


PPPL	PRINCETON PLASMA PHYSICS LABORATORY ES&H DIRECTIVES		
	ES&HD 5008 SECTION 11, CHAPTER 1 Operations Hazard Criteria		
Approved	Date: 5/21/2002	Revision 4	Page 1 of 7

1.0 INTRODUCTION

The purpose of this Manual Chapter is to classify operations (i.e., projects or experimental devices) as to their hazard level, to indicate the required control actions to be performed for each hazard level, and to specify the approval level required. This directive is responsive, in part, to DOE Order 5481.1B, "Safety Analysis and Review System".

2.0 HAZARD CLASSIFICATIONS

All operations at PPPL shall be classified as either LOW, MODERATE, OR HIGH safety hazards. Hazard classification shall be determined by line management (i.e., by the responsible Department Head or his/her designee), in consultation with the ES&H Division Head, and with the concurrence of the Deputy Director of the Laboratory. Final hazard classifications, along with all required approvals and documentation as stated in this Chapter, shall be completed before implementation of any new operation.

Nuclear operations shall also be classified in accordance with DOE-STD-1027, "Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports."

2.1 LOW HAZARD OPERATIONS

A low hazard operation presents minor onsite and negligible offsite impacts to people or the environment. Typical low hazard operations are as follows:

1. Normal shop operations, using hand and power tools.
2. Operation of small research devices and experiments.
3. Office work.

2.1.1 LOW HAZARD CONTROL TECHNIQUES

Applicable safety training, on the job training, supervisor pre-job briefings and adequate management supervision are primary techniques of low hazard control. Preparation of Job Hazard Analyses (JHAs) in accordance with PPPL procedures should be considered for low hazard operations.

2.1.2 LOW HAZARD APPROVALS

The immediate supervisor approves low hazard operations and written documentation of the approval is not required.

2.2 MODERATE HAZARD OPERATIONS

A moderate hazard operation presents considerable potential onsite impacts to people or the environment, but at most only minor offsite impacts. Typical moderate hazard operations may involve some or all of the following:

1. Operation of an energy storage capacitor bank.
2. Operations where personnel safety interlocks have been bypassed or rendered inoperative.
3. Confined Space Entry
4. Crane Operation

2.2.1 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 Head or Principal Investigator. These documents must be reviewed and approved by the PPPL Safety Review Committee (SRC). See Section 3.0 for topics to be addressed in project hazards analyses and SADs.

2.2.2 MODERATE HAZARD APPROVALS

Moderate hazard operations require written approval from the responsible Department Head.

2.3 HIGH HAZARD OPERATIONS

A high hazard operation presents major potential for serious onsite 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 which increase the probability of a serious accident. Typical high hazard operations or their potential effects are as follows:

1. NSTX Operations
2. Any operation where there is a real possibility of > \$1 Million property loss or damage, including costs of cleaning, decontaminating, renovating, replacing, or rehabilitating structures, equipment, or property [threshold for Type B Investigation per DOE 225.1A].
3. Any operation where there is a real possibility of ≥ 100 mrem effective dose equivalent to an offsite individual [ESH 5008, Section 10, Table 10.7].
4. Any operation where there is a real possibility of ≥ 600 mrem effective dose equivalent to any occupational worker [ESH 5008, Section 10.210]

2.3.1 HIGH HAZARD CONTROL TECHNIQUES

A safety certificate is required (See ES&HD 5008, Section 11, Chapter 2). Either a Safety Assessment Document (SAD) or a Safety Analysis Report (SAR), as determined by DOE, shall be prepared, reviewed and approved by the PPPL Safety Review Committee (SRC). See Section 3.0 for topics to be addressed in SARs and SADs.

2.3.2 HIGH HAZARD APPROVALS

Once an operation has been classified as a high hazard, a safety certificate authorizing commencement of operations shall be issued by the ES&H-EB after review and documentation per ES&HD 5008, Section 11, Chapter 2. If specified by DOE, DOE approval shall also be required.

3.0 HAZARD ANALYSIS

The following topics must be addressed in project hazard analyses, Safety Assessment Documents (SADs) and Safety Analysis Reports (SARs):

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.
4. 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.

Appendix 2 provides some suggested analytical elements that can be used in performing a project hazard analysis, SAD or SAR. The ES&H Division can be consulted for additional guidance. High hazard operations should perform failure modes and effects analyses (FMEAs) and include them in their SADs or SARs.

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 SAD/Project Hazard Analysis Change Approval Form (see Appendix 3). Up to six (6) such Change Approval 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. The SRC Chairperson will determine whether a Change Approval Form requires review by the full SRC or others (e.g., the Activity Certification Committee for a high hazard operation). The Responsible Line Manager (RLM) or Accountable Technical Individual (ATI) signing a Change Approval Form must inform all affected workers of the changes covered by the Form or SAD/Analysis revision. The RLM (e.g., Department Head) should file approved Change Approval Forms with the SAD or Project Hazard Analysis to which they apply.

4.0 DEFINITIONS

4.1 OPERATIONS - At PPPL, operations as defined here are generally synonymous with projects or experimental devices. Operations do not include activities that involve hazards that are routinely encountered and accepted in the course of everyday living by the vast majority of the

general public (e.g., machine shops which do not handle hazardous materials, cars for personal transportation).

4.2 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.

4.3 PROJECT HAZARD ANALYSIS – A brief summary of an operation, including identification of hazards associated with the operation, and design features and administrative controls to mitigate these.

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

4.5 SAFETY ANALYSIS - A documented process (via SAD or SAR) to systematically identify the hazards of a PPPL operation, to describe and analyze the adequacy of the measures taken to eliminate, control or mitigate identified hazards, and to analyze and evaluate potential accidents and their associated risks.

4.6 SAFETY ANALYSIS REPORT (SAR) - A SAR is an extensive documentation process in which potential hazards associated with facility operations are: identified, analyzed to determine and quantify consequences; associated with a specific level of risk; and minimized through the choice of appropriate methods of detection and control. The topics to be addressed are discussed in Section 3.0 (except SARs for nuclear facilities which must follow DOE Order 5480.23). The SAR shall be reviewed and approved by the PPPL Safety Review Committee (SRC) per PPPL document O-022. The SAR may also have to be presented to DOE for review and approval, particularly if a nuclear facility is involved.

4.7 SAFETY ASSESSMENT DOCUMENT (SAD) - This document presents the safety assessment of a High Hazard operation (and may be used for other hazard level operations if deemed desirable). 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 document content and format should follow the requirements of DOE Order 5481.1B, Chapter II, Section 4. The SAR shall be reviewed and approved by the PPPL Safety Review Committee (SRC) per PPPL document O-022.

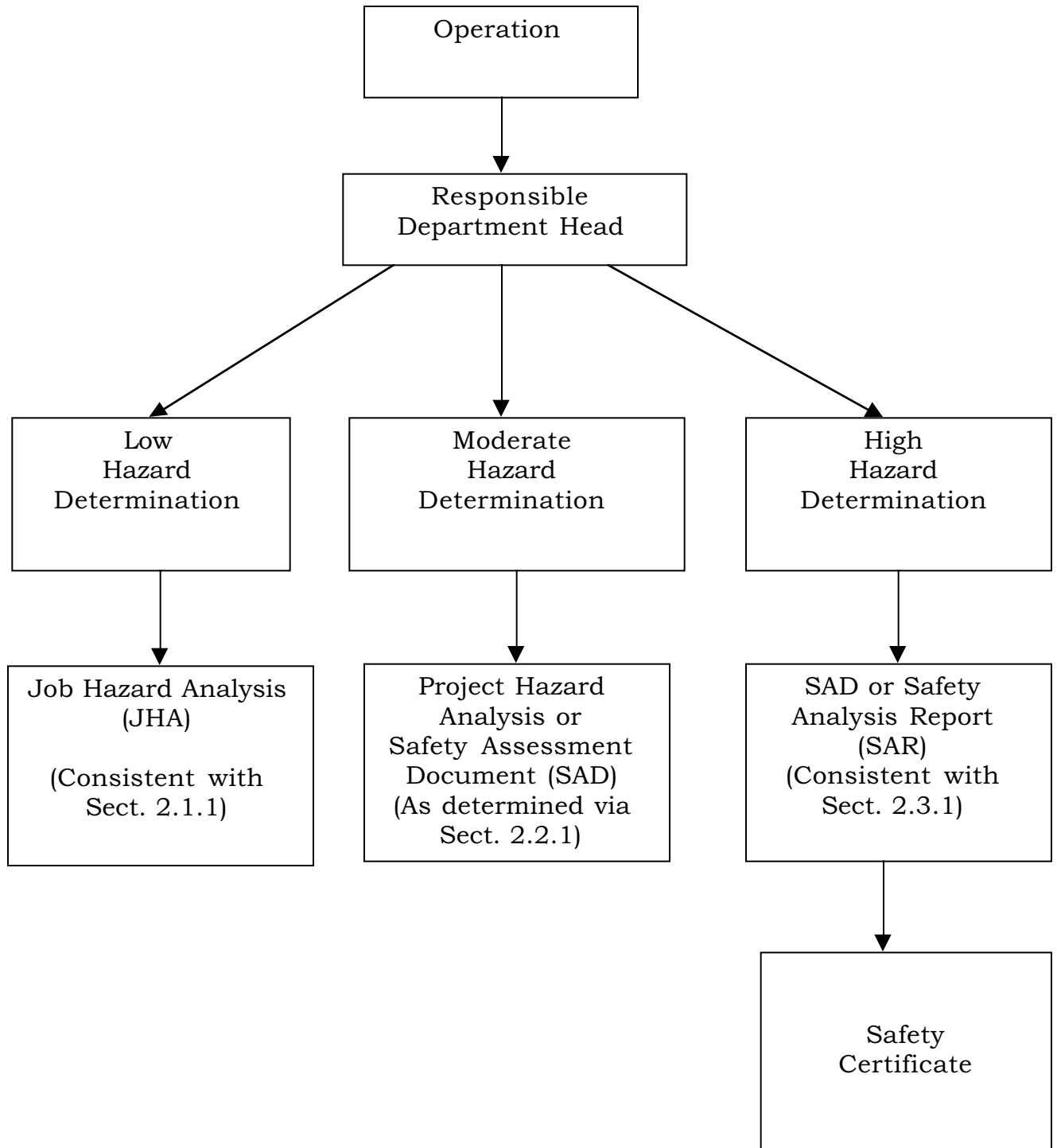
4.8 SAFETY CERTIFICATION - This is a document that authorizes start-up and/or continuing operation of a high hazard operation, and is issued by the ES&H/EB after review and documentation per ES&HD 5008, Section 11, Chapter 2.

5.0 REFERENCES

PPPL Document O-022	Safety Review Committee Charter
DOE Order 225.1A	Accident Investigations
DOE Order 5480.23	Nuclear Safety Analysis Reports
DOE Order 5481.1B	Safety Analysis and Review System
DOE-STD-1027	Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports

APPENDIX-1

FLOW CHART FOR HAZARD DETERMINATIONS AND DOCUMENTATION



APPENDIX-2

SUGGESTED ELEMENTS FOR PROJECT HAZARD ANALYSIS, SAD AND SAR

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.

APPENDIX-3
SAD/PROJECT HAZARD ANALYSIS CHANGE APPROVAL FORM

Title of SAD or Project Hazard Analysis _____

Revision # _____

Change # _____

Description of Change (attach marked-up SAD/Project Hazard Analysis pages):

1. Are previously documented hazard consequences changed in likelihood or severity?

YES [] NO []

Explanation

2. Are new hazards or new hazard consequences involved?

YES [] NO []

Explanation

3. Does this change require a revision to an approved Safety Certificate?

YES [] NO []

Explanation

Review and Approval

Accountable Technical Individual (ATI) _____

Responsible Line Manager (RLM) _____

Safety Review Committee Chairperson _____

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