) See Safety Envelope.

Commissioning For fusion experiments that meet the definition of Accelerator, a phase that is typically used to perform integrated systems testing, including integrated field coil testing. The details of the duration, breadth and formality of a commissioning period for each Accelerator would be agreed upon jointly by PPPL and DOE-PSO. Commissioning activities are bounded by an Accelerator Safety Envelope (ASE) and preceded by an Accelerator Readiness Review (ARR). At its conclusion, the Accelerator is ready for performance of an ARR for routine operations, or directly for routine operations if the ARR was part of the commissioning process.

Credited Controls Controls determined through safety analysis to be essential for safe operation directly related to the protection of personnel or the environment.

ES&H/EB Environment, Safety & Health Executive Board (PPPL document O-021)

MSW Management Safety Walkthrough, which involves participation by PPPL management (including those independent of the High Hazard or Accelerator operation) in a physical walkdown of the High Hazard or Accelerator facility.

Operations At PPPL, operations as defined here are generally synonymous with experimental devices.

Pre-Job Briefing (PJB) This is a briefing conducted by the supervisor with the employee in which the supervisor explains the job that the employee is to perform. It includes a description of hazards and potential risks associated with the job and emphasizes safety precautions required and the correct sequence of operations, as well as the description of required protective equipment. Recent changes to relevant equipment and/or procedures are considered. See also procedure ESH-004, Job Hazard Analysis.

Project Hazard Analysis A brief summary of a Moderate Hazard operation, including identification of hazards associated with the operation, and design features and administrative controls to mitigate these.

Risk A quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.

Safety Analysis A documented process to systematically identify the hazards of a PPPL operation; including description and analyses of the adequacy of the measures taken to eliminate, control or mitigate the hazards and risks of normal operation; and identification and analyses of potential accidents and their associated risks.

Documented Safety Analysis (DSA) A DSA is a documented analysis of the extent to which a hazard category 1, 2 or 3 nuclear facility (as defined in DOE-STD-1027) can be operated safely with respect to workers, the public, and the environment, including a description of the conditions, safe boundaries, and hazard controls that provide the basis for ensuring safety. DSAs are approved by DOE. Details on the requirements for a DSA and related documentation are included in 10 CFR 830 Subpart B.

Safety Assessment Document (SAD) This document contains the results of a safety analysis for High Hazard operations and Accelerators (and may be used for other hazard level operations if deemed desirable) pertinent to understanding the risks of operating the High Hazard or Accelerator facility. The SAD provides descriptions of relevant structures, systems and components, identification of hazards associated with the operation, and design features and administrative controls to mitigate these. The topics to be addressed are discussed in Attachments 1, 2 and 5. The SAD shall be reviewed by the PPPL Safety Review Committee (SRC) per PPPL document O-022 and approved by the Deputy Director for Operations. Preparation and review of SADs for lithium operations must also follow the guidelines in the PPPL Lithium Safety Program document. An Accelerator SAD represents the technical basis for the Accelerator Safety Envelope (ASE), and must follow the requirements of DOE O 420.2C (see Attachment 1).

Safety Certificate This is a document that authorizes start-up and/or continuing operation of a High Hazard operation, and is issued by the ES&H/EB after review and documentation per Section B of this procedure.

Safety Envelope The Safety Envelope, which is the basis for the conditions and limitations in the Safety Certificate authorizing a High Hazard operation, constitutes the provisions that must be satisfied to permit the High Hazard operation to proceed or continue. For Accelerators, an Accelerator Safety Envelope (ASE) is a set of verifiable physical and administrative credited controls that define the bounding conditions for safe operation and address the Accelerator facility hazards and risks. See Attachment 7. Restart of an Accelerator facility or activity after a DOE-mandated shutdown because of an ASE violation requires approval of the DOE-PSO Manager.

SRC Safety Review Committee (PPPL document O-022)

Unreviewed Safety Issue (USI) and Unreviewed Safety Issue Determination (USID) A USID is performed for a Moderate Hazard Operation to document changes to an approved SAD or Project Hazard Analysis; and for a High Hazard operation to evaluate a proposed change (e.g., a new machine component, change in operating parameters, etc.) or new information to determine whether there are any impacts on the approved SAD, approved Safety Envelope (documented in the SAD), and/or approved Safety Certificate. If the Safety Envelope and/or Safety Certificate are affected, a USI exists requiring the Project Manager or Principle Investigator (PM/PI) for the operation to determine the necessary changes that need to be made to the Safety Certificate, and the ACC to present those changes to the ES&H Executive Board. The Board would then approve or disapprove the changes, and the Safety Certificate would be revised as needed. The operation then would need to make any approved changes. For Accelerators, a USI exists if there is a significant increase in the probability of or consequences from (1) a planned modification that creates a previously unanalyzed postulated accident or condition that could result in a significant adverse impact, or (2) a previously analyzed postulated accident or condition. Activities involving identified USIs for Accelerators must not commence before DOE-PSO has provided written approval. Restart of an Accelerator facility or activity after a DOE-mandated shutdown because of a USI also requires approval of the DOE-PSO Manager.

HAZARD CLASSIFICATIONS (see Lithium Safety Program document for additional guidance on classification of lithium work)**1. Low Hazard Operations**

A low hazard operation presents minor onsite and negligible offsite impacts to people or the environment. Typical low hazard operations include operation of small research devices and experiments.

2. Moderate Hazard Operations

A moderate hazard operation can present considerable potential onsite impacts to people or the environment, but at most only minor offsite impacts. Typical moderate hazard operations include operation of moderate sized research devices and experiments, and/or may involve one or more of the following:

- a. Operation of an energy storage capacitor bank.
- b. Operations where personnel safety interlocks may need to be bypassed or rendered inoperative.
- c. Operations involving confined space entry.
- d. Operations involving crane operation.

3. High Hazard Operations

A high hazard operation can present potential for serious onsite and/or offsite impacts to people or the environment. Operations are defined high hazard due to their intrinsic hazards or due to a collection of lower hazards that increase the probability of a serious accident. Typical high hazard operations or their potential effects are as follows:

- a. Large research devices and experiments with multiple sources of hazards on the scale of NSTX-Upgrade (NSTX-U) but which do not meet the definition for Accelerator.
- b. Any operation where there is a real possibility of > \$2.5 Million property loss or damage, including costs of cleaning, decontaminating, renovating, replacing, or rehabilitating property [threshold for appointing an Accident Investigation Board per DOE 225.1B].
- c. Any operation where there is a real possibility of ≥ 100 mrem effective dose equivalent to an offsite individual [ES&HD 5008, Section 10, Table 10.7].
- d. Any operation where there is a real possibility of ≥ 600 mrem effective dose equivalent to any occupational worker [ES&HD 5008, Section 10.210]

4. Nuclear Facility

In addition to the classifications in 1-3 above, a PPPL operation other than an Accelerator that will involve quantities of radionuclides must be evaluated using the criteria of DOE-STD-1027 to determine if classification as a Category 1, 2 or 3 nuclear facility is required.

5. Accelerator

An operation that meets the Accelerator definition in this procedure.

HAZARD CONTROL TECHNIQUES**1. Low Hazard Control Techniques**

Applicable safety training, on the job training, pre-job briefings and adequate management supervision are primary techniques of low hazard control. Preparation of one or more Job Hazard Analyses (JHAs) in accordance with PPPL procedure ESH-004 is required for low hazard operations.

2. Moderate Hazard Control Techniques

Pre-job briefing, training, personnel certification, written permits, written approvals, and coordination of activities are the primary control techniques.

Periodic management walk-throughs and safety inspections should be employed for moderate hazard operations.

A Project Hazard Analysis is required. A Safety Assessment Document (SAD) may be directed by the responsible Department Head or the ES&H-EB, or may be prepared at the discretion of the responsible Project Manager or Principal Investigator. These documents must be reviewed by the PPPL Safety Review Committee (SRC) and approved by the Deputy Director for Operations. See Attachments 1, 2 & 5 for topics to be addressed in project hazards analyses and SADs.

3. High Hazard Control Techniques

A safety certificate is required for all High Hazard operations. A Safety Assessment Document (SAD) shall be prepared, reviewed by the PPPL Safety Review Committee (SRC) and appointed Activity Certification Committee (ACC), and approved by the Deputy Director for Operations. See Attachments 1, 2 & 5 for topics to be addressed in SADs.

4. Nuclear Facilities Control Techniques

In addition to the applicable techniques in 1-3 above, Category 1, 2 or 3 nuclear facilities require Documented Safety Analyses (DSAs) approved by DOE (see 10 CFR 830, Subpart B).

5. Accelerator Control Techniques

DOE approval is required to commission and operate all Accelerators. A Safety Assessment Document (SAD) shall be prepared, reviewed by the PPPL Safety Review Committee (SRC) and appointed Activity Certification Committee (ACC), and approved by the Deputy Director for Operations. See Attachments 1, 2 & 5 for topics to be addressed in SADs.

In addition, Accelerators require an approved Accelerator Safety Envelope (ASE) (see Attachment 7), an Unreviewed Safety Issue (USI) process that supports configuration management efforts to help assure facility and supporting safety documentation are current and periodically updated, an Accelerator Readiness Review (ARR) program that ensures facilities are adequately prepared for safe commissioning and/or operations (see Attachment 8), and clearly defined roles and responsibilities for Accelerator activities including those for training and procedures.

DOE-PSO Manager approvals are required for the ASE, start of commissioning activities after assuring that an appropriate ARR has been conducted, start of routine operations, restart of an Accelerator facility or activity after a DOE-mandated shutdown because of a USI or ASE violation, activities that justify a USI, decommissioning activities, and exemption/equivalency requests in accordance with DOE O 420.2C. In addition, DOE Program Secretarial Officer approval is required for ASEs for Accelerator facilities where site boundary consequences for credible postulated accident scenarios potentially exceed

1 rem (0.01Sv) and/or Emergency Response Planning Guide ERPG-2, and for exemption/equivalency requests in accordance with DOE O 420.2C.

SECTION A

Hazard Classification

All operations (i.e., experimental devices) at PPPL shall be classified as Low, Moderate, or High hazard operations, or where applicable, as Accelerators or Nuclear Facilities. Hazard classification shall be determined by the responsible Department Head or his/her designee, in consultation with the Principle Investigator/Project Manager, the ES&H Department Head, and with the concurrence of the Deputy Director for Operations. Use Attachment 9 to document the classification.

Responsibility

Action

Principle
Investigator/
Project Manager

1. Defines new operation for implementation at PPPL.
2. Confers with responsible Department Head or his/her designee using Attachments 2 and 5 to define operational hazards, and the hazard classifications defined in this procedure. Completes and signs Attachment 9.

Department Head,
ES&H Head,
Deputy Director
for Operations

3. Department Head consults with the ES&H Department Head, and with the concurrence of the Deputy Director for Operations, agrees on Hazard Classification. All sign Attachment 9 approving the classification. The completed Attachment 9 is provided to the PPPL Operations Center.

Project Manager
or Principle
Investigator (PM
or PI)

4. Approves the conduct of low hazard operations, and written documentation of the approval is provided by the PM or PI signing the JHA.

Department Head

5. Approves the conduct of moderate hazard operations with written documentation of the approval.
6. For High Hazard operations, Accelerators and nuclear facilities, requests the ES&H/EB to appoint an Activity Certification Committee (ACC).

ES&H/EB
Chairperson

7. Appoints an ACC to review the proposed High Hazard operation, Accelerator or nuclear facility to support issuance by the ES&H/EB of a safety certificate for a High Hazard operation, and to support DOE approvals for nuclear facilities and Accelerators. See Sections B and C of this Procedure. The appointment must be documented, include the specific charge to the Committee, and designate (at least)

the chairperson for the ACC. A list of members will be maintained on the ES&H Executive Board.

SECTION B

High Hazard Operations (including Safety Certificate)

(Nuclear facilities and Accelerators require separate approvals by DOE to commence operations. See 10CFR830, Subpart B for nuclear facilities, and Section C for Accelerators)

<u>Responsibility</u>	<u>Action</u>
------------------------------	----------------------

ES&H/EB
Chairperson

1. In consultation with the responsible Department Head and the Head of ES&H, appoints an Activity Certification Committee (ACC) to arrange for reviews of all supporting analyses and documentation required for a safety certificate. The ACC consists of at least two (2) members who are not part of the operation's line organization and have knowledge and experience commensurate with performing the necessary reviews, and may include external members. The ACC will remain intact for the duration of the High Hazard operation or until dissolved by the ES&H/EB. DOE employees may be asked to serve on the ACC as ex officio members.
2. The ES&H/EB chairperson may solicit help from a non-PPPL source to assist or serve on the ACC.

Project Manager
(PM), Principle
Investigator (PI),
or designee

3. Prepares all required information to support the granting of a Safety Certificate, including any proposed constraints to ensure safe operations. This must include a conduct of operations implementation procedure, including a matrix of the requirements in DOE O 422.1 (see ENG-055).
4. Arranges for all required supporting analyses and documentation for the Safety Certificate, and provides them to the ACC, allowing for appropriate lead time.
5. Responds to all action items and requests for further information by the ACC.
6. Information provided by the PM, PI or designee to the ACC to support their review for issuance of a Safety Certificate should include, but not necessarily be limited to:
 - a. Safety Assessment Document (SAD).
 - b. Preoperational test plans, and any necessary emergency response plans.
 - c. Operating procedures relevant to the safe conduct of operations, including the conduct of operations implementation procedure (per ENG-055).

d. Certification of Qualified Operators. When the circumstances of the activity warrant medical and/or technical certification of operating personnel, the specific certification requirements shall be submitted. This submission shall document the medical, training, and/or experience requirements.

e. Other information deemed relevant by the ACC.

ACC

7. Performs review of information provided by PM, PI or designee, and physical inspections and walk-downs of appropriate sub-systems.
8. Maintains a core group of subject matter experts specific to the technical requirements of the ACC. Calls on appropriate personnel external to the ACC (e.g., Safety Division, Site Protection Division, etc.) to participate in the safety review process conducted by the ACC, and to provide assistance as required to support issuance of a Safety Certificate.
9. Replaces ACC membership as appropriate to maintain core competency within the committee, based on ACC Chairperson recommendation and ES&H/EB Chairperson approval.
10. Consults, as required, with PM/PI/designee, DOE and the Environment, Safety, & Health Department on safety and environmental matters pertaining to the High Hazard operation under its review.
11. Conducts safety reviews supporting issuance of Safety Certificates.

PM, PI, or
designee

12. Meets with the ACC Chairperson to determine if one or more Management Safety Walkthroughs (MSWs) should be performed of the planned operation to help verify readiness when the High Hazard Operation is ready to commence. These MSWs, including correction of any deficiencies deemed important to operational readiness, must be completed prior to issuance of a Safety Certificate by the ES&H/EB.

ACC

13. Recommends to the ES&H/EB issuance or denial of Safety Certificates along with any necessary special conditions or constraints on which the issuance of Safety Certificates should be based.

ES&H/EB

14. Based on the ACC recommendations, the results of the MSWs and completion of corrective actions for any deficiencies that are necessary to operational readiness, and other factors deemed relevant by the ES&H/EB, the Board will decide on issuance of the Safety Certificate. The Safety Certificate Form (see Attachment 6) should be completed by the PM or PI and approved by the ES&H/EB Chairperson.

PM, PI, or
designee

15. Retains the original approved Safety Certificate. Posts a copy of the Certificate prominently in a location visible to the operations personnel for the High Hazard operation. Operates within the stated constraints of the Certificate.
16. Take necessary action to close out a Safety Certificate upon completion of the operations for which it was issued. Retains the original approved Safety Certificate. Posts a copy of the Certificate prominently in a location visible to the operations personnel for the High Hazard operation. Operates within the stated constraints of the Certificate.
17. Upon completion of the operation or activity covered by a Safety Certificate, the PM, PI or designee shall remove the posted copy of the Safety Certificate and indicate and initial the date of activity completion on the original Safety Certificate. The original Safety Certificate should be retained by the PM, PI or designee. Copies of the closed out Safety Certificate should be sent to the ES&H/EB Chairperson and the Head of the ES&H Department.

SECTION C

Accelerators

DOE approvals are required as indicated below. Guidance to help implement the steps in Section C of this procedure can be found in DOE G 420.2-1A Chapter 2.

The ES&H Department will maintain a current listing/inventory of PPPL Accelerators approved by DOE for commissioning and/or routine operations, and exemptions and equivalencies granted by DOE in accordance with DOE O 420.2C. This listing/inventory will include the name of the facility, its operational status, the date of the current SAD, the approval of the ASE if applicable, date of exemption approval if applicable, and the programmatic sponsor.

Responsibility

Action

ES&H/EB
Chairperson

1. Appoints an Activity Certification Committee (ACC) to arrange for reviews of all supporting analyses and documentation required for obtaining DOE approval for commissioning and routine operations. See Section B Step 1 for additional details.

Project/PPPL
Management

2. Prepares all required information to support obtaining DOE approval for commissioning and routine operations, including any proposed constraints to ensure safe operations. This must include:
 - a. The Safety Assessment Document (SAD)
 - b. The Accelerator Safety Envelope (ASE)
 - c. A conduct of operations implementation procedure, including a matrix of the requirements in DOE O 422.1 (see ENG-055)

- d. Clearly defined roles and responsibilities for Accelerator activities, including those for training and procedures (see DOE G 420.2-1A Sections 2.4 and 2.5 for guidance)
- e. Preoperational test plans, and any necessary emergency response plans
- f. Operating and other procedures for safe operations (See DOE G 420.2-1A Section 2.4 for guidance)
- g. Training program for safe operations (see DOE G 420.2-1A Section 2.5 for guidance)
- h. Other information deemed relevant by the ACC.

ACC

- 3. Performs review of information provided by project management, and physical inspections and walk-downs of appropriate sub-systems (see Section B Steps 7-11). The ACC review should be guided by the need to prepare for and facilitate an effective Accelerator Readiness Review (ARR), using the guidance of Attachment 8 and DOE G 420.2-1A Section 2.10.

Project/PPPL
Management

- 4. Communicates with DOE-PSO to reach agreement on the path forward for conducting an Accelerator Readiness Review (ARR), in accordance with Attachment 8, to support DOE-PSO Manager approval to start commissioning activities. As part of the ARR process, the Accelerator Safety Envelope (ASE) (see Attachment 6) is reviewed by the ARR team, the ACC and the SRC, approved for PPPL by the Deputy Director for Operations, and submitted to the DOE-PSO Manager for approval. If site boundary consequences for credible postulated accident scenarios potentially exceed 1 rem (0.01Sv) and/or Emergency Response Planning Guide ERPG-2, Project Management coordinates with DOE-PSO to obtain approval of ASE from the Director of the DOE Office of Science (DOE-SC).
- 5. Upon successful completion of the ARR, requests approval from the DOE-PSO Manager to start commissioning activities.
- 6. Upon receipt of DOE-PSO Manager approval to start commissioning activities, retains the original approved ASE. Posts a copy of the DOE approved ASE prominently in a location visible to the operations personnel for the Accelerator operation. Conducts commissioning activities within the credited controls of the approved ASE.
- 7. Communicates with DOE-PSO to reach agreement on the path forward for conducting an ARR, in accordance with Attachment 8, to support DOE-PSO Manager approval to start routine operations. Any changes required to the ASE must be reviewed and approved as noted in Step 4 above. If the ARR for routine operations was part of the commissioning process, this step is not needed.

8. Upon successful completion of the ARR or commissioning activities, as appropriate, requests approval from the DOE-PSO Manager to start routine operations.
9. Upon receipt of DOE-PSO Manager approval to start routine operations, retains the original approved ASE. Posts a copy of the DOE approved ASE prominently in a location visible to the operations personnel for the Accelerator operation. Conducts operations within the credited controls of the approved ASE.
10. Activities to decommission an Accelerator must have prior approval from the DOE-PSO Manager (see DOE G 420.2-1A Chapter 4 for guidance). Upon completion of the operation or activity covered by an approved ASE, removes the posted copy of the ASE. The original ASE should be retained by the Project Manager.

SECTION D

Modifying a Project Hazard Analysis or SAD

When activities associated with an operation require a change to a Project Hazard Analysis or SAD, the change can be made either by revising and re-approving the analysis or SAD, or by processing a USID Form (see Attachments 3 and 4). A maximum of six (6) such USID Forms can be processed for a specific SAD or Project Hazard Analysis Revision #. If a seventh change is needed, the analysis or SAD must be revised and re-approved. Changes to a SAD for a high hazard operation or Accelerator may also result from application of the USID process; see Sections E & F. (Note: revisions to a DSA for a Category 1, 2 or 3 nuclear facility must follow the requirements of 10 CFR 830 Subpart B). If an operation is reclassified (e.g., from High Hazard to Accelerator), the existing SAD may be revised or a new SAD (Rev. 0) may be created for the reclassified operation.

Modifying a SAD or Project Hazard Analysis

<u>Responsibility</u>	<u>Action</u>
Project Manager (PM), Principle Investigator (PI), or designee	1. Submits proposed changes to the SAD or Project Hazard Analysis to the USID Evaluator (Head, ES&H) using a USID Form (Attachment 3).
USID Evaluator	2. Completes the USID Form. If no USI is involved (High Hazard operation or Accelerator only; see also Sections E & F), submits Form and document changes to the SRC Chairperson for review.
SRC Chairperson or full SRC	3. Reviews changes to the SAD or Project Hazard Analysis. After approval, signs USID Form and sends to PM, PI or designee for Project Hazard Analysis (copy USID Evaluator), or to Deputy Director for Operations for SAD.

- | | |
|-----------------------------------|--|
| Deputy Director
for Operations | 4. Approves changes to the SAD, signs USID Form and sends it to the PM, PI or designee (copy to USID Evaluator). |
| PM, PI, or
designee | 5. Informs all affected workers of the changes covered by the USID Form and SAD/Project Hazard Analysis revision. Determination of these affected workers is done by the PM, PI or designee in consultation with the USID Coordinator. |
| | 6. Files approved SADs, Project Hazard Analysis and USID Forms in Project files or Departmental files. |

SECTION E

Unreviewed Safety Issue Determinations (USIDs) – High Hazard Operation Only (Non-Accelerators)

A USID is performed for a High Hazard operation to evaluate a proposed change (e.g., a new machine component, change in operating parameters, etc.) or new information to determine whether there are any impacts on the approved SAD, approved Safety Envelope, and/or approved Safety Certificate. If the Safety Envelope and/or Safety Certificate are affected, a USI exists and the Project Manager or Principle Investigator (PM/PI) for the operation, or their designee (e.g., Associate Project Manager, Operations Manager, etc.) would determine the necessary changes that need to be made to the Safety Certificate, and the ACC would present those changes to the ES&H Executive Board. The Board would then approve or disapprove the changes, and the Safety Certificate would be revised as needed. The approved changes could then be made to the High Hazard operation.

<u>Responsibility</u>	<u>Action</u>
------------------------------	----------------------

- | | |
|--------------------------------|---|
| PM, PI or designee | 1. Reviews proposed changes to an existing High Hazard operation using an ECN, the Work Planning System, Technical Procedure Modification (MPC or T-Mod), Design or Peer Review, or other means for any potential Unreviewed Safety Issues (USI's) or changes to the SAD. If a potential USI or SAD change exists, fills out a USID-Non Accelerator form, Attachment 3, and submits it to the USID Evaluator (Head, ES&H) to complete the USID. |
| USID Evaluator
(Head, ES&H) | 2. Completes the USID Form. If Evaluator determines that no USI is involved, follows process in Section D, "Modifying a Project Hazard Analysis or SAD". If USI exists, also informs PM or PI and provides USID Form to ACC Chairperson to start process for modifying the Safety Envelope and Safety Certificate. |
| PM, PI or designee | 3. Works with the ACC to modify the Safety Certificate and request approval from the ES&H/EB, following the steps outlined in Section B for the initial Safety Certificate. |

- | | |
|--------------------|--|
| ACC | 4. Presents the changes to the Safety Certificate to the ES&H Executive Board. |
| ES&H/EB | 5. Approves or disapproves the changes to the Safety Certificate. |
| PM, PI or designee | 6. Implements approved changes to the High Hazard Operation. Informs all affected workers of the changes covered by the USID Form, including revisions to the SAD and Safety Certificate. Determination of these affected workers is done by the PM, PI or designee in consultation with the USID Coordinator. |

SECTION F

Unreviewed Safety Issue Determinations (USIDs) –Accelerators

The USI process is used to determine whether planned Accelerator operations or modifications will introduce significant safety consequences beyond those addressed in the facility's SAD or ASE. The USI process addresses modifications to documentation, systems, or components, and the Accelerator facility, including new activities. Configuration management is to be used as a tool to flow significant changes in documentation, systems, or components to initiate the USI process whenever those changes impact on Accelerator safety requirements. The USI process focuses primarily on preventing a change from significantly affecting safety of the Accelerator facility, and if necessary, the USI process should be used to support a discovery or an "as-found condition" that impacts on safety. If a discovery is confirmed to exist and is determined to represent a significant increase in the probability of or consequences from an accident or condition, then PPPL must communicate the concern to DOE-PSO. PPPL and DOE-PSO would work together to consider whether interim actions are required, including Accelerator facility shutdown until the safety issue is resolved. If Accelerator operations can go forward with alternate protection providing equivalent safety, as agreed upon by the DOE-PSO, then PPPL Accelerator management would document the alternate protection.

Accelerator management should develop a risk-matrix table for decision making to help define "significant increase in the probability or consequence of an analyzed or unanalyzed event" for use in the USI process.

See DOE G 420.2-1A Section 2.6 for additional guidance

Responsibility

Action

- | | |
|---|---|
| Project Manager
(PM)/Accelerator
Management | 1. Working with the USID Evaluator, reviews proposed changes to, or discovered event or condition of an existing Accelerator operation using an ECN, the Work Planning System, Technical Procedure Modification (MPC or T-Mod), Design or Peer Review, or other means for any potential Unreviewed Safety Issues (USI's), changes to the ASE, or changes to the SAD. If a potential USI, ASE change, or SAD change exists, fills out (or directs the filling out of) a USID-Accelerator form, Attachment 4, and submits it to the USID Evaluator (Head, ES&H) to complete the USID. |
|---|---|

- USID Evaluator (Head, ES&H) 2. Completes the USID Form. If Evaluator determines that no USI is involved, follows process in Section D, "Modifying a Project Hazard Analysis or SAD". If USI exists, informs ,PM, SRC Chairperson, ACC Chairperson, Deputy Director for Operations, and DOE-PSO Manager, and provides USID Form to ACC Chairperson to start process for modifying the ASE.
- Project Manager (PM)/Accelerator Management 3. Prevents implementation of changes associated with a positive USI determination, and stops operations relevant to a discovered event or condition that results in a positive USI determination until DOE-PSO Manager approval is received for change implementation, resumption of operations, or interim actions. Works with the ACC to modify the SAD and ASE, and to request approval of the ASE from the DOE-PSO Manager.
4. Implements approved changes to the Accelerator Operation within the credited controls of the approved ASE. Informs all affected workers of the changes covered by the USID Form, including revisions to the SAD and ASE. Determination of these affected workers is done by the PM or designee in consultation with the USID Coordinator.

TRAINING (SECTION REQUIRED FOR ALL PROCEDURES)

- Head, ES&H Department 1. Target Audience: Project Managers, Principle Investigators, Department Heads, designated Project staff
Instructor: Head, ES&H Department
Training Method:
X Read only
X Email distribution only
- Frequency:
X Once only
X Other: When changes are made to this procedure

RECORDS REQUIREMENTS SPECIFIC TO THIS PROCEDURE

Records Custodians must assure records are maintained as follows:

Record	Record Custodian	Location	Retention Time
Safety Certificate	PM/PI	Operations Center	Review annually. Cutoff when superseded, obsolete, or cancelled. Destroy 25 years after cutoff. PENDING - DO NOT DESTROY Hold indefinitely – DOE <i>Reference: Environmental Records (1.b.4.b)</i>
Safety Assessment Document	PM/PI	Operations Center	
Documented Safety Analysis (nuclear facilities)	PM/PI	Operations Center	
USID Form	PM/PI	Operations Center	

Accelerator Safety Envelope (ASE)	PM/PI	Operations Center	Review annually. Cutoff when superseded, obsolete, or cancelled. Destroy 25 years after cutoff. PENDING - DO NOT DESTROY Hold indefinitely – DOE <i>Reference: Environmental Records (1.b.4.b)</i>
Operation Hazard Classification Form	PM/PI	Operations Center	

ATTACHMENTS

Attachment 1 Hazard Analysis

Attachment 2 Suggested Elements for Project Hazard Analysis and SAD

Attachment 3 Unreviewed Safety Issue Determination (USID) Form – Non-Accelerator

Attachment 4 Unreviewed Safety Issue Determination (USID) Form – Accelerator

Attachment 5 SAD and Project Hazard Analysis Review Checklist

Attachment 6 Safety Certificate Form – Typical

Attachment 7 Accelerator Safety Envelope (ASE)

Attachment 8 Accelerator Readiness Review (ARR)

Attachment 9 Operation Hazard Classification Form

PPPL	Princeton Plasma Physics Laboratory	PROCEDURE	ESH-025 Rev 2 page 1 of 1
HAZARD ANALYSIS			Attachment 1

HAZARD ANALYSIS

The following topics must be addressed in Project Hazard Analyses and Safety Assessment Documents (SADs):

1. An overview of the operation (project or experimental device), including mission, goals, and/or objectives.
2. Descriptions of structures, systems and components relevant to the operation, with emphasis on environment, safety and health (ES&H) features.
3. Identification of hazards associated with the operation and methods employed for their mitigation. Suggested elements for consideration in the hazards analyses is provided in Attachment 2, and a Review Checklist to assist line management in determining the potential hazards encountered for an operation is found in Attachment 5.
4. Discussion of the Safety Envelope for SADs associated with High Hazard operations,
5. Description of how operations will be conducted, with emphasis on ES&H features.

The depth of the discussions of these topics should be commensurate with the hazard level and the severity of the specific hazards associated with the operation. Additional topics may also be addressed.

Attachment 5 provides some suggested analytical elements that can be used in performing a Project Hazard Analysis or SAD. The ES&H Department can be consulted for additional guidance.

SADs for Accelerators must:

- a. identify hazards and associated onsite and offsite impacts to workers, the public, and the environment from the facility for both normal operations and credible accidents;
- b. contain sufficient descriptive information and analytical results pertaining to specific hazards and risks identified during the safety analysis process to provide an understanding of risks presented by the proposed operations;
- c. provide detailed descriptions of engineered controls (e.g., interlocks and physical barriers) and administrative measures (e.g., training) taken to eliminate, control, or mitigate hazards from operation; and
- d. include or reference a description of facility function, location, and management organization in addition to details of major facility components and their operation.

See DOE G 420.2-1A Section 2.2 for additional guidance.

PPPL	Princeton Plasma Physics Laboratory	PROCEDURE	ESH-025 Rev 2 page 1 of 1
SUGGESTED ELEMENTS FOR PROJECT HAZARD ANALYSIS & SAD			Attachment 2

1. **Energy and Hazardous Material Analysis** - the process of identifying the types of energy, (kinetic, potential, electrical, radiation, etc.) or hazardous material, their sources and potential target(s) should an unwanted transfer of energy or hazardous material occur.
2. **Barrier Analysis** - the process of identifying the types and location of barriers present to control the source of energy or hazardous material, e.g., on the source, on the target, between the two, or separation of source and target by time and space.
3. **Protective Devices Analysis** – the process of determining the adequacy of protective devices, e.g., personal equipment, interlocks, etc.
4. **Failure Mode and Effects Analysis (FMEA)** - a FMEA is a detailed analysis of the failure modes in and the effects of those failures on components, subsystems, systems, etc., ultimately to determine the effects on the level of safety present in the system.
5. **Event Tree Analysis (ETA)** - an ETA is a logic block diagram for systematically determining, through event identification, the effects on the safety of the project and systems.
6. **Fault Tree Analysis (FTA)** - an FTA is a logic block diagram for systematically determining, through fault identification, the probability of failures in components and systems and the safety effects.
7. **Component Hazard Analysis** - an analysis and study to determine the effects of failures on safety at the component level.
8. **Subsystem Hazard Analysis** - a detailed study of a particular subsystem (a system that together with other systems, make up a larger, more complex system) to determine the effects on safety should that subsystem fail or malfunction.
9. **System Hazard Analysis** - a detailed study of an entire system, or project, to detect the effects of failures on safety of the overall system or any of its subsystems.
10. **Support of Operations Hazard Analysis** - a projected analysis to identify hazards associated with the operating and support functions of a system.
11. **Inspection and Maintenance Hazard Analysis** - the process of identifying hazards resulting from maintenance actions and to determine the adequacy of the inspection requirements.
12. **Sneak Circuit Analysis** - a study of electrical or electronic circuitry and their components to assure that they are completely isolated from other circuits and cannot activate unwanted states in associated circuits and/or other components.
13. **Human Factors Analysis** - an analysis of that part of the machine that interfaces with people to determine if the machine is suitably/safely designed for the people who will operate it.

PPPL	Princeton Plasma Physics Laboratory	PROCEDURE	ESH-025 Rev 2
			page 1 of 2
Unreviewed Safety Issue Determination (USID) Form: Non-Accelerator			Attachment 3

USID Evaluation No. _____

Description of Proposed Change (including new information):

- Does this change require a revision to an approved SAD or Project Hazard Analysis? If Yes, provide specific changes (attach markup if needed), and indicate Title of SAD or Project Hazard Analysis, Document Revision #, and Change #.

YES [] NO []

Explanation

- Are previously documented hazard consequences changed in likelihood or severity?

YES [] NO []

Explanation

- Are new hazards or new hazard consequences involved?

YES [] NO []

Explanation

- Does this change require a revision to an approved Safety Envelope and/or Safety Certificate? If Yes, a USI exists and the ACC must evaluate the change and present the proposed revision to the ES&H Executive Board for approval. Board approval of the revised Safety Certificate is required prior to operating with the proposed change.

YES [] NO []

Explanation

PPPL	Princeton Plasma Physics Laboratory	PROCEDURE	ESH-025 Rev 2 page 2 of 2
Unreviewed Safety Issue Determination (USID) Form: Non-Accelerator			Attachment 3

Reviews and Approvals

Project Manager/Principle Investigator (PM/PI) or Designee_____

USID Evaluator (Head ES&H)_____

SRC Chairperson (SAD/Project Hazard Analysis Changes)_____

Deputy Director for Operations (SAD changes)_____

ACC Chairperson (USIs only)_____

ES&H Executive Board Chairperson (USIs only)_____

A maximum of six (6) USID Forms may be approved for a specific SAD or Project Hazard Analysis Revision # before the document must be revised. PM's/PI's or their designees must inform all affected workers of the changes covered on an approved USID Form

USID Evaluation No. _____

Description of Proposed Change, or Discovered Event or Condition

1. Does this proposed change or discovery require changes to an approved SAD? If Yes, provide specific changes (attach markup if needed), and indicate Title of SAD, Document Revision #, and Change #.

YES [] NO []

Explanation

2. Does the proposed change or discovery affect any of the requirements in the Accelerator Safety Envelope (ASE)? If so, provide specific changes (attach markup if needed).

YES [] NO []

Explanation

3. Could the proposed change or discovery significantly increase the probability of or consequences from an accident or condition previously evaluated in the SAD?

YES [] NO []

Explanation

4. Could the proposed change or discovery create a previously unanalyzed accident or condition that may result in a significant adverse impact?

YES [] NO []

Explanation

5. Is DOE-PSO Manager approval required*?

YES [] NO []

***Accelerator USI Determination:** A USI is determined to exist if the answer to any of questions 2-4 above is "Yes". If the answers to questions 2-4 is "No", then no USI exists. A positive USI determination requires DOE-PSO Manager approval to: (a) implement the proposed change; (b) continue operating the Accelerator after the discovered event or condition. DOE-PSO Manager approval is also required for changes to the ASE.

PPPL	Princeton Plasma Physics Laboratory	PROCEDURE	ESH-025 Rev 2 page 2 of 2
Unreviewed Safety Issue Determination (USID) Form: Accelerator			Attachment 4

Reviews and Approvals

Project Manager/Principle Investigator (PM/PI) or Designee_____

USID Evaluator (Head ES&H)_____

SRC Chairperson (SAD Changes)_____

ACC Chairperson (SAD Changes and USIs)_____

Deputy Director for Operations (SAD changes and USIs)_____

DOE-PSO Approval Required for Proposed Change or Continued Operation? Yes ☐ No ☐

DOE-PSO Approval Received (Date or N/A) _____

***A maximum of six (6) USID Forms may be approved for a specific SAD Revision # before the document must be revised.
PM's/PI's or their designees must inform all affected workers of the changes covered on an approved USID Form***

**SAD AND PROJECT HAZARD ANALYSIS REVIEW
CHECKLIST**
Attachment 5

Potential Project Hazards				
A. Personnel Exposures				
Chemical				
Radio Frequency or Microwave (Radiation)				
Magnetic (5G, 30G, 1T)				
Radiation				
Nanoparticles				
Beryllium				
Asbestos				
Cryogenic				
Fire/Smoke				
Electrical (Arc/Flash, Shock, etc.)				
Heat/Cold				
Noise				
Pathogens				
Compressed Gas/Air				
Laser				
Dusts/Fumes/Aerosols				
Flash (e.g. Welding)				
B. Equipment Failures				
Explosion				
Electrical				
Flooding				
Hazardous Energy Release				
Hazardous Leaks				
Fire				
Collapse				
Uncontrolled Operation				
Crane Operations				
C. Environmental Exposures (Air/Water/Ground)				
Radiation				
Chemical				
Nanoparticles				
Water Release				
Pathogens				
Waste Management				

**SAD AND PROJECT HAZARD ANALYSIS REVIEW
CHECKLIST**
Attachment 5

Potential Project Hazards				
Chemical				
Pathogen				
Radiological				
Solid				
Liquid				
Other Hazards				
D. Infrastructure Damages				
Fire				
Flooding				
Collapse				
Weakening				
Containment Breach				
E. Operations Conditions				
Special PPE requirements				
Heat Exposure				
Noise				
Cold Exposure				
Vibrations				
Confined Space				
Outdoor Operation				
Mobile Equipment				
Combustible Liquids				
Fall Exposure				
Pressure System				
Vacuum System				
Physical Exertion				
F. Nuclear Operations	Special Conditions defined in DOE-STD-1027			
G. Other				

**Safety Certificate****LOCATION** (Site, Area, Bldg., Room, etc.):**ACTIVITY** (Brief Description):**CONDITIONS/LIMITATIONS:****PROJECT MANAGER OR PRINCIPLE INVESTIGATOR:****APPROVED BY** (ES&H/EB Chairperson):**ACTIVITY COMPLETED** (Dated and Signed by Project Manager or Principle Investigator):

PPPL	Princeton Plasma Physics Laboratory	PROCEDURE	ESH-025 Rev 2 page 1 of 1
Accelerator Safety Envelope (ASE)			Attachment 7

The requirements of an Accelerator Safety Envelope (ASE) are as follows (per DOE O 420.2C):

- a. A documented ASE must define the physical and administrative bounding conditions and controls for safe operations based on the safety analysis documented in the Safety Assessment Document (SAD).
- b. The ASE must be submitted to DOE Princeton Site Office (PSO) for approval and may be submitted as a separate document from the SAD.
- c. An activity expected to exceed the bounding conditions of the ASE requires DOE-PSO approval. Any activity violating the ASE must be terminated immediately and be put in a safe and stable configuration. Any activity that was shut down by DOE must not recommence until DOE approves the activity.

Strict adherence to the approved bounding conditions of the ASE is expected during all commissioning and operations activities. It may be advisable to establish an “Accelerator operations envelope” (AOE) with limits more conservative than those addressed in the ASE as an aid to assure that the ASE is not exceeded. Other limitations, controls, and restrictions not directly based on the SAD safety analysis also could be addressed in the AOE.

See DOE G 420.2-1A Section 2.3 for additional guidance.

PPPL	Princeton Plasma Physics Laboratory	PROCEDURE	ESH-025 Rev 2 page 1 of 1
Accelerator Readiness Review (ARR)			Attachment 8

ARRs must be performed before DOE approval for commissioning and routine operation and as directed by the DOE Princeton Site Office (PSO) Manager. As part of the ARR process, PPPL must demonstrate to the satisfaction of the DOE-PSO Manager that the following processes are in place:

- a. A Contractor Assurance System that maintains an internal assessment process;
- b. A Facility Configuration Management Program that is related to Accelerator safety; and
- c. Credited controls and appropriate administrative processes related to Accelerator safety (e.g. training, procedures, etc.).

See DOE G 420.2-1A Section 2.10 for additional guidance, including setting up an internal readiness plan/process to prepare for and facilitate an effective ARR. Other relevant sections of DOE G 420.2-1A (e.g., Section 3.4 on Configuration Management during Operations) should be consulted as well.

OPERATION HAZARD CLASSIFICATION FORM**NAME OF OPERATION:** _____**LOCATION & DESCRIPTION :** _____

Check one:

☐ **LOW HAZARD**☐ **MODERATE HAZARD**☐ **HIGH HAZARD**☐ **ACCELERATOR**☐ **NUCLEAR FACILITY****Justification (attach additional sheets as needed):** _____

Signature

Date

Principle Investigator/Project Manager _____**Responsible Department Head** _____**Head, ES&H** _____**Deputy Director for Operations** _____