TEMPORARY CHANGE REQUEST

TCR NO. TCR-ESH-016, R3-001

The Temporary Change Request (TCR) Form is to be used to process urgent or minor changes for PPPL Policies, Organization/Mission Statements and Procedures. The TCR should be used when changes are:

1) urgent, and can not wait the 2-4 week period for Department Head review/comment, or

2) minor, and do not warrant Department Head review.

Person Requesting Change: Richard Borusovic

Department Name: ES&H **Phone Ext:** 3740

Document Number: ESH-016 **Revision No.:** R3-001

Document Title: Control of Hazards/Energy Sources-Safing/Lockout/Tagout

Reason for change: To clarify the use of uniquely identified lockout locks. These locks should not be used for purposes other than lockout/tagout. They should be only used for locking out equipment or attached to a lock box.

Change description: (Summarize and attach changed pages, with changes clearly indicated)
On Attachment E Added: **These locks should not be used for purposes other than lockout/tagout. They should only be used for locking out equipment or attached to a lock box.**

1. Does this TCR significantly alter the intent or scope of the document? **YES:**__ **NO:X**____

2. Does this TCR significantly impact **ES&H**? **YES:**____ **NO:X**____

If 1 or 2 is **YES**, Explain why the changes should not be routed for Department Head review:

_____

Jerry Levine (signature on file) **3/4/04**
Department/Division Head Approval **Date**

Jack Anderson (signature on file) **3/4/04**
Head, ES&H and Infrastructure Support/designee **Date**

Release/Effective date of this TCR: **March 10, 2004**

Incorporate this TCR into next revision of this document? **Yes X** **No**_____

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PPPL	PRINCETON PLASMA PHYSICS LABORATORY	PROCEDURE	No. ESH-016 Rev 3 page 1 of 4

Subject:	Effective Date:	Initiated by:
Control of Hazards/ Energy Sources - Safing/Lockout/Tagout	November 2, 2001	Head, Engineering and Technical Infrastructure
	Supersedes: Rev. 2, dated 5/1/97 and TCR-ESH-016,R2-001	Approved: Director

Introduction

This procedure describes the general principles and requirements for the control of hazards/energy sources via safing/lockout/tagout. A detailed definition of safing/lockout/tagout is included in Attachment A.

Applicability

This procedure applies to all activities that bring personnel into close proximity or contact with an area, room, device, system, etc., that is or can be hazardous. The hazards include, but are not limited to: Chemical, Cryogenic, Electrical, Hydraulic, Mechanical, Pneumatic and Thermal.

Attachments

A. Requirements for Safing
B. Single Hazard Safing
C. Transfer of Responsibility
D. Contents of a Safing/Lockout/Tagout Procedure
E. Lock and Tag Specifications
F. Logging Format
G. Temporary Removal of Tags
H. Removal of Locks and Tags by Individuals Other Than Those Who Placed Them

Reference Documents

29CFR1910.147	Control of Hazardous Energy (Lockout/Tagout)
29CFR1910.333	Electrical- Safety Related Work Practices
DOE Order 5480.19	Conduct of Operations, Attachment I, Chapter IX, Lockout/Tagout
P-038	Control of Hazardous Energy Sources
ESHD 5008	Section 2, General Requirements
ESH-001	Use of Safety, Accident Prevention and Equipment Protection Tags
DOE-STD-1030-96	Guide to Good Lockout/Tagout

Definitions

Affected Worker — An individual who will perform work on a system or equipment which has been safed by an authorized employee.

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Authorized Employ An individual with the overall responsibility for the safing, locking out and tagging out of a system. This individual must know the system, its hazards, and the means of safing and isolation of the hazards.

Hazard/Energy Isolating Device A hazard/energy barrier that prevents the transmission or release of the hazard/energy by insulating or conducting it away from personnel. Examples of barriers are:

- Circuit breakers
- Line valves
- A blank flange
- Application of adequate grounds
- Breaker Rack-out
- Disconnect Switch
- Removal of conductors or fuses
- Venting of a pilot line

Lock box A box in which PPPL safing Lock keys, safety interlock system keys, and danger tag stubs may be kept. It is a convenient way of permitting piggy-backing on an implemented procedure.

Procedure

A. Implementation of Lockout/Tagout

Note: If there is only one hazard and it can be isolated by one lockable energy barrier, the process may be a non-group lockout/tagout. Go to Attachment B.

Responsibility	Action
Authorized Employ	1. Identifies the hazards.
	2. Identifies the appropriate devices to isolate the hazards. See Attachment A.
	3 Documents the lockout/tagout. See Attachment F for the suggested lockout/tagout logging information. This step need not be done in sequence.
	4. Goes to Attachment C if there is a need to transfer the responsibility for a group lockout/tagout.
	5. Obtains or prepares a safing/lockout/tagout procedure. The procedure may be stand-alone or it may be imbedded in another procedure such as an operations, maintenance, inspection etc., procedure. The contents of a safing/lockout/tagout procedure are shown in Attachment D.
	6. Notifies affected workers of the intention to safe a system.
	7. Assures the configuration of the energy/safety barriers
	8. Assures the correct application of locks and tags on the energy/safety barriers, in parallel with step 7.

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9. Locks the keys and tag stubs in a lock box and maintains control over lock box key. Acceptable means of controlling the lock box key include key rings, key cabinets, lock boxes or desk drawer (it is not necessary to lock the key in its storage location). For lockouts that are of short duration, less than a day, the stubs and keys may be kept on the person of authorized employee. See Attachment E.

10. Verifies that the system/equipment has been placed in a safe state. See Attachment A.

11. Notifies affected workers that the system is safe and work may begin.

Affected Worker

12. Performs required work on the safed system and removes tools and debris when the work is complete.

Authorized Employ

13. Goes to Attachment G, if any part of the lockout/tagout must be temporarily removed for testing or repositioning.

14. Notifies affected workers of the intention to return the equipment/system to an unsafe state and personally assures that individuals are clear and the area is free of debris, tools, etc.

15. Assures the removal of all locks and tags and the restoration of the system to the unsafe state. If the individual who placed the tags is off site, the individual should be asked to return. If the individual is not available, go to Attachment H.

WARNING **Locks and/or tags are placed to protect life, environment and equipment. Unauthorized removal or tampering with a locked/tagged energy isolation device or removal of a safing lock or danger tag is cause for disciplinary action or dismissal. Whenever possible, a lock/tag should be placed in a location that precludes removal of the energy isolation device.**

B. Administrative Requirements for the Safing/Lockout/Tagging System

Responsibility	Action
Certification and Training	1. Provides awareness training to all Laboratory personnel via the basic safety training program (GET Module II) every two years.
Managers	2. Ensure compliance with the requirements of the Lockout/Tagout program.

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Supervisors

3. Assures that authorized employees are trained and that the sub-contractors are trained as required via small group meetings. Provides retraining [consistent with the requirements of 29 CFR 1910.147(c)(7)(iii)], for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures.

   Additional retraining shall also be conducted whenever an inspection reveals, or whenever there is reason to believe that there are deviations from or inadequacies in the employee's knowledge or use of the Lockout/Tagout procedures. The retraining shall reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary.

4. Conduct annual interviews of authorized employees concerning Lockout/Tagout implementation. The interview should be documented either in a log book or on a procedure.

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Safing

Safing is a process of rendering a subject system/equipment safe to work on by removing the energy source as well as any accumulated energy and positively preventing re-energization. The key elements of a safing process are:

Identification of hazards
Identification of energy/safety barriers
Configuration of energy/safety barriers
Locking and tagging the barriers
Verification of correct placement of locks and tags
Verification that a safe state has been achieved

Lockout/Tagout is the application of safety locks and danger tags to the energy and/or safety barriers used in a safing process to ensure that they cannot change state and thus compromise personnel safety.

Identifying the steps of a safing process requires a thorough knowledge of the entity to be safed and its associated hazards and therefore may only be performed by an authorized employee.

Because of the complex and unique nature of many PPPL systems, it is not practical to define a generic safing process. Instead, relevant safety requirements of ES&HD 5008 and DOE STD 1030-92 are reproduced or referenced in this document so that authorized employees, who know the hazards of their systems, can define a safing process that complies with PPPL safety requirements.

Electrical

Systems or component that operate at voltages over 50 Volts shall be positively de-energized (electrically safe work condition) as the primary method of protecting employees from the hazards of live parts. (ES&HD 5008, Sect.3.3.2)

An Electrically Safe Work Condition shall be achieved when:

1. Determine all possible sources of electrical supply to specific equipment has been disconnected from all sources of energy operated over 50 volts. Check applicable up-to-date drawings, diagrams, and identification tags.
2. After properly interrupting the load current, open the disconnecting device(s) for each source.
3. Where possible, visually verify that all blades of the disconnecting devices are fully open or that draw-out type circuit breakers are withdrawn to the fully disconnected position.
4. After disconnecting means has been visually checked, lockout and safety tagout devices shall be installed in accordance with documented and approved PPPL procedure ESH-016 to prevent a change of state.
5. Use an adequately rated vaoltage detector to test each phase conductor or circuit part to verify they are de-energized. Before and after each use, determine that the voltage detector is operating satisfactorily.

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6. Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being de-energized could contact other exposed energized conductors or circuit parts, apply ground connecting devices rated for the available fault current.
7. Circuits 480/277 V ac/ 251-600 V dc and over shall be shorted and grounded with an approved safety ground.
8. Circuits greater than 600 volts shall have at least one visible break not susceptible to arc-over. See ES&HD 5008, Section 2,Chapter 4, paragraph 4.18.
9. Equipment parts, circuits and energy sources which have not been positively de-energized in accordance with steps 1 thru 8 above shall be considered energized.

Verification of a Safe State: Testing to "0" volts with an instrument that has been verified operational before and after each use.

The degree of disconnection required is a function of the operating voltage of the system or component being safed, as follows (ES&HD 5008, Sect. 2, Chap. 4):

High Voltage (Greater than 600 V ac or dc) - Energized parts of high-voltage equipment and circuits shall be isolated from surfaces exposed to personnel by two independent energy barriers or an energy barrier and a safety barrier.

Low Voltage (Equal or less than 600 V ac or dc and below) - by one energy or safety barrier.

A energy barrier prevents the transfer of energy between the source and personnel and can be of the insulating or conducting type.

A safety barrier restricts access to energy sources by personnel.

If a lock can not be installed, the equivalent level of safety may consist of a tag on the barrier that can not be locked plus a second tagged barrier.

The above are excerpts from ES&HD 5008 and are reproduced here to facilitate description of the safing process and is not to be considered as a substitute for understanding those sections of ES&HD, Section 2, Electrical Safety, that are relevant to the work performed by each employee.

Mechanical

Piping Systems Practices (from DOE-STD-1030-96, Para. 4.2.3.3):

Systems, portions of systems, and components that operate at temperatures or pressures above ambient should be vented and, if necessary for the performance of work, drained or cooled. Whenever possible, an atmospheric drain and/or vent between the component to be worked and

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sources of pressure to the component should be tagged in the open position to depressurize the equipment and to accommodate thermal expansion or contraction.

Systems that operate at high temperatures (e.g., greater than 200 degrees F for a water system) or high pressures (e.g., greater than 500 psig), should be isolated from the work area by two closed valves in series, and a telltale vent or drain valve between the isolation valves should be opened. Systems containing hazardous materials should be isolated by two valves in series and the isolated section should be purged. When any of these conditions exists and two valve isolation cannot be provided, specific management approval should be obtained before performing work.

Verification of a Safe State: Venting, purging or draining constitutes verification of a safe state. Verifying de-pressurization by breaking flanged connections, loosening valve bonnets, removing instrument tubing, or other similar actions should be avoided unless no other means for verifying de pressurization exists. Strict supervisory control and advanced planning are required if these methods are used."

Valve Practices (from DOE-STD-1030-96, Para. 4.2.3.4):

Pneumatically operated valves and solenoid-operated valves may be used as isolation points if the following conditions are met:

- A pneumatically or solenoid-operated valve that fails open is not considered closed for lockout/tagout purposes, unless its power (air) supply is isolated and the valve is forcibly closed with an installed jacking device or gag. The valve and its power (air) supply isolation points must be tagged.

- A pneumatically or solenoid-operated valve that fails closed is not considered closed for lockout/tagout purposes, unless its power (air) supply is isolated and the valve is visually confirmed to be closed. The valve and its power (air) supply isolation points must be tagged.

A pressure operated valve or check valve cannot be used as an isolation boundary valve unless it is physically restrained in the required position by a gagging device approved by the safety group.

A motor operated valve may be used as an isolation boundary point provided that, after the valve has been positioned as required by the lockout/tagout, its power supply is isolated and tagged.

The local control point (e.g., hand wheel, manual operator) for a motor or pneumatically operated valve must be locked/tagged when the valve is used as an isolation boundary point. Any remote control points (e.g., control switch, reach rods, etc.) should also be tagged.

General:

Safing must isolate all hazards. Consider the isolation of a pump motor for bearing maintenance. The safing "should also include shutting and tagging the pump suction and discharge valves to prevent possible rotation from fluid flow." (DOE-STD-1030-96, Guide to Good Lockouts and Tagouts)

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If energy/safety barriers are applied to high voltage, high temperature or high pressure equipment, those steps must be done with a safety watch (as described in ESHD 5008).

Any person who is required to work on safed equipment may attach a lock/tag, but their lock/tag must be removed at the end of each day and on completion of their work.

Authorized employees may permit sub-contractors, for whom they are responsible, to use the sub-contractor's lockout/tagout procedures, if the procedures are consistent with this procedure.

The above requirements for safing and verification are not exhaustive and are intended to provide guidance to authorized employees in developing safing plans for various systems. If there are any questions about how to safe a particular system, the safety group should be consulted.

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For the process to be considered a non-group lockout/tagout, all of the following requirements must be met.

- The machine or equipment has no potential for stored or residual energy or re-accumulation of stored energy after shut down which could endanger affected workers.
- The single energy source can be readily identified and isolated and will completely de-energize and deactivate the machine or equipment.
- A single lockout device will achieve a locked-out condition.
- The safing barrier is under the exclusive control of the authorized employee performing the service.
- The work does not create hazards for other employees.
- PPPL has had no accidents in the utilization of ESH-016 involving the unexpected activation of equipment during servicing

If all of these conditions can <u>not</u> be met, the process is a group lockout/tagout. Go to procedure step A1.

If all of these conditions can be met, a written procedure is not required. The process is described below. The authorized employee:

1. Notifies affected employees of intent to de-energize the equipment.
2. Operates/installs the energy barrier.
3. Locks and tags using a standard or a picture tag (see Attachment E).
4. Verifies the safe state.
5. Locks the keys and tag stubs in a lock box and maintains control over lock box key. See Section A, step 9.
6. Services the equipment removing all tools and debris when finished.
7. Notifies affected employees of intent to remove the energy barrier.
8. Removes the lock, tag and energy barrier.

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The following are the requirements for the transfer of responsibility between authorized employees:

- The employment of transfer of responsibility must be approved by the cognizant division head who will ensure that the use of this feature is necessary and that it is being properly implemented.
- Transfer of responsibility can only occur between authorized employees.
- The names of the authorized employees must appear on the tags and in the procedure.
- At any given time only one person can be the "active" authorized employee.
- The LO/TO log or the procedure must be updated on transfer of responsibility to show the name of the current "active" authorized employee.
- The means to be used for communicating status to an oncoming authorized employee must be stated in the procedure.
- A lock box must be used and the "active" authorized employee is the custodian of the lock box key. When transferring responsibility between non-adjacent shifts, the lock box key must be kept in a secure location (e.g., security).

The essential element in the transfer of responsibility between authorized employees is the communication of status.

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The following information must be included in procedures involving lockout/tagout.

1. A description or diagram of the system.

2. The sequence of activities necessary to place a system/equipment in a safe state.

3. The name of the authorized employee(s) who will perform the isolation of the energy sources. When there are multiple authorized employees, one must function as a coordinator and all must lock and tag the lock box.

4. The methods to be used to verify that the equipment/system are in a safe state.

5. When the process includes the transfer of responsibility to other authorized employees, the procedure must include the following information:

    a. The names of the other authorized employees

    b. The means to be used to communicate status to an oncoming authorized employee.

6. The sequence of activities necessary to restore a system/equipment to an unsafe state.

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Danger Tags for Group Lockout/Tagout

Danger tags should be placed on the lockout mechanism along with the lock. If a lock can not be used, the tag must be placed where the lock would have been placed. The tag should include the following:

- The tag number
- The name of the authorized employee
- The device on which it is attached
- The procedure number under which it is placed
- The phone number of the authorized employee
- The date of the tag placement

The tag stub should include the following:

- The tag number
- The device on which it is attached

Danger Tags for Non-Group Lockout/Tagout

In lieu of using a standard danger tag, a danger tag with the authorized employee's photo may be used. The tag should include the following:

- The name of the authorized employee
- The phone number of the authorized employee
- The picture of the authorized employee
- The device being locked out

Lock Specifications

The standard lock for lockout is uniquely identified by the red band around the bottom. This lock is the standard metal "Masterlock" as shown below. Where space and weight of this lock is a consideration a lighter lock ("Masterlock #410, Red color, not shown below) is available in the stockroom as an alternate lock. *These locks should not be used for purposes other than lockout/tagout. They should be only used for locking out equipment or attached to a lock box.* TCR-ESH-016, R3-001

Safety interlocks [e.g., kirk locks] may be used, in lieu of the standard lock, in the safing process when the device that is kirk-locked is an energy isolating device and the removal of the key prevents operation. When a kirk lock is employed in the safing process, a danger tag must be affixed to the kirk lock or the operating handle of the device.

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A log book is required for all lockout/tagouts and should include the following information:

Tag number*

Authorized employee(s)

Procedure number

Date of tag application

Device identification*

Date of tag removal

Comments

* The tag numbers and device identifications should be documented in a log if they are not documented on a procedure.

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If the lockout tagout must be temporarily removed (e.g., for testing or repositioning) the following steps must be completed:

Authorized Employee

1. Notifies affected workers of the intention to return the equipment/system to an unsafe state and personally assures that individuals are clear and the area is free of debris, tools, etc.

2. Removes the locks, tags and energy isolating devices and annotates the steps on the procedure.

3. Proceeds with testing or positioning

4. Repeats steps A.6 through A.10 in the procedure.

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If the lockout/tagout must be cleared and the authorized employee is not available, the following steps must be completed:

Supervisor	1. Uses the existing safing procedure and a walk down of the system with the safety group representative, to determine if the lockout tagout can be safely cleared.
	2. Annotates the existing safing procedure or writes a memo listing the steps taken to ensure the safe clearance of the lockout/tagout.
Safety Group Representative	3. Documents concurrence by signing the annotated procedure or written memo along with the supervisor.
Supervisor	4. Assumes the responsibility of the authorized employee, upon the concurrence of the safety group representative, and returns the system/equipment to the unsafe state.
	5. Notifies affected workers of the intention to return the equipment/system to an unsafe state and personally assures that individuals are clear and the area is free of debris, tools, etc.
	6. Assures the removal of all locks and tags and the restoration of the system to the unsafe state.
	7. Notifies placing individual that removal of safing lock and tag occurred when the placing individual returns to the Laboratory.

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