

MINOR CHANGE REQUEST FORM

MCR NO. **MCR-ENG-030,R7-003**

(e.g., MCR-ENG-021,R0-001)

The Minor Change Request (MCR) Form is to be used to process Minor, or in some necessary cases, Urgent or Temporary changes to PPPL Lab-wide documents). The MCR should be used when changes are:

- 1) **minor** and do not warrant further SME review;
- 2) **urgent** and cannot wait the 2-4 week period for further SME review; or
- 3) **temporary**, to revert to original state by a given expiration date (must be within 6 months).

For questions about definitions of “minor,” “urgent,” and “temporary” changes, please review Lab-wide Procedure GEN-001, **Development, Review, and Approval of Lab-wide Documents**.

Person Requesting Change: Mark Cropper

Phone Ext: 3600

Department Name: Engineering

Document Number: ENG-030

Revision No.: 7

Document Title: PPPL Technical Procedures

Reason for change:

Documents referenced on the procedure cover sheet have changed or no longer exist.

Change description: (Summarize and attach changed pages, with changes clearly indicated)

Remove “Master Equip. List Mod (MC-002/MC-003)”

Change “RWP (HP-OP-20)” to “RWP (HP-OP-12)”

Change “Lift Procedure (ENG-021)” to “Lift Procedure (ES-MECH-007)”

1. Does this change significantly alter the intent or scope of the document? YES: NO: X

2. Does this change significantly impact ES&H? YES: NO: X

If 1 or 2 is YES, explain why the changes should not be submitted as a revision:

3. Place a check mark next to the appropriate type of change request:

- Minor change? X
- Urgent change? (revision must follow within 2 weeks)
- Temporary change?

If “temporary change” is checked, provide expiration date, allowing document to revert to original state (must be within 6 months):

Management System Owner/Designee Approval

Date

Head, PPRM/designee

Date

Release/Effective date of this MCR: 3/12/19

PPPL	PRINCETON PLASMA PHYSICS LABORATORY	PROCEDURE	No. ENG-030 Rev 7 page 1 of 20
Subject: PPPL Technical Procedures	Effective Date: 8/20/18	Initiated by: Engineering Department Head	
	Supersedes: Revision 6, dated January 31, 2018	Approved: Director	

MCR-ENG-030,R7-003

Management System (Primary): 03.00 Engineering
Management System Owner: Head, Engineering
Management Process: 03.07 Conduct of Operations
Process Owner: Head, Engineering
Sub-Process: 03.07.13 Operations Procedures
Sub-Process Owner: Head, Engineering
Subject Matter Expert (SME): Head, Heating Group; Head, Power Systems Group; Head, Fabrication Group

1. Applicability

This procedure applies the graded approach defined in the PPPL Quality Assurance Program Description, including the definition of required approval authorities for Technical Procedures. Technical Procedures are required for A-1 and A-2 work, they are optional for A-3 work. Technical Procedures are needed for A-3 work when any of the following applies:

- Requires use of calibrated equipment.
- Includes electrical access, installation or repair, unless covered by a work order that is reviewed by the Electrical Safety Specialist. Minor electrical maintenance and repair are exempt.
- Requires a D-site work permit, unless the work, e.g. non-invasive inspections, is listed as not requiring a technical procedure in OP-AD-09.
- Requires a complex Lock-Out Tag-Out.

2. Introduction

This procedure specifies the requirements for creation, revision, approval, and implementation of technical procedures. Procedures approved prior to the effective date of this procedure may continue to be used; major and minor revisions of such procedures should be done according to this procedure. Technical Procedures must comply with Laboratory-wide Policies, Procedures, and Manuals, applicable Safety Assessments and Safety Analyses, and governing project or site-specific policies and procedures. Procedures are used in conjunction with a Job Hazard Analysis form per ESH-004.

Authors of technical procedures need to consider the intended audience, the level of complexity, the sustainability of knowledge, and the quality of technical procedures and their implementation. Care must be taken to write, review, approve, and implement procedures that are in compliance with the Safety Manual (ESHD-5008) and other lab policies and procedures. Strong and declarative statements for procedure steps, drawing references, sketches, definitive ranges for acceptable outcomes, diagrams, photos, and cautionary notes should be employed to clearly identify, describe, and execute procedures. To ensure the quality of the implementation and

documentation, it is strongly recommended that the procedure include sign offs on procedure steps, hold points, and at the conclusion of the procedure.

Note: Any procedure or change to a procedure associated with a High Hazard Operation or Accelerator that impacts or potentially impacts an approved Safety Assessment Document (SAD), Safety Certificate (High Hazard Operation), or Accelerator Safety Envelope (ASE for an Accelerator) must be evaluated by the Unreviewed Safety Issue Determination (USID) process provided in ESH-025 before being approved and implemented. Any positive USI for a High Hazard Operation (non-Accelerator) shall be reviewed by the applicable Activity Certification Committee (ACC) for recommendation prior to issuance of the procedure or procedure change. Any positive USI for Accelerators requires DOE-PSO approval prior to issuance of the procedure or procedure change.

3. Reference Documents

- a) PPPL ISM Document, Integrated Safety Management implementation
- b) PPPL QAPD, Quality Assurance Description Program
- c) ESHD-5008 PPPL ES&H Directives (The Safety Manual)
- d) ESH-004, Job Hazard Analysis
- e) ESH-016, Lock-out Tag-out. MCR-ENG-030 R7-002
- f) ESH-025, Operations Hazard Classification Criteria and Safety Certification System
- g) ENG-032, Work Planning System
- h) ENG-006, Preparation, Review & Approval of Technical Specifications
- i) ENG-036, Control of Temporary Modifications
- j) ENG-059, Process Plan/Traveler for PPPL Built Components
- k) P-032, Hierarchy of Documents
- l) P-086, Calibration of Measuring and Test Equipment
- m) OP-AD-77, Operation and Maintenance of Tritium Contaminated Systems
- n) OP-AD-09, D-Site work permits

4. Definitions

Access Procedure	Procedures that are used to remove or minimize all hazards in an area prior to or during personnel access.
Author	The Author is appointed by the Responsible Engineer and is accountable for the technical content and accuracy of the procedure. The Author works with the Responsible Engineer to meet the technical requirements specified in the Procedure Requirements Checklist.

Administrative Operations Procedures	Procedures that provide direction for the administration and conduct of PPPL operations. Examples of the topics covered by Administrative Procedures include the duties of operations personnel and project specific conduct of operations.
Alarm Response Procedures	Written instructions that identify the source and probable cause of an alarm and define systems operator actions to be taken in response to specific system or component alarms. Additionally, these procedures describe the actions required by Security Personnel for the notification of subsystems personnel for certain alarm conditions. Alarm Response procedures shall provide guidance for multiple causalities.
Caution	Alerts users to conditions, practices, or procedures that must be observed to avoid potential hazards involving equipment and conditions adversely affecting site operations or personnel safety.
Check	The act of inspecting for satisfactory condition or performance.
Checklist/form	An appendix to a controlled document that is used to document or control the performance of tasks. Checklists/Forms are included as separate sections in various types of procedures, e.g., Alarm Response Procedures, Emergency Operations Procedures, or Administrative Procedures. The main body of the procedure describes how the checklist/form is to be used. The completed checklist/form must be returned to the appropriate record keeping facility, e.g., the Operations Center. Additionally, these checklist/forms can be used to control routine administrative tasks (e.g., Work Permits, Flame Permits, etc.).
Chief Engineer	The Chief Engineer provides technical oversight of engineering design and operation activities performed by PPPL and ensures that engineering assurance functions are applied based on a conservative evaluation of risks to the Laboratory.
Confirm	See Check
Consistency Check	A check of the procedure by a knowledgeable reviewer to ensure that the purpose, scope, and steps in the procedure are in accord with referenced drawings, piping and instrumentation diagrams (P& IDs), specifications, simulations, modeling, or procedures.
Controlled copy	A document for which an organization has been assigned to maintain control, typically the Operations Center. These copies may be distributed to Controlled Copy Holders by the responsible organization.

Emergency Operations Procedures	Written instructions designating actions to be taken in the event of abnormal conditions which, if not corrected, could result in injury to personnel, damage to equipment, or an uncontrolled release of toxic substances or radiation to the environment. EO procedures coordinate operational interactions between different systems and augment individual Alarm Response Procedures to ensure smooth integration of overall facility response to emergencies. Emergency Operations procedures shall provide guidance for multiple causalities.
Engineering Operations Manager	Directs operations and control of equipment at D-site in accordance with directives of PPPL procedures. Responsible for the configuration of the D-site experimental facilities and the maintenance of their documentation.
Ensure	A positive act of making certain of the occurrence of a particular event or events, or existence of a prescribed condition.
Fabrication Procedures	Procedures that outline, define, and describe the prerequisites, requirements, safety considerations, and actions entailed in the fabrication of complex items. These procedures can refer to Technical specifications and travelers.
General Operating Procedures	Written instructions which describe the major steps required to pass from one normal operating mode to the next, e.g., Glow Discharge Cleaning (GDC) to Pulse Discharge Cleaning (PDC). They coordinate operational interactions between the different systems, and augment the individual System Operations Procedures to ensure smooth integration of overall facilities operations.
Hold Point	A point where consultation with the system engineer, test director, quality control, or other authority is required before continuing with the activity. Hold points must be used to require the analysis, by designated system experts, of data taken during the performance of a procedure if that data provides criteria for future actions in that procedure.
Independent Verification	A separate, independent check performed apart in time to confirm that a device is in its required state. Independent Verification requires the action step to be initiated by one person and then at a different point in time confirmed by another person.

Installation Procedures	Procedures that outline, define, and describe the prerequisites, requirements, safety considerations, and actions entailed in the installation of all equipment. These procedures can refer to Technical specifications and travelers. At D-Site, installation procedures are required in the former TFTR Test Cell, the Test Cell Basement, the Tritium Systems area, Mechanical Equipment Room, Liquid Effluent Collection System and Tanks, the Mockup Decon/Cleanroom Facility, and the NSTX Test Cell as described in OP-AD-09.
Integrated System Test Procedures	Written instructions that define the equipment, methods, and steps required to test the integrated operation or interactions of multiple systems.
Maintenance Procedures	Approved and controlled documents that specify the actions required to perform preventive maintenance on PPPL equipment.
Minor Procedure Change (MPC)	An interim change to a procedure to allow deviation from the procedure, or make minor corrections that do not alter the intent or scope of the procedure as determined appropriate by the Author of the procedure.
Note	Provide important supplemental information to users. This information is presented in a note if it would otherwise be difficult to incorporate in the procedure.
Observe	The act of seeing a particular happening or sequence of happenings that gives evidence of an event occurring, such as a motor starting, an indicator light energizing, a valve cycling, or a parameter changing.
Original Copy	The actual signed copy of a document.
P&ID Check	The mark up of Piping and Instrumentation Diagrams (P& IDs) in a stepwise fashion following the procedure steps. The marked up P& IDs serve as part of the documentation of the review.
Pre-Test Brief	A meeting held prior to the start of a test to discuss as a minimum the following points: <ol style="list-style-type: none"> 1. Safety 2. Personnel responsibilities 3. Personnel qualifications 4. The actual test
Preoperational Test Procedures	Written instructions that define the equipment, methods and steps required to test equipment and systems in order to qualify them as fully operational at predetermined performance levels. These tests are normally conducted prior to the initial operation of a system, after a long shutdown period, and after some critical maintenance or repair tasks to assure systems are fully operational.

Preventative Maintenance	Any process (such as changing oil for a pump), calibration, or measurement that reduces or prevents equipment failure or degradation of an instrument's measurement accuracy.
Programmatic Equipment	All mechanical, electrical, electromechanical, and electronic devices that, in total, comprise an experimental machine such as LTX or NSTX. Excluded are "real property" such as buildings and roads that are maintained by the PPPL Maintenance & Operations Division.
Quality Control Inspection or Witnessing	Examinations, measurements, or testing by Quality Control personnel to independently verify whether an item or an activity conforms to specified requirements or acceptance criteria.
Repair	A maintenance activity that returns a failed component to operational status.
Repair Procedures	Procedures that specify the actions required to perform repairs on PPPL programmatic equipment. Repair procedures are required: <ul style="list-style-type: none"> a) When the repairs involve personnel or equipment safety considerations, b) On equipment governing the movement or containment of tritium, or c) For repair of a tritium containing system or potentially tritium contaminated systems.
Responsible Engineer	The individual assigned responsibility by line management for a specific system, such as the C-Site Motor Control System or the Bakeout System. A list of approved system engineers is available on the Engineering Department web page.
Run copy	A copy of a controlled document issued for use in the field and stamped "Run Copy." This copy is to be used to document the performance of the procedure.
Satellite Areas	Subsystem areas outside of the Operations Center, which are authorized to issue run copies of approved procedures.
Shall	Implies that no operator flexibility outside specified limits is allowed. For example, "The current shall be 10.0 (+ 1.0, - 0.0) Amps."
Should	Implies that some flexibility in exercising operational control is allowed. For example, "The current should be 10 Amps" allows for some operator judgment.
Systems Operations Procedures	Approved and controlled procedures that specify the prerequisites, requirements, and actions for operating <u>individual</u> systems in various modes. The procedures describe the normal startup, startup after a long shutdown, shutdown, periodic testing, and operation of a single system or subsystem, using checklists to specify and document action steps wherever

feasible.

Test Exception

An item which affects running the test in accordance with the Run Copy of the procedure or results which are outside the limits specified in the procedure. Examples:

1. Instrument in place is the wrong range
2. Procedural steps cannot be performed in specified order
3. Instrument failure (reading not taken)
4. Valve lineup incorrect as written

Uncontrolled Copy

A copy of a controlled document issued for purposes other than use in the field. This copy will be date stamped "Uncontrolled Copy" and will not be tracked or updated.

Verify

Check that a specific activity has occurred or that a stated condition exists. Verification requires the action step to be initiated by one person and then confirmed by another person. Not to be confused with Independent Verification.

Walkdown

Consists of physically visiting and observing the location in which the activities are to be performed and the equipment that will be used. A walkdown is performed to ensure that the equipment and environment are actually as envisioned and that the personnel involved can perform the required task.

Walkthrough

See Consistency Check. This phrase creates confusion and should not be used. It is included here for historical reasons.

Warning

Warnings alert users to conditions, practices, or procedures that must be observed to avoid loss of life or severe injury. Warnings also alert users to potential hazards to personnel or equipment.

Witness Point

A point where independent verification by Quality Control is required before continuing with the activity unless waived by Quality Control.

5. Responsibilities

The Responsible Engineer assigns an Author for the procedure. The Author is accountable for the technical content and accuracy of the procedure. The Responsible Engineer ensures that Technical Procedures for A-1 and A-2 systems and equipment do not alter their configuration or result in operations/use outside of their design basis. Individuals performing work under the guidance of a technical procedure are responsible to adhere to the steps of the procedure.

6. Types of Procedures and their naming convention

The types of procedures covered by this procedure are listed in Table 1.

The name structure is: **Site-Project-Type-System-XX Rev #.**

Site is C or D.

Project is void when the procedure is applicable for entire D-Site or C-Site.

Format for **Type** and **System** is listed in Table 1.

	Type	System
Administrative Operations Procedures	OP	AD
General Operations Procedures	OP	G
Alarm Response	OP	AR
Emergency Operations	OP	EO
Preoperational Test	PTP	Sys
Integrated System Test Proc.	ISTP	void
System Operations Procedures	OP	Sys
Access procedure	AP	Sys
Fabrication Procedure	FP	Sys
Installation Procedure	IP	Sys
Maintenance Procedure	MP	Sys
Repair Procedure	RP	Sys

Table 1

7. General Rules Applicable to all Procedures

All procedures are required to list the procedure number, revision number, and page number in the upper right corner.

Attachment 1 details ownership, review, and sign off roles for technical procedures.

General rules and guidelines applicable to all procedures are:

1. The principles and functions of Integrated Safety Management should be considered when developing procedures. The guiding principles are line management responsibility for safety, clear roles and responsibilities, competence commensurate with responsibilities, balanced priorities, identification of safety standards and requirements, and hazard controls tailored to work being performed. The functions are to define the work, analyze the hazard, develop/implement controls, perform the work, and provide feedback and improvement.
2. Upper tier documents should be referenced as appropriate.
3. A procedure should consist of step-by-step instructions for the work to be done. If steps in a procedure section do not have to be performed in a specified sequence or specific steps should only be performed when certain conditions prevail, they should be so indicated.
4. Procedures should be written in sufficient detail as to be understandable by the field personnel performing the work and by the technical and safety reviewers. Ancillary detail for background, explanation, reference data, instruction, etc., should be placed in well-organized and clearly titled appendix sections. Care should be taken to include information for sustainability of the procedure to guide future usage including examples, photos, special techniques, acceptable ranges and outcomes, and other types

of job knowledge to correctly, accurately, and repeatedly perform the work scope across assigned staff skills, training, and experience, as well as time between uses.

5. Installation, maintenance and repair procedures need to include functional verification of installed safety items starting or returning equipment to operation.
6. The need for calibrated tools or equipment should be explicitly identified. See policy P-086 for further guidance on when calibrated tools shall be used and when the tool ID shall be recorded. Specification of measurement instruments shall include proper scaling for the quantity to be measured, and accuracy consistent with monitoring quantities ensuring safety and equipment integrity.
7. A blank signoff line should be provided in the document for each critical action step of the procedure. These lines should be initialed by the individual executing the procedure to indicate and document that the required actions have been taken. A substitute is to have signoff lines at the end of sections of the procedure.
8. Steps or sections requiring verification or independent verification should contain an additional blank line in the document for the verifying person to initial.
9. Hold points requiring consultation with the Responsible Engineer should be used if the analysis of data taken during the performance of the procedure is used as criteria in determining future actions in the procedure.
10. Checklists may be included to expedite extensive series of action steps. Each step of the checklists should be initialed or simply checked; in the latter case, there should be a signoff line for the person completing the checklist.
11. All text, graphs, etc. should utilize 8-1/2 X 11 inch format. Convenience copies of approved drawings are acceptable full size when needed
12. Review any relevant SAD/Safety Envelope/ASE considerations including the need to use the Unreviewed Safety Issue Determination (USID) process per Procedure ESH-025. Procedures shall not be approved prior to satisfactory closure of the USID process, where applicable per ESH-025
13. Typical sections are listed below. Sections (a), (b), (e), (i) and (j) are mandatory.
 - a) Purpose: A brief statement explaining the purpose of the equipment or system to which it applies, the reason the procedure is being run, and the purpose of the document.
 - b) Scope : A summary of what the procedure covers or includes, any special circumstances deemed necessary to perform the procedure, and any limitations on the applicability of the procedure for given facility conditions or systems
 - c) Responsibilities: Responsibilities of the various positions involved in the procedure.
 - d) Definitions
 - e) Reference: A listing of documents that may need to be accessed and that have information or instructions relevant to the procedure. Unnecessary references should be avoided. References may include

appropriate codes and standards, design drawings, procedures, vendor manuals, etc.

- f) Background: Background information relevant to the procedure
- g) Special Tools, Equipment, and Materials: List of equipment, tools, apparatus, and consumables needed to perform the procedure which may not be readily available. For each tool that is required to be calibrated, this section must include the associated tool identifier as well as the most recent calibration date.
- h) Precautions/Limitations: A list of potential hazards and how they should be mitigated. This alerts the individuals to the concerns or dangers that may or will exist during execution of the procedure and the safeguards which should or must be implemented. The appropriate warnings and cautions required to protect personnel and equipment are inserted in the procedure prior to the step to which they pertain.
- i) Prerequisites: A list of specific activities or special plant conditions which must be performed or exist prior to execution of the procedure. The supporting systems required to be operational for the procedure should be listed. Verification of performance of prerequisite tests should be listed and documented by a checklist. Prerequisites identified should be clear, concise instructions, each written as a single task.
- j) Step-by-step instructions: Instructions for the procedure. Test criteria for test procedures.
- k) Acceptance Criteria: Relevant for test procedures only.
- l) Emergency Actions: For any anticipated emergencies, steps required to leave system in safe state.
- m) Records: Records required to be maintained.
- n) Final Conditions: Final conditions that the system should be left in at the end of the procedure.
- o) Completion Signoff: To acknowledge that work has been properly completed and that the implementation and documentation in the run copy of the procedure and any data collected are professional, acceptable, and compatible with proper Conduct of Operations.
- p) Appendices: For forms, checklists, test data sheets, calibration sheets, etc.
- q) Qualifications: Qualification or training requirements for those who will execute the procedure.

Attachment 2 contains additional rules and guidelines for Alarm Response Procedures.

A. Planning, writing, reviewing, and approving new procedures or major revisions to existing procedures

Responsibility

Action

Responsible Engineer 1. When a procedure needs to be developed, written, revised, or

implemented:

- Determines the category of the procedure based on the categories of the affected item;
- If the activity is inconsistent with the determined category, consults with the Chief Engineer (for rows 3, 4, and 6 of Table 1 of the QAPD) and the ES&H Head (for rows 1, 2, and 5 of Table 1) who determine and justify the appropriate category (justification to be noted in the box next to the category)
- Assigns an Author.

Chief Engineer	2. Confirms the identified reviewers are adequate and appoints a relevant Independent Reviewer for procedures involving actions on A1 items.
Responsible Engineer	3. Completes the Procedure Requirements portion of the Procedure Cover Sheet (Attachment 3), and fills the Reviewers panel following the process described in Attachment 1.
Author	<p>4. Obtains a procedure number or a revision number from the Operations Center.</p> <p>5. Researches and writes a draft procedure or revision in accordance with this procedure and in compliance with applicable sections of the Safety Manual 5008. Identifies all hazards and the appropriate methods for mitigation. Reviews all field modifications and Minor Procedure Changes (MPCs) against the existing procedure revision to assure proper inclusion. This step includes identifying any potential hazards to the environment, public, or workers that may result from execution of the procedure and establishing controls to mitigate these hazards. Attachment 8 contains guidance for the use of Human Performance Improvement concepts in the identification of and mitigation for error-likely situations.</p> <p>6. Investigates and resolves any potential conflicts with documents of higher precedence (See Section 4, Hierarchy of Documents).</p> <p>7. Prepares, if revising an existing procedure, a Revision Sheet (Attachment 4) to identify briefly the reason for the revision.</p> <p>8. Distributes to reviewers (see Attachment 1) the draft procedure and Revision Sheet if applicable. Specifies due date for comments.</p> <p>9. Performs a consistency check and walkdown of the procedure, if specified in the Procedure Requirements, generating a marked up copy of the procedure and/or marked up drawings and diagrams, as appropriate.</p>
Procedure Reviewers (may be individually or via peer review)	10. Mark up procedure and return to Author in a timely manner. In addition to the review of the technical content of the procedure, reviews the procedure for human performance concerns. Attachment 8 provides additional guidance for these concerns.
Author	11. Receives, evaluates, and resolves the comments, suggestions, or

objections generated by the reviews of steps 9 and 10. Obtains signature of reviewer indicating concurrence with resolution.

Responsible Engineer	12. Reviews procedure, comments, and their resolution.
Independent Reviewer	13. Where applicable, performs and completes an independent review.
Author and Responsible Engineer	14. Resolve Independent Reviewer's comments.
Author	15. Signs the 'Author' approval line on the Procedure Cover Sheet (Attachment 3).
Reviewers (and Independent Reviewer where applicable)	16. Check the final procedure package and sign.
Responsible Engineer	17. Reviews the final procedure package and approves the procedure by signing.
	18. Fills in the training information on the Training Requirements (Attachment 3).
Author	19. Forwards copy of the procedure with the training requirements to Human Resources Training Office and, for A-1 and A-2 installation, maintenance, and repair procedures, to Quality Assurance.
	20. Forwards the original of the procedure and the documentation, including all marked up copies of the draft procedures containing comments and drawings, to the Operations Center.
Operations Center	21. Replaces all long-standing previous revision Run Copies (such as Alarm Responses) with the new procedure.

B. Implementing minor procedure changes (MPC)

Minor procedure changes (MPCs) are only allowed for changes that do not alter the intent or scope of the procedure as determined by the Chief Engineer.

If a proposed change would alter the intent or scope of the procedure, the steps of Part A of this procedure must be followed. Also, a maximum of four active MPCs are allowed for a procedure. If the proposed MPC is the fifth, the steps of Part A of this procedure must be followed.

Responsibility

Action

MPC Originator	1. Identifies the need for an MPC to an existing procedure and completes the MPC form (Attachment 5). Attaches copies of pages to be changed clearly indicating the changes. Changes shall be initialed and dated. Indicates all affected pages on the MPC form.
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|----------------------|-----|---|
| | 2. | Requests MPC number from the Operations Center and writes MPC number on any attached sheets. |
| Operations Center | 3. | Assigns the MPC number. |
| Responsible Engineer | 4. | Performs a technical review of the MPC to determine if the MPC significantly alters the scope or intent of the original. If yes, a major revision of the procedure is required, per Section A. |
| | 5. | Reviews the MPC to determine if executing the modified procedure could potentially result in a significant ES&H impact. If so, requests ES&H Department review. If no, go to step 7. |
| ES&H Department | 6. | Reviews the impact of the MPC on ES&H considerations. Signs MPC upon satisfactory resolution of any ES&H concerns. |
| USI screener | 7. | If the original procedure was USI screened, reviews the MPC and, if satisfied no USID is required, approves the procedure by signing. Otherwise, stops the MPC and identifies concerns to the MPC Originator. |
| Chief Engineer | 8. | Reviews the impact of the MPC on system and, if satisfied, approves the procedure by signing. Otherwise, identifies concerns to MPC Originator. |
| MPC Originator | 9. | Forwards signed copy to the Operations Center. |
| Operations Center | 10. | Files MPC with original procedure. Assures that all current run copies of the procedure and any new distributions of the procedure contain all open MPCs. |
| MPC Originator | 11. | Attaches signed copy of the MPC to the run copy of the procedure in use when the MPC was generated, if required. Either replaces pages in the run copy of the procedure with annotated pages or notes changes in the procedure at the affected steps. |
| Responsible Engineer | 12. | Replaces all long-standing previous revision Run Copies (such as Alarm Responses) with the new procedure. |

C. Use of run copies

Run copies are official copies of approved and controlled procedures issued for use in the field and are required when performing specific technical activities with recordable data such as installation procedures, pre-operational and integrated system test procedures, system operation procedures, access procedures, and maintenance or repair procedures. Run copies may be required for other procedures such as general operating procedures and access procedures if specified on the procedure cover sheet. Run copies are not required for procedures that are established and maintained to safely conduct more global project activities as is the case in administrative, alarm response, and emergency operations procedures. Run copies are stamped "Run Copy" and used to document the actual performance of the procedure. Run copies are usually issued by the Operations Center though they may be issued from official Satellite Areas (section F).

The following rules apply for the execution of run copies:

- a) All blanks shall be filled in with the required information.
- b) With concurrence (oral or written) of the Responsible Engineer, steps may be marked not applicable, e.g., writing "N/A" or crossing out blank spaces, or writing "N/A" and placing an arrow down a column.
- c) In the event that a run is terminated, add after the last step performed, "Run Terminated", along with an explanation of what caused the termination. Blank spaces after the "Run Terminated" do not have to be marked N/A.
- d) Entry errors shall be corrected by drawing a single line through the incorrect information and entering the correct information adjacent to it or in space available with reference to the deleted information. The individual making the correction shall initial and date the deleted information.
- e) Unusual conditions: In the event that a procedure activity is interrupted prior to completion for a reason such as procedure conflicts, procedure inadequate for the intended task, or when unexpected results occur, the operator shall bring the equipment to a safe condition, not necessarily shutting down the equipment. For parameters outside the specified maximum/minimum values, the out-of-specification condition shall be circled in the procedure and promptly reported to the Responsible Engineer. The causes of the unusual condition shall be promptly investigated. Disposition of the circled parameter shall be explained in the comment section of the procedure or in the margin, as appropriate. If a modification (including missing required steps, using different tools or materials) to the procedure is necessary, the execution of the procedure stops until the Responsible Engineer has discussed the modification with the team, noted it on the procedure, and signed it off

Note that in emergency situations only, operators have the authority to deviate from written procedures during an emergency while necessary to protect personnel and equipment. The deviation shall be documented in the procedure and the operator's supervisor shall be promptly notified. In all cases where the supervisor can be contacted without undue risk, the operator shall obtain permission to deviate from the procedure. If the emergency was caused by a shortcoming of the procedure this needs to be revised before work can restart.

Responsibility

Action

Authorized User

1. Obtains a run copy from the Operations Center or Satellite Area. If a run copy is already in the possession of the Authorized User, he/she verifies that the working copy is current (with Ops Center), or if not, returns the obsolete version for destruction and obtains a current version.
2. Conducts pre-job brief, if necessary. The briefing should be documented on a Record of Training Sheet (Attachment 6).

Topics to be covered in the brief are:

- a) The purpose and scope of the procedure

- b) The procedure prerequisites
- c) The roles of the participants
- d) How communications among the participants will be conducted during the procedure
- e) Who will be responsible for overseeing the work activity
- f) Safety related issues including hazards and human performance concerns and how they are mitigated. See attachment 9 for further guidance.
- g) Post-procedure activities (e.g., restoration of equipment, system turnover).
- h) Other issues of concern (meal breaks, shift changes, etc.)

Participants should be given the opportunity to ask questions or express concerns.

Authorized User

3. Executes procedure in accordance with planned operations using trained and qualified personnel. Documents compliance with the procedure in the run copy of the procedure. Unqualified personnel-in-training are permitted to operate a system only under the constant direct supervision of a fully qualified operator.
4. Writes MPCs, if required, following the steps of section B.
5. Conducts post job brief, when appropriate. Post job briefs are valuable if the procedure is expected to be executed again in the future or if problems were encountered in the execution of the procedure. If the procedure needs to be revised before its next use, this shall be noted on the Ops Center copy and the satellite copies retrieved. Attachment 9 contains additional guidance for post-job briefs. Post-job briefs provide an excellent opportunity to obtain sustainability information to the procedure for its next revision. Notes added to the Run Copy during execution are copied and forwarded to the Responsible Engineer so any lessons learned are incorporated into revisions and other procedures.
6. Ensures that all required signoffs are in the procedure and annotates the applicable portions of the document for the given operation. Returns completed "run copies" to the Operations Center per instructions on the procedure cover sheet. Completed run copies are filed in the Operations Center unless special archiving requirements have been specified by the Responsible Engineer.
7. Lost or unexecuted procedures:
 - a. In the event that a completed run copy is lost, the person who received the run copy shall notify the Operations

Center and complete Attachment 7.

- b. If controlled run copies are distributed for planned operations and subsequent events result in the cancellation of the planned operations, the user of these run copies will contact the Operations Center and cancel the run copies.

D. Cyclical Review of Procedures

All procedures must be reviewed every three years to determine if any changes are required.

Responsibility

Action

- | | |
|----------------------|--|
| Operations Center | 1. Sends out a Document Review Request to the Responsible Engineer prior to three-year expiration of procedures. |
| Responsible Engineer | 2. Determine if any changes are required and implements these changes per Parts A and B of this procedure. If no changes are needed, a new signature page must be generated. |

E. Procedure Training/ Pre- and Post-Job Briefs

Training on the use of a procedure is required to ensure that the procedure is carried out as intended by the Responsible Engineer who will make the final decision on what level of procedure training is appropriate, considering the extent of the changes and the complexity of the procedure, and specify that requirement on page 2 of attachment 3. Training considerations are as follows:

- | | |
|----------------------|---|
| No Training Required | This is appropriate in the case where the procedure is to be performed only by the Author or the Responsible Engineer. |
| Read Only | “Read Only” training is prescribed in cases where either a group is expected to read and understand a procedure in support of general activities (such as in the case of Administrative, Alarm Response, and Emergency Operations procedures) <u>OR</u> when a person or group performing the procedure is expected to read and understand a procedure when issued a Run Copy (as in the case of other types of procedures). In the case of Administrative, Alarm Response, and Emergency Operations procedures, training is a pre-requisite for starting general project operations and a well-defined set of employees will be trained on these procedures before operations begin. “Read Only” training on these procedures should be documented on a Record of Training form (attachment 6) and forwarded to the Human Resources Training office. In the case of other types of procedures (general operations procedures, installation procedures, pre-operational and integrated system test procedures, maintenance procedures, repair procedures, and access procedures), the completed Run Copy on file in the Operations Center will serve as a record of “Read Only” training. |

Pre-Job Briefs

Pre-Job Briefs and instructional discussions are prescribed in cases where it is appropriate that the responsibilities of the participants in specific work activities be further reinforced. These discussions also include related safety issues such as job hazards and required permits, and responses to all questions and concerns of the participants. This training should be documented on a Record of Training form and forwarded to the Human Resources Training Office. See ESH-004, Job Hazards Analysis, attachment 3, Human Performance Tools for an Enhanced Pre-Job Brief, for further guidance.

Post-Job Briefs

Post-Job Briefs are carried out if the procedure is expected to be executed again in the future or if problems were encountered in the execution of the procedure. Discussions at a Post-Job Brief include the parts of the procedure that went well, improvements that can be made, any safety related issues, and overall lessons learned. Minutes of the Post-Job Brief are sent to the Operations Center with the completed Run Copy of the procedure. See Attachment 9 for further guidance. Post-job briefs provide an excellent opportunity to add sustainability information to the procedure for its next revision. Notes added to the Run Copy during execution need to be copied and forwarded to the Author and Responsible Engineer so any lessons learned can be incorporated into revisions and other procedures.

F. Satellite Areas

Satellite areas are physical areas outside of the Operations Center, which are authorized to issue run copies of approved procedures for work performed in the area.

Legacy run copies are CC1 from the NSTX-U Control Room and CC5 for all other satellites. New run copies are:

CC1	NSTX-U Control Room
S1	Facilities
S2	NB
S3	MG
S4	LTX

Responsibility**Action**

- | | |
|--|--|
| Responsible Engineer | 1. Requests, from the Operations Center, creation of a Satellite Area providing appropriate justification and documenting type of work to be performed in the area. Identifies individual responsible for the integrity of the Satellite Area and types of procedures to be located in the Satellite Area. |
| Operations Center | 2. Approves the Satellite Area with the appropriate limitations. |
| | 3. Assures that copies of all appropriate, approved procedures are transmitted to the Satellite Area. Maintains lists of procedures located in each Satellite Area. |
| Individuals responsible for Satellite Area | 4. Assure that usage of run copies issued from the Satellite Area adhere to the requirements of part C. |

8. TRAINING

- | | |
|-------------------|---|
| Head, Engineering | 1. Ensures the appropriate training methods and means (below) are provided and obtains concurrence of the Management System Owner and the Management Process Owner. |
|-------------------|---|

Target Audience: Engineers, Responsible Engineers, Reviewers defined in Attachment 1.

Instructor: Head, Engineering

Training Method:

- Briefings (major re-issues, newly assigned personnel)
- E-mail (minor revisions)

- | | |
|-------------------|--|
| Head, Engineering | 2. Notifies the Human Resources Training Office of the training so that they will be aware of the training requirements and be able to provide assistance and guidance in the course development, implementation, tracking, and maintenance if needed. |
|-------------------|--|

9. Records Requirements Specific To This Procedure

Records Custodians must assure records are maintained as follows:

Record Title	Record Custodian	Location	Retention Time
Master	Ops Center	Ops Center	Cut off the records at the end of the fiscal year, and destroy them 5 years after the date of the completion of the task or the completion of the performance of the activity or the action. <i>Reference: Admin 18 Security, Emergency</i>

			<i>Planning and Safety Records(35.b)</i>
Controlled Procedures	Ops Center/ Satellites	Ops Center/ Satellites	Cut off the records at the end of the fiscal year, and destroy them 5 years after the date of the completion of the task or the completion of the performance of the activity or the action. <i>Reference: Admin 18 Security, Emergency Planning and Safety Records(35.b)</i>
Procedure Run Copies	Ops Center/ Satellites	Ops Center/ Satellites	Cut off the records at the end of the fiscal year, and destroy them 5 years after the date of the completion of the task or the completion of the performance of the activity or the action. <i>Reference: Admin 18 Security, Emergency Planning and Safety Records(36)</i>
Minor Procedure Change (MPC) Approval Form	Operations Center	Operations Center	Cut off the records at the end of the fiscal year, and destroy them 5 years after the date of the completion of the task or the completion of the performance of the activity or the action. <i>Reference: Admin 18 Security, Emergency Planning and Safety Records(35.b)</i>
Lost or Destroyed Run Copies Form	Operations Center	Operations Center	Cut off the records at the end of the fiscal year, and destroy them 5 years after the date of the completion of the task or the completion of the performance of the activity or the action. <i>Reference: Admin 18 Security, Emergency Planning and Safety Records(36)</i>
Document Review Request	Operations Center	Operations Center	Cut off the records at the end of the fiscal year, and destroy them 5 years after the date of the completion of the task or the completion of the performance of the activity or the action. <i>Reference: Admin 18 Security, Emergency Planning and Safety Records(36)</i>
Training Form	Human Resources Training Office	Human Resources Training Office	Check specific type of training record in PPPL Record Schedules for Record Custodian and retention schedule.

10. Attachments

1. Ownership, review and sign off of technical procedures

2. Alarm Response Procedures
3. Procedure Cover Sheet
4. Revision Sheet
5. Minor Procedure Change (MPC) Approval Form
6. Record of Training Form
7. Sample Lost or Destroyed Run Copies Form
8. Human Performance Considerations for Procedures
9. Human Performance Considerations for Pre- and Post-Job Briefs

Ownership, review and sign off of technical procedures**1. Ownership**

The Responsible Engineer owns the technical procedures for their system, with the exception of NSTX-U where procedures involving more than one Responsible Engineer become the responsibility of the NSTX-U Operations Manager.

2. Review**MANDATORY**

The Chief Engineer identifies an independent reviewer for A-1 procedures.

Preoperational Test, Fabrication, Installation, Maintenance, and Repair A-1 and A-2 procedures shall be reviewed by QA to establish whether they require a Quality Inspection Plan (QIP, QA-004).

D-site procedures are reviewed by a USI Screener.

Procedures for any work in the **Tritium** Areas require review by the Tritium Systems RE.

An ES&H Electrical Safety Specialist review is required for all **electrical access and installation** procedures to verify compliance with the safety aspects of the National Electrical Code (NEC), the National Fire Protection Association (NFPA 70E) the Occupational Safety and Health Act (OSHA), and relevant DOE orders.

OPTIONAL

The RE shall list all Responsible Engineers owning systems affected by or required by the work. These shall reply stating whether they decline or accept to review. Those who accept to review and submit comments will be asked to review the revised procedure. All will sign the final procedure in the chosen column.

ES&H receives all technical procedures to review. They shall reply stating whether they decline or accept to review. If accepting to review and submitting comments, they will be asked to review the revised procedure. ES&H will sign the final procedure in the chosen column.

PPPL	PRINCETON PLASMA PHYSICS LABORATORY	PROCEDURE	No. ENG-030 Rev 7 Attachment 1
Ownership, review and sign off of technical procedures			Page 2 of 2

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3. Sign off

The Responsible Engineer needs to sign off all their completed technical procedures.

When QC inspections or tests (per QA-004) are required by a technical procedure, the Responsible Engineer shall approve the QIP and QC shall sign the completed technical procedure before the Responsible Engineer.

ALARM RESPONSE PROCEDURES (SITE-PROJECT-OP-AR-XX)

A recommended format for Alarm Response Action and Checklist is included in this attachment. Alarm Response Procedures are written for one of two groups:

1. Communication Officer of Security Personnel
2. Subsystem Personnel

Since it is impractical for operations personnel responding to alarms or emergency situations to obtain “run copies” of procedures from the Operations Center, controlled copies of the Alarm Response Procedures and Emergency Operations Procedure (or checklist associated with these procedures) will be distributed to Satellite Stations. It is recommended to maintain a log book with a couple of run copies in it at all times for emergency use. Upon completion of these procedures (or checklists), these completed procedures will be returned to the Operations Center and handled in a way similar to other issued run copy.

A. Alarm Response for Communication Officer of Security Personnel**1. Format**

The format should include the following sections:

1. Purpose
2. Scope
3. Responsibilities
4. References
5. Alarm Description
6. Alarm Precedence
7. Procedure
 - a. Security Actions
 - b. System Personnel Actions
8. Alarm Response Checklist

2. Content Description

1. Alarm Response Procedures for Security Personnel are written mainly to ensure prompt notification of cognizant personnel in the event of an alarm condition. They are also written for conditions that require Security Personnel to perform minor actions to abate an alarm condition.
2. The Alarm Description should describe the indication (as seen in the C-Site Security Office) of the alarm condition.
3. The Alarm Procedures should contain a prioritized list of Alarm Response Procedures in the order in which they should be executed.
4. The Alarm Response Checklist is the portion to be used by Security personnel during the alarm event. The checklist should be an abbreviated version of the Alarm Response Procedure.

B. Alarm Response for Subsystems Personnel**1. Format**

The format should include the following sections (when applicable):

1. Title line containing the alarm name, panel name, and facility location of the panel
2. The set point and source of the alarm
3. The most probable cause(s)
4. Automatic actions (if applicable)
5. Immediate operator actions
6. Subsequent Recovery Operator Actions
7. References and applicable drawing numbers (if applicable)

2. Content Description

1. Alarm Response Procedures for subsystems personnel are written mainly to ensure the proper actions of subsystems personnel to an alarm condition or report of an alarm condition from security personnel.
2. Each individual Alarm Response Procedure should contain concise information, including the origin and most probable cause of the specific alarm condition.
3. "Immediate Operator Action" Section should contain:
 - a. Steps to confirm that an alarm condition exists,
 - b. Steps to verify that the automatic actions occurred successfully,
 - c. Steps required to determine the cause of the alarm condition; and, if necessary,
 - d. Steps required to place the equipment in a safe condition or,
 - e. If necessary, instructions to execute an Emergency Procedure.
4. "Subsequent Recovery Operator Action" section should contain steps to verify proper execution of the "Immediate Actions" and additional steps to place the system in a normal configuration.
5. Alarm Response Procedures do not take the place of Emergency Operations Procedures. They should not supersede any higher precedence procedure.
6. If an alarm condition could lead to an Emergency Operation Procedure, appropriate instructions should be included in the Operator Action section.

ALARM RESPONSE CHECKLIST

PRINCETON PLASMA PHYSICS LABORATORY
PROJECT NAME PROJECT

System/Panel #
Row-Number

PANEL LOCATION: *System, Panel Number*

SYSTEM: *Enter system name here*

INITIATING DEVICE: *Instrument responsible for alarm initiation*

Annunciator
Nomenclature

Setpoint: *If applicable*

ALARM RESPONSE

A	<u>POSSIBLE CAUSE(S) OF ALARM</u> <i>Enter a list of any scenarios, malfunctions, or problems which could lead to the initiation of this alarm.</i>	
B	<u>AUTOMATIC ACTION (S)</u> <i>Enter a list of all actions which happen automatically due to the initiation of this alarm.</i>	
C	<u>CONTROL ROOM OBSERVATION(S)</u> <i>Enter a list of all observations/indications including any TRECAMS observations that should be available as a result of this alarm.</i>	<u>LOCAL OBSERVATION (S) INDICATION</u> <i>Enter a list of any indications in the area of the system equipment which could be observed during this alarm.</i>
D	<u>IMMEDIATE OPERATOR ACTION</u> <i>Enter a list of actions required to place the affected system(s) in a safe condition. Include in this list any actions required to inform the appropriate personnel of the alarmed condition.</i>	
E	<u>CONSEQUENCES</u> <i>Enter a list of potential consequences due to receipt of this alarm.</i>	

PROCEDURE COVER SHEET TEMPLATE

Princeton Plasma Physics Laboratory Procedure			
Procedure Title:			
Number:		Revision:	Effective Date: Expiration Date: (3yr. unless otherwise stipulated)
CAT: <input type="checkbox"/> A1 <input type="checkbox"/> A2 <input type="checkbox"/> A3		Justification: (If required) CE and/or ES&H Head:	
Author			Date
Responsible Engineer			Date
Procedure Requirements designated by Responsible Engineer LABWIDE:			
	Work Planning Form # _____ (ENG-032)		Lockout/Tagout (ESH-016)
	Confined Space Permit (5008, Sec. 8, Chap 5)		Lift Procedure (ES-MECH-007)
			ES&H Review (NEPA, IH, etc.)
	RWP (HP-OP-12)		Independent Review
	Walkdown		Pre-job Brief
	Post-job Brief		Job Hazard Analysis – JHA (ESH-004)
	T-MOD (ENG-036)		Special archiving requested for completed
	Run Copy Required (performance of procedure must be documented and archived per ENG-030)		Run Copies: _____
D-SITE SPECIFIC:			
	D-Site Work Permit (OP-AD-09)		Door Permit (OP-G-93)
	Work on Tritium Contaminated Sys. (OP-AD-77)		Activity Certification Committee Review
√	USI Screening (OP-AD-131)		
FOR INSTALLATION PROCEDURES ONLY: Was an ECN required?			
If ECN was required, list drawing numbers affected:			

Sample Procedure Cover Sheet

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MANDATORY REVIEWERS (set according to ENG-030 Attachment 1)

OPTIONAL REVIEWERS (set according to ENG-030 Attachment 1)

	Decline and sign	Accept – no comment	Accept - comment
ES&H			

REVIEWERS (designated by Chief Engineer for A1)

Independent Reviewer

TRAINING (designated by Responsible Engineer)

No training required _____ Instructor _____

Personnel (group, job title, or individual name)	Read Only*	Instruction	Hands-On

Responsible Engineer _____

* “Read Only” training for Administrative, Alarm Response, and Emergency Operations procedures must be documented on a Record of Training form (attachment 6). The completed Run Copy will serve as the documentation of “Read Only” training for all other types of procedures.

MINOR PROCEDURE CHANGE (MPC) APPROVAL FORM

COMPLETED BY REQUESTER				
Procedure Title >				No. >
	CAT: <input type="checkbox"/> A1 <input type="checkbox"/> A2 <input type="checkbox"/> A3			
Rev >		Procedure Issue Date >		Procedure Expiration Date >
MPC No. >		MPC Issue Date >		MPC Expiration Date >
Change Requested: (Attach Additional Documents, If Necessary):				
Reason for Change: (Attach Additional Documents, If Necessary):				
Training Determination		None Required >		Read Before Use >
Does the MPC "significantly impact ES&H?"		Yes >		No >
Type of MPC (Check ONLY One): Temporary/Limited >			Permanent >	
Person Requesting Change	Printed Name	Signature		Date

REVIEW AND APPROVAL		
ES&H Dept. Review (Only if MPC "significantly impacts ES&H"):	Signature	Date
USI screener (Only if original procedure was USI screened):	Signature	Date
Approval Responsible Engineer from Procedure Cover Sheet	Signature	Date
Determination (i.e. to confirm this is a small change) Chief Engineer	Signature	Date

Record of Training form

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RECORD OF TRAINING

COURSE TITLE (From Training Office), DOCUMENT TITLE, OR TOPIC:

DOCUMENT NUMBER: __ REVISION AND/OR DATE: __

TYPE OF TRAINING (check one):

☐ Read Only☐ Instructional Discussion☐ Video☐ Small Group Meeting☐ Practical/Hands Only☐ Other _____INSTRUCTOR: _____
(please print)

SIGNATURE: _____

Use reverse side for any additional information or comments.

ATTENDANCE INFORMATION				
PRINT NAME CLEARLY	SIGNATURE	DATE	SUPERVISOR (Print Name)	DB
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				

Just a Reminder...

To ensure proper posting of the information contained herein, please complete this training form, print to pdf, send to Human Resources Training Office and the Ops Center.

Received by Training Office: Initials _____ Date _____

REPORTING LOST OR DESTROYED RUN COPY FORM

COMPLETED BY REQUESTER				
Procedure Title >				No. >
	CAT: <input type="checkbox"/> A1 A2 <input type="checkbox"/> A3			
Rev >		Run Copy Issue Date >		Procedure Completion Date >
Results of performance of this procedure:				
Technical Data recorded during performance of this procedure:				
Does this Procedure need to be repeated?				
Yes >			No >	
Person Requesting Change	Printed Name	Signature		Date

REVIEW AND APPROVAL TO CLOSE RUN COPY		
Responsible Engineer Review Procedure Cover Sheet	Signature	Date
ES&H Dept. Review (Only if ES&H related data is recorded on this run copy):	Signature	Date
Approval Responsible Line Manager from Procedure Cover Sheet	Signature	Date

The information presented below is taken from the Human Performance Fundamentals Course Reference, National Academy for Nuclear Training, December 2002, Revision 6, pages 137 and 138 revised for applicability to this procedure.

Critical Task Analysis

1. Develop step list.	These are all steps within the procedure.
2. Identify the critical steps.	Steps are considered critical if the consequences of incorrect performance by people are significant. Consequences might be personnel or equipment safety, significant costs, or schedule delays.
3. Identify the error-likely situations for each of these critical steps.	Identify the possible errors that could result from each step. Errors may be active or latent. An action error concerns “changes to equipment, system or plant state triggering <i>immediate</i> undesired consequences.” A latent error is “an error, act or decision that results in organization-related weaknesses or equipment flaws that lie dormant until revealed either by human error, testing, or self-assessment.”
4. Identify the consequences if errors occur at these critical steps.	The consequences can be characterized as either the worst that could happen or the most likely outcome.
5. Identify the error precursors or task demands which are “Unfavorable factors embedded in the job site that increase the chances of an error during the performance of a specific task by a particular individual.”	A list of error precursors may be found on the subsequent pages of this attachment.

6. Identify tools that would prevent human error.

Tools include:

- Self Checking
- Peer Checking
- Independent Verification – check performed by individuals not directly involved in the work and at a separate time from the work being performed
- Knowledge/Training
- Questioning Attitude
- Place-keeping – marking in procedure that a step was performed successfully
- Effective Communication – acknowledgement of communication
- Pre-job Briefs
- Job Hazard Analysis
- Supervisor Involvement and Coaching
- Turnovers – transfer of work responsibilities from team to team frequently as a result of shifts
- Stop Work
- Procedure Step Highlighting – Highlighting critical steps warranting greater attention

Error Precursors (Bold are most frequent)

Driver Code	1 – TASK DEMANDS	Driver Code	3 – INDIVIDUAL CAPABILITIES
1A	-Time Pressure (in a hurry)	3A	-Unfamiliarity with task/First time
1B	-High workload (memory requirements)	3B	-Lack of knowledge (faulty mental model)
1C	-Simultaneous, multiple tasks	3C	-New technique not used before
1D	-Repetitive actions/Monotony	3D	-Imprecise communication habits
1E	-Irreversible actions	3E	-Lack of proficiency; Inexperience
1F	-Interpretation requirements	3F	-Indistinct problem-solving skills
1G	-Unclear goals, roles, or responsibilities	3G	-“Can do” attitude for safety-critical task
1H	-Lack of or unclear standards	3H	-Illness or fatigue; general health
1I	-Confusing procedure/Vague guidance	3I	-Unawareness of critical parameters
1J	-Excessive communication requirements	3J	-Inappropriate values
1K	-Delays: idle time	3K	-Major life event; medical, financial, emotional
1L	-Complexity/High information flow	3L	-Poor manual dexterity
1M	-Excessive time on task	3M	-Low self-esteem; moody
1N	-Long-term monitoring	3N	-Questionable ethics (bends the rules)
		3O	-Sense of Control. Learned helplessness
		3P	-Personality type
Driver Code	2 – WORK ENVIRONMENT	Driver Code	4 – NATURAL TENDENCIES/HUMAN NATURE
2A	-Distractions/Interruptions	4A	-Stress
2B	-Changes/Departure from routine	4B	-Habit patterns
2C	-Confusing displays/controls	4C	-Assumptions
2D	-Work-arounds/OOS instrumentation	4D	-Complacency/Overconfidence
2E	-Hidden system responses	4E	-Mindset (intentions)
2F	-Unexpected equipment conditions	4F	-Inaccurate risk perception
2G	-Lack of alternative indication	4G	-Mental shortcuts or biases
2H	-Personality conflicts	4H	-Limited short-term memory
2I	-Back shift or recent shift change	4I	-Pollyanna effect
2J	-Excessive degree of group cohesiveness	4J	-Limited perspective (bounded rationality)
2K	-Production overemphasis	4K	-Avoidance of mental strain
2L	-Adverse physical climate (habitability)	4L	-Tunnel vision (lack of big picture)
2M	-No accounting of performance	4M	-“Something is not right”
2N	-Conflicting conventions; stereotypes	4N	-Pattern matching bias
2O	-Poor equipment layout; poor access	4O	-Social preference
2P	-Fear of consequences of error	4P	-Easily bored
2Q	-Mistrust among work groups	4Q	-Close-in-time cause-effect correlation
2R	-Meaningless rules	4R	-Difficult to see own errors
2S	-Unavailable parts or tools	4S	-Frequency & similarity bias
2T	-Acceptability of “cook-bookings”	4T	-Overload bias
2U	-“Rule book” culture	4U	-Imprecise physical actions
2V	-Equipment sensitivity (inadvertent actions)	4V	-Limited attention span
2W	-Lack of clear strategic vision or goals	4W	-Spatial disorientation
2X	-Identical & adjacent displays or controls	4X	-Physical reflex
2Y	-Out of service warning systems	4Y	-Anxiety (involving uncertainty)
2Z	-Nuisance alarms		

Common Error Precursor Descriptions

Task Demands	Description
1A–Time Pressure (in a hurry)	Urgency or excessive pace required to perform action or task. Manifested by shortcuts, being in a hurry, and an unwillingness to accept additional work or help others No spare time
1B–High workload (high memory requirements)	Mental demands on individual to main high levels of concentration; for example, scanning, interpreting, deciding, while requiring recall of excessive amounts of information (either from training or earlier in the task)
1C–Simultaneous, multiple tasks	Performance of two or more activities, either mentally or physically, that may result in divided attention, mental overload, or reduced vigilance on one or the other task.
1D–Repetitive actions/Monotony	Inadequate level of mental activity resulting from performance of repeated actions; boring Insufficient information exchange at the job site to help individual reach and maintain an acceptable level of alertness
1E–Irreversible actions	Action that, once taken, cannot be recovered without some significant delay No obvious means of reversing an action
1F–Interpretative requirements	Situations requiring “in-field” diagnosis, potentially leading to misunderstanding or application of wrong rule or procedure
1G–Unclear goals, roles, or responsibilities	Unclear work objectives or expectations Uncertainty about the duties an individual is responsible for in a task that involves other individuals Duties that are incompatible with other individuals
1H–Lack of or unclear standards	Ambiguity or misunderstanding about acceptable behaviors or results; if unspecified, standards default to those of the front-line worker (good or bad)
2A–Distractions/Interruptions	Conditions of either the task or work environment requiring the individual to stop and restart a task sequence, diverting attention to and from the task at hand
2B–Changes/Departure from routine	Departure from a well-established routine Unfamiliar or unforeseen task or job site conditions that potentially disturb an individual’s understanding of a task or equipment status
2C–Confusing displays/controls	Characteristics of installed displays and controls that could possibly confuse or exceed working memory capability of an individual Examples: <ul style="list-style-type: none"> • missing or vague content (insufficient or irrelevant) • lack of indication of specific process parameter • illogical organization and/or layout • insufficient identification of displayed process information • controls placed close together without obvious ways to discriminate conflicts between indications
2D–Work-arounds/OOS instrumentation	Uncorrected equipment deficiency or programmable defect requiring compensatory or non-standard action to comply with a requirement; long-term material condition problems that place a burden on the individual
2E–Hidden system responses	System response invisible to individual after manipulation Lack of information conveyed to individual that previous action had any influence on the equipment system
2F–Unexpected equipment conditions	System or equipment status not normally encountered creating an unfamiliar situation for the individual

Human Performance Considerations for Procedures
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Task Demands	Description
2G–Lack of alternative indication	Inability to compare or confirm information about system or equipment state because of the absence of instrumentation.
2H–Personality conflict	Incompatibility between two or more individuals working together on a task causing a distraction from the task because of preoccupation with personal differences
3A–Unfamiliarity with tasks/First time	Unawareness of task expectations or performance standards First time to perform a task (not performed previously; a significant procedure change)
3B–Lack of knowledge (mental model)	Unawareness of factual information necessary for successful completion of task; lack of practical knowledge about the performance of a task
3C–New technique not used before	Lack of knowledge or skill with a specific work method required to perform a task
3D–Imprecise communication habits	Communication habits or means that do not enhance accurate understanding by all members involved in an exchange of information
3E–Lack of proficiency/inexperience	Degradation of knowledge or skill with a task because of infrequent performance of the activity
3F–Indistinct problem-solving skills	Unsystematic response to unfamiliar situations; inability to develop situations; inability to develop strategies to resolve problem scenarios without excessive use of trial-and-error or reliance on previously successful solutions Unable to cope with changing plant conditions
3G–“Unsafe” attitude for critical tasks	Personal belief in prevailing importance of accomplishing the task (production) without consciously considering associated hazards Perception of invulnerability while performing a particular task Pride; heroic; fatalistic; summit fever; Pollyanna; bald tire
3H–Illness/Fatigue	Degradation of a person’s physical or mental abilities caused by a sickness, disease, or debilitating injury Lack of adequate physical rest to support acceptable mental alertness and function
4A–Stress	Mind’s response to the perception of a threat to one’s health, safety, self-esteem, or livelihood if task is not performed to standard Responses may involve anxiety, degradation in attention, reduction in working memory, poor decision-making, transition from accurate to fast Degree of stress reaction dependent on individual’s experience with task
4B–Habit patterns	Ingrained or automated pattern of actions attributable to repetitive nature of a well practiced task Inclinations formed for particular train/unit because of similarity to past situations or recent work experience
4C–Assumptions	Suppositions made without verification of facts, usually based on perception of recent experience; provoked by inaccurate mental model Believed to be fact Stimulated by inability of human mind to perceive all facts pertinent to a decision
4D–Complacency/Overconfidence	A “Pollyanna” effect leading to a presumption that all is well in the world and that everything is ordered as expected. Self-satisfaction or overconfidence, with a situation unaware of actual hazards or dangers; particularly evident after 7-9 years on the job Underestimating the difficulty or complexity of a task based upon past experiences

Task Demands	Description
4E-Mind-set	<p>Tendency to “see” only what the mind is tuned to see (intention): preconceived idea</p> <p>Information that does fit a mindset may not be noticed and vice versa; may miss information that is not expected or may see something that is not really there; contributes to difficulty in detecting one’s own error(s)</p>
4F-Inaccurate risk perception	<p>Personal appraisal of hazards and uncertainty based on either incomplete information or assumptions</p> <p>Unrecognized or inaccurate understanding of a potential consequence or danger</p> <p>Degree of risk-taking behavior based on individual’s perception of possibility of error and understanding of consequences</p>
4GMental shortcuts (biases)	<p>Tendency to look for or to see patterns in unfamiliar situations; application of rules of thumb or “habits of mind” (heuristics) to explain unfamiliar situations</p> <ul style="list-style-type: none"> • confirmation bias • frequency bias • similarity bias • availability bias
4H-Limited short-term memory	<p>Forgetfulness; inability to accurately attend to more than 2 or 3 channels of information (or 5 to 9 bits of data) simultaneously</p> <p>The mind’s “workbench” for problem-solving and decision-making; the temporary, attention-demanding storeroom we use to remember new information</p>

The information below is included in this procedure for ease of use. The source of this information is ESH-004, Job Hazards Analysis.

HUMAN PERFORMANCE TOOLS FOR AN ENHANCED PRE-JOB BRIEF

Ensure Situational Awareness: All individuals must understand the job requirements, the equipment conditions, and the work environment before starting work.

Perform a Job-Site Review: Take the time necessary to get all workers acquainted with the immediate work area.

Promote a Questioning Attitude: Encourage workers not to make assumptions or use opinion instead of fact. When any doubt exists, the work is unsafe.

Remind to Stop when Unsure: Workers should seek accurate information about the work situation before proceeding with an activity. If a question arises or uncertainty exists, every person has the responsibility and authority to stop work.

Practice Effective Communication: Issue instructions face-to-face, have the instructions repeated back to the original instructor, and correct any misunderstandings.

Conduct Task Preview using SAFER:

1. **Summarize** the critical steps. Ask “What are the actions that if performed improperly, will cause irreversible harm to equipment or people?”
2. **Anticipate** errors for each critical step and relevant error precursors. Ask “What could go wrong?”
3. **Foresee** probable and worst-case consequences should an error occur during each critical step. Ask “What’s the worst that could happen?”
4. **Evaluate** controls or contingencies at each critical step to prevent, catch, and recover from errors, and to reduce their consequences. Ask “How do we prevent those errors or consequences from happening?”
5. **Review** previous experience and lessons learned relevant to the specific task and critical steps. Ask “Have we done anything like this before?”

HUMAN PERFORMANCE TOOLS FOR AN ENHANCED POST-JOB BRIEF

During a Post-Job Brief, ask the following questions:

- Were there any surprises? Was the task accomplished with expected results?
- Were procedures or work packages accurate? Is this the way the job should be performed in the future?
- What specific errors occurred during the task? What job-site conditions were associated with errors, flawed defenses, or near misses?
- Was the supervisor aware of conditions (precursors) that, if uncorrected, could lead to human error the next time the task is performed?

- Were planning and scheduling optimized to reduce the potential for human error?
- Were job-site resources and information sufficient?
- Was training for the job appropriate and effective?
- Were work processes efficient and supportive?
- Were any lessons learned from this job that should be recorded and passed on to others?
- Did supervision provide needed support and appropriate guidance when necessary?