TEMPORARY CHANGE REQUEST

TCR NO. ESH-004, R6-001
(e.g., TCR-ENG-021,R0-001)

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: William Slavin **Phone Ext:** 2533

Department Name: ES&H

Document Number: ESH-004 **Revision No.:** 6

Document Title: Job Hazard Analysis

Reason for change:
1. Clarify the difference between voluntary use of N95/Dust Mask use and the required use of respirators per DOE Assessment
2. Organizational name change from ESH&S to ES&H

Change description: (Summarize and attach changed pages, with changes clearly indicated)
On JHA Form, added new category for "Respiratory Hazards" with associated control measures"
On page 13 in body of procedure under definitions, added description of "Respiratory Hazards" category.
Changed ESH&S to ES&H in several locations throughout procedure

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:

William Slavin **5/29/15**
Department/Division Head Approval **Date**

John DeLooper **6/2/15**
Head, Best Practices and Outreach/designee **Date**

Release/Effective date of this TCR: **6/3/15**

Incorporate this TCR into next revision of this document? **YES:**X **NO:**

Subject:	Effective Date:	Initiated by:
Job Hazard Analysis	February 4, 2015	Head, ES&H Department
	Supersedes: Revision 5 dated, March 25, 2014	Approved: Director

ESH-004,R6-TCR-001

Management System (Primary): 09.00 ESH and Integrated Safety Management
Management System Owner: Deputy Director for Operations
Management Process: 09.01 Environment, Safety and Health Management
Process Owner: Head, ES&H Department
Sub-Process: 09.01.12 Job Hazard Analysis
Sub-Process Owner: Head, Safety Division
Subject Matter Experts (SMEs): Head, ES&H Department; Head, Safety Division

Applicability

This procedure applies to activities at C and D-Sites of the Laboratory whether performed by PPPL employees, subcontractors, collaborators, students or visitors. Identification of existing and potential workplace hazards and evaluating the risks of associated worker injury or illness is a DOE, OSHA and PPPL requirement.

Introduction

Line managers and workers are required to identify existing and potential workplace hazards and to evaluate the risk of worker injury or illness associated with job tasks. A Job Hazard Analysis (JHA), as described in this procedure, is an effective way to accomplish this. An approved JHA is required to analyze or review designs of new facilities and modifications to existing facilities and equipment; operations and procedures; and equipment, product, and service needs. Unlike NEPA reviews (see procedure ESH-014), which identify general Environment, Safety and Health (ES&H) issues and control measures in the early stages of proposed activities, the JHA should be performed at the task level when the activity has matured to the point where detailed steps and procedures have been identified. The JHA should be considered a tool, a device designed to help the worker perform his/her job safely. The form presented in this procedure (Attachment 1) was written specifically to assist workers in identifying and controlling hazards associated with jobs and activities at PPPL. Be aware, however, that hazards may occur at any time from unanticipated sources, and that no JHA is a substitute for conscientious workers and good, safe work practices. The JHA shall be signed by the Responsible Line Manager (RLM), the supervisor, or their designee for the task, shop, or procedure activity.

A Job Hazard Analysis must be completed when:

- A new job or activity with potential hazards* is being planned or performed, or
- A new hazard is introduced to a project or activity* that was not previously reviewed under a Job Hazard Analysis, or
- The Cognizant Individual (COG) or Responsible Line Manager (RLM) indicates that it is a requirement. [This can be indicated verbally or on a Work Planning form, Work Order, Work Request form, procedure, or other means], or
- A line worker involved with the project requests that a JHA be completed, or
- PPPL Safety Division (Safety) requests or initiates the JHA.

* Some activities are inherently low hazard and are routinely encountered and/or accepted by the general public. Such activities would not typically require completion of a JHA unless required by the COG or Responsible Line Manager (RLM). Examples of low hazard activities are provided in Attachment 2 as guidance. The COG, and ultimately the RLM, make the determination when a JHA is to be completed by applying a graded approach based on risks involved with the work.

Routine activities that involve hazards also require a JHA to be completed. A job that is performed on a regular basis may have a single JHA prepared to cover all occurrences of that job.

The JHA should be reviewed prior to the commencement of the work, and all personnel involved must be briefed on the contents of the JHA. Any new hazards discovered or identified for that job must be listed on the JHA.

The Job Hazard Analysis form is a valuable tool to assess work. A JHA begins with a hazard inventory. The JHA and inventory can be generated by line workers and/or the COG, and might include discussions with other workers and Safety. Inspection of the job location is always appropriate. Review of project or facility documentation may also be necessary.

When serious or unusual hazards exist, a full and more detailed Job Hazard Analysis for that particular activity must be performed and PPPL Safety Division must be consulted. Work must not proceed until job hazards are appropriately abated in accordance with the ES&H Manual (ESHD 5008).

All completed JHA forms must be kept for a minimum of one year after completion of the work (as per National Archives and Records Administration (NARA) records requirements). The forms may be kept with the work package or work order, kept by the division/department, filed in the Ops Center or sent to PPPL Safety Division for storage. Storage may be either paper or electronic.

JHA forms written for routine or ongoing activities shall be reviewed annually for correctness. If a JHA was created to cover a written procedure, the JHA must be reviewed when the procedure is reviewed. A copy of the JHA should be attached to the procedure for this purpose. A procedure may also be used to identify the hazards and controls associated with certain steps or portions of that procedure. In this case,

the JHA must include a reference to the procedure to show the alternate location of the information. Reviews shall be documented with a dated, signed form. An existing JHA may be annotated with a new date and signature or initials. Workers must be briefed on the JHA and should initial the form after each annual review. JHA's for ongoing activities should be reinitiated every three years to ensure the use of current forms and to allow for further review cycles.

The JHA is considered a living document throughout the duration of the job or activity that it covers. For jobs of extended duration, or which include different phases, daily plan-of-the-day briefings should be held with the workers to review each day's planned tasks and the associated hazards and control measures. If the scope of work should change, if new hazards are identified or are introduced, or if new control measures are to be utilized, the JHA must be corrected to address these changes. If changes are made to an associated procedure (such as through an MPC), the JHA must be reviewed and modified if necessary to address new hazards or controls. All affected workers must be briefed on the changes to the JHA.

This procedure includes directions for performing a Job Hazard Analysis utilizing the JHA form (Attachment 1). Customized JHA forms may be developed to suit the needs of the project, department or facility where the work is to be performed. Customized forms must be reviewed by PPPL Safety Division prior to use. JHA forms shall list all of the Personal Protective Equipment (PPE) required for performing the job safely, and therefore will act as certification of Hazard Assessment as required by OSHA (29 CFR 1910.132).

It is very important to share the results of the Job Hazard Analysis with workers. Workers must be informed of foreseeable hazards and the required protective measures prior to commencement of work. A pre-job briefing of the hazards and controls identified by the JHA is a recommended method of accomplishing this.

The JHA form and procedure may also be used for improving the safety of personnel engaged in off-site activities, such as work at other DOE or international laboratories. Refer to Policy P-085, "Environment, Safety and Health Policy for Off-site Work," for more information.

To improve the effectiveness of the pre-job brief, Human Performance tools may be included to help anticipate, prevent and catch errors related to hands-on work. Several methods and tools for performing an "enhanced" pre-job brief are included in Attachment 3 of this procedure.

Reference Documents

DOE Order 440.1A	Worker Protection Management for DOE Federal and Contractor Employees
ESH-014	NEPA Review System
ENG-032	Work Planning Procedure
29 CFR 1910.132	OSHA Personal Protective Equipment Standard
INPO 06-002	Institute for Nuclear Power Operations (INPO), "Human Performance Tools for Workers – General Practices for Anticipating, Preventing, and Catching Human Error During the Performance of Work," April 2006.

Procedure

Responsibility	Action
Cognizant Individual, Accountable Technical Individual (ATI), or Other Knowledgeable Individual	1. Begin the Job Hazard Analysis process by contacting line personnel knowledgeable about the job, review pertinent documentation, and/or inspect the areas where the work is to be performed. For purposes of this procedure, this person will be the Author of the JHA.
	2. Complete a Job Hazard Analysis (JHA) form using Attachment 1, as follows: (a) List any applicable Reference numbers such as Work Order Number, Work Permit Number, or Procedure Number. (b) Enter the name of the individual completing the JHA, the date the form was originated, and the section, group, branch, project, etc., who will be performing the job. (c) Describe the types of duties and activities to be performed and indicate the location~~s~~ (room~~s~~, building~~s~~, etc.) where the job will be taking place. (d) Using the checklist, identify all known and potential hazards that may occur due to the work activity, the location of the work, and other work in the area that may affect the job being performed. When using the checklist, use the space in the hazard box to identify the source(s) of the hazard, such as the names or types of chemicals, the type of ergonomic hazards, the tools being used, etc. (e) For every hazard identified, a control measure must be specified. In the column marked "Control Measures", list the control next to the hazard by either writing the control in the space provided, using the provided check boxes, or selecting a control measure from the menu list on the back side of the form. If using the menu, write the number(s) of the controls in the column at the far right. In some cases, menu items will need to be clarified, such as indicating which type of glove is being used (leather, Kevlar, neoprene, etc.). (f) Use the comments box at the end of the checklist to clarify or add any information as necessary.
Cognizant Individual, Accountable Technical Individual (ATI), or Other Knowledgeable Individual	3. Obtain a review of the JHA by PPPL Safety Division, if appropriate. NOTE: Review of the JHA by Safety is not always mandatory, but must be obtained if so designated by the author of the JHA, the Department, the Project or the RLM. A review by Safety should be requested if the job has the potential for unusual or serious hazards, difficult control measures, or other situations where Safety would normally be consulted. Any JHA written where "Working Alone" will take place MUST be reviewed

and approved by Safety prior to the start of the activity.

PPPL Safety Division (Safety)

4. Review JHA forms when requested or required. Consult ES&H and other safety professionals, as appropriate. Ensure that hazards are identified and appropriate control measures indicated. Make any necessary changes to the form in conjunction with the JHA author. Sign the form, return it to the author of the JHA, and provide appropriate explanations of hazards and controls.

Writer (Author) of the JHA

5. Obtain the RLM's, supervisor's or their designee's signature for the job being surveyed [Note: The list of approved RLMs is available on the Engineering & Infrastructure Department home page.]

Supervisor or Responsible Line Manager (RLM) or designee

6. Review and approve the JHA after ensuring that hazards are identified, are appropriate, and that control measures are indicated on the JHA form. Sign the form and return it to the JHA author.

Author of the JHA

7. Inform all affected workers of the hazards and ensure that the required protective control measures described within the approved JHA are implemented prior to commencement of work. Have all affected workers print their names on the JHA at the bottom of the back page, indicating that they have been briefed on the JHA. Be aware that other individuals working in the same location or upon connected systems may be affected by the work covered by the JHA and should be briefed regarding the contents of that JHA.
8. Keep the completed JHA at the job site in a readily accessible location for reference by workers on that or other jobs, and ensure that workers are aware of the location of the JHA.
9. Consider the need for periodic jobsite inspections by Safety, or other ES&H professionals. Request such inspections, as appropriate.
10. Provide necessary oversight to ensure that control measures described within the approved JHA are implemented.
11. Correct or modify the JHA if new hazards are identified during the course of the work activity, or if changes are made to the scope of work or the applicable procedure. All affected workers must be informed of the changes.
12. For jobs of extended duration, or which include different phases, daily plan-of-the-day briefings should be held with the workers to review each day's planned tasks and the associated hazards and control measures.

Author of the JHA

13. For phased work involving different groups of workers, conduct formal turnover (including post-job briefings) of the jobsite from one phase to the next, including a review of the JHA for currency, accuracy, and completeness, to communicate the status of the site and associated hazards to the incoming group. Post-job briefings should also be considered at the completion of a job to review lessons learned. When practical, use the questions in Attachment 4 to enhance the usefulness of the post-job brief.

14. Store written JHA forms for at least one year after the job has been completed.

Safety Division

15. Monitor the use and effectiveness of the JHA process in the field and provide feedback or intervention to organizations as appropriate.

TRAINING (SECTION REQUIRED FOR ALL PROCEDURES)

Author

1. Specifies the appropriate training methods and means (below) and obtains concurrence of the Management System Owner and the Management Process Owner.

A. Target Audience: Cognizant Individuals
Instructor: W. Slavin & J. Levine
Training Method:
XClassroom: Hazard Awareness Class

Frequency:
X Once only

Management System Owner or Designee

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.

RECORDS REQUIREMENTS SPECIFIC TO THIS PROCEDURE

Records Custodians must assure records are maintained as follows:

Record	Record Custodian	Location	Retention Time
Job Hazard Analysis Form	Head, Safety Division	Safety Division	Cut off when task is no longer performed Destroy 1 year after cut off [reference: NARA Request for Records Disposition Authority N1-064-11-002 (1.b)]

Attachments

Attachment 1 - JOB HAZARD ANALYSIS form
Attachment 2 - Examples of Low Hazard Activities
Attachment 3 - Human Performance Tools

Definitions:

Hazard: Any object, condition, or event likely to cause injury to personnel, harm to the environment, or damage to property

Serious Hazard: A hazard that has a moderate or high probability of causing severe damage to personnel, property or the environment.

Unusual Hazard: A hazard that the author of the JHA or the other workers is not familiar with or that has not arisen before at PPPL.

Author: The author or writer of the JHA should be the individual most knowledgeable about the job or activity to be performed. This person must enter their name in the "Written by" area of the JHA form. In most cases, this will be the senior technician directly involved in performing the work. In some cases, the JHA will be written by one individual (such as the ATI or procedure writer) and will be reviewed and modified by another individual (such as the person physically performing the work).

Human Performance Tools: Techniques to help anticipate, prevent, or catch errors before they cause harm to people, equipment or property.

Control Measures (Controls): Systems, practices or devices designed to reduce the risk of harm caused by a hazard. The most effective controls eliminate the hazard completely. Controls can be broken down into three main categories: Engineering, Administrative, and Personal Protective Equipment.

Engineering controls are installed systems designed to reduce or eliminate hazards, and are therefore the most preferred controls. Examples of engineering controls include exhaust ventilation systems (fume hoods, elephant trunks) that pull harmful chemical vapors out of the air, noise enclosures that reduce noise to safe levels, and substitution of a non-hazardous material or activity for a more hazardous one.

Administrative controls are work practices or procedures that help to reduce the hazards to safe levels. Examples include signs or barriers to keep people away from hazards, training to perform jobs safely, and rotating workers out of strenuous tasks for rest breaks.

Personal Protective Equipment (PPE) is worn directly on an individual to prevent harm. Normally, PPE does not reduce the hazard, but instead protects a single worker from being injured by that hazard. For this reason, PPE are the least favorable of all control measures. Examples of PPE include hard hats to prevent injury from falling objects, safety glasses to prevent injury from flying particles, and Kevlar gloves to prevent accidental injury from knife use.

Engineering controls are the most favorable, followed by Administrative controls, and lastly by PPE, which is considered the last line of defense. In many cases, a combination of any or all three of the control measures may be used to reduce a hazard and prevent injury. For example, when working with a hazardous chemical degreaser, the worker places the chemical in a fume hood (Engineering Control – exhaust ventilation) to reduce or eliminate the vapors that may be produced and inhaled by the worker. Since the worker must occasionally pour some of the material into a pan to degrease a part, the worker pours carefully and replaces the lid on the container when finished (Administrative Control – good work practices). However, the worker must put hands inside the hood to handle and pour the chemical degreaser, and has his/her face near the glass sash

of the hood so chemically resistant gloves and chemical splash goggles are worn in case of spill or splash from the chemical (PPE – gloves and eye protection).

Routine Activity: A job or task that is performed on a regular, repeated or ongoing basis. This job may have hazards as identified by the JHA and will not fall into the low hazard category. Although the job will be performed multiple times, multiple JHA forms may not be required. If a single JHA can and will cover all reasonably anticipated hazards associated with an activity, that single form will suffice. However, if circumstances change due to location, scope of work, or other situation that would introduce new hazards, the existing JHA must be modified, or a new JHA must be created.

> **Example:** The activity is changing light bulbs. Under normal circumstances, this activity routinely involves several hazards, including electricity and working on ladders. A single JHA could possibly cover all occurrences of this activity. However, if the activity is changing the light bulbs in one of the Test Cells, significant new hazards arise, including the possibility of ionizing radiation, crane use, and the need for fall protection. In this case, a separate JHA should be written.

HAZARDS AND CONTROLS GLOSSARY

This section is designed to aid the author of the JHA in understanding some of the hazards that may be encountered. It is by no means all-inclusive. Section and paragraph numbers from the ES&H Manual (ESHD 5008) are listed next to the hazard as a reference on where to find more information on the hazards and the appropriate controls.

Chemicals: *[Section 8, Chapter 1 and Chapter 2]* Chemicals may be found in many forms with many hazards. The three main forms of chemicals that are typically encountered are solid, liquid or gas. Common solids include: sheet stock metals, welding rods, grinding wheels, fiberglass insulation, resin beads, and lead bricks or solder. Common liquids include: degreasing agents, spray paint, lubricants, RTV, and cleaners. Common gases include: nitrogen, helium, sulfur hexafluoride, most refrigerants (freon), and oxygen. Hazards vary from substance to substance and from manufacturer to manufacturer. Always refer to the label on the container and the Material Safety Data Sheet (MSDS) or Safety Data Sheet (SDS) for information on the hazards and proper controls. Always consider using the least hazardous chemical available; in many instances, a non-hazardous or less hazardous alternative exists. Consider the application and need for the use of chemicals and whether a non-chemical method may be utilized. Consult with the Safety Division if questions arise regarding the safe use of chemicals. Consult with Environmental Services (ES) to determine what regulations apply for the eventual disposal of the chemicals and associated equipment.

Ergonomic Issues: *[No ES&H Manual Chapter yet]* The definition of ergonomics is the interaction of humans with the work environment. For practical purposes, ergonomics involves how well the tool or job is suited for a human to perform it. Excessive stress on the body will cause injury and must be avoided. Common issues to pay attention to for ergonomics include:

> Manual lifting of heavy weights: A single person should not lift more than 50 pounds. Repetitive lifting of lighter weights can have the same, or even more harmful effects than a single heavy lift. Utilize lifting aids such as winches, forklifts, hand trucks or another person, to reduce the stress on the body.

Repetitive Motion: continuous or frequently repeated motions of the body cause an injury called Cumulative Trauma Disorders (CTDs) or musculo-skeletal disorders (MSDs). One of the most common of these is Carpal Tunnel Syndrome. To use carpal tunnel syndrome as an example, repeated flexing of the wrist and fingers causes a swelling around the nerve passageway in the wrist (the carpal tunnel). This swelling can cause pain and numbness in the fingers. Similar injuries can occur with other portions of the body (such as "tennis elbow", muscle and back sprains). Use well designed tools, take frequent rest breaks, perform stretching exercises, and plan the work to avoid these injuries.

Body Position and stress: The human body is very flexible, but when forced into unnatural positions for long periods of time, injuries can occur. Working in cramped spaces, using poor posture, sitting in an uncomfortable chair, and maintaining a single position for a long time can be sources of this type of injury. Try to position the work to better fit the relaxed position of the body. Construct platforms to access hard to reach areas rather than working with arms overhead. Contact Safety for evaluations of workspaces and jobs that may create ergonomic concerns.

Ionizing Radiation: *[Section 10]* Ionizing radiation is tightly controlled by PPPL Health Physics (HP) through the use of Radiation Work Permits (RWP), training, signs and barriers. If working with any ionizing source, such as tritium, x-ray emitters, or other sources of alpha, beta, gamma or neutron radiation, be sure that HP is consulted in planning the activity, and that HP has provided a RWP (where required by Health Physics) and is monitoring the work as required.

Non-Ionizing Radiation *[Lasers-Section 3, Magnetic Fields (EMF), Microwaves & RF-Section 4]* Non-ionizing radiation arrives from four main sources at PPPL.

Most common are lasers that can be found in experimental areas, as laser pointers, or in laser levels. Pay attention to signs when working around existing laser sources. If beginning a project involving the use of a higher-powered laser, consult with the Safety Division Laser Safety Officer.

Magnetic fields occur around high voltage sources and magnets used in experiments. Most of these will only have an effect on pacemaker wearers, so signs should be posted appropriately.

Radio Frequency (RF) sources primarily exist as part of experimental projects at PPPL. All users of RF must leak test the systems to ensure that personnel exposure is within limits. Others must pay attention to posted warning signs.

Microwaves are used for transmitting data (such as in cell phone towers) and for heating food. All microwave sources other than ovens require periodic testing.

Environmental Impacts *[Hazardous Waste - Section 7, Other Environmental Concerns – Section 12]* PPPL is concerned with protecting the environment. As such, any work that could have an affect on the environment needs to be evaluated for damage potential. Environmental impacts of work must be evaluated through the NEPA process *[Procedure ESH-014]*. Activities which can adversely affect the environment include: performing work using chemicals, allowing material to flow to a floor drain, using sinks for chemicals, releasing gases to the atmosphere, and leaving containers unprotected. Questions about this type of work that could affect the environment should be directed to the PPPL Head of

Environmental Compliance. The other aspect of environmental protection is proper disposal of waste products. All hazardous materials (chemicals) or radioactive materials that are to be disposed must be handled through the Environmental Services (ES) Division (contact Head of Waste Management). Pre-planning for the collection and disposal of these wastes is essential to avoid safety and environmental concerns.

Noise: *[Section 8, Chapter 8]* High noise can damage hearing. Anything which produces sound levels over 85 decibels (dBA) must be controlled. A rule of thumb test to determine if an area, process or tool is too noisy is that you must raise your voice to be understood 3 feet away. Most permanently noisy areas are posted. Most tools are not. If there is a question regarding the noise levels, contact Safety for monitoring.

Sharp Objects/Tools: *[Section 9, Chapter 12]* The obvious hazard from sharp objects is the risk of being cut. Consideration should also be paid to possible equipment damage. Using knives, saws, chisels, etc. must be done carefully. Never cut towards your hand or body. If the surface is uneven or the circumstances awkward, utilize cut resistant gloves to avoid being cut by a slipping tool. Sharp objects should be padded or protected when possible to prevent the worker or other personnel from accidental contact with the sharp edge.

Working Surfaces / Tripping Hazards: *[Section 8, Chapter 9 "Housekeeping" and Section 9, Chapter 9 "Office Safety"]* While no ES&H manual chapter specifically covers this classification of hazard, components may be found in the above two cited references. Walking surfaces and any platforms where people are working must be kept clear of clutter. Surfaces that have non-removable tripping hazards require additional preventative measures such as covering of the hazard with a walkway, taping electrical cords to the surface, posting signs, roping off of areas, or merely using added caution.

Falls / Elevated Work: *[Section 9, Chapter 16 "Fall Protection"]* When on a walking/working surface with an unprotected side or edge which is 6 feet or more above a lower level in construction operations, or 4 feet or more above a lower level in all other operations, employees must be protected from falling. This can be accomplished with guardrails, full body harness and lanyard, or the use of man lifts (scissor or aerial lifts). If a personal fall arrest system (full body harness and lanyard) are to be used, the anchor point needs to be verified by a competent person to ensure that it can hold the required weight of 5,000 pounds, minimum. The Safety Division should be contacted to review fall protection issues associated with an activity, especially when personal fall arrest is required.

Cranes / Rigging / Forklifts: [Section 9, Chapter 8 "Forklifts, …" and ENG-021 "Hoisting and Rigging Program"] The use of forklifts, cranes, hoists and other lifting devices requires additional training offered through Human Resources. Only qualified personnel can use this equipment. Be aware that using this equipment will frequently cause other hazards to be present, such as foot hazards, vehicle exhaust fumes, falling objects, potential energy, and occasionally impairing of fire protection systems.

Welding / Cutting / Grinding / Open Flame: [Section 9, Chapter 15, "Welding Cutting & Brazing"] These operations always produce a fire hazard, and all require a "Hot Work Permit" from the Emergency Services Unit (ESU). Be aware of other associated hazards such as heat stress, eye hazards, toxic fumes, and sharp edges.

Impairing a Security / Fire System: [ENG-025, ENG-026, ENG-027] Performing any work which requires the impairing of a fire detection or suppression system, or a security system requires a permit issued by the Emergency Services Unit. Impairments include: blocking open a fire door, removing a fire seal, opening a new penetration in a fire wall, disabling a smoke detection system to prevent false alarms, etc. Contact Security at x 2536 to obtain a permit.

Hot Surfaces / Cryogenics: [Section 9, Chapter 3 "Cryogenic Safety"] Hot surfaces which could cause burns or start fires must be protected. Cryogenics have the capability of producing numerous hazards such as: cold burns or frostbite, displacement of the oxygen in the atmosphere leading to asphyxiation, and fires or explosions. Know the hazards of the specific cryogenic gas involved. Protect surfaces from contact. Provide plenty of ventilation. Do not release flammable gases where sparks or flame may be present.

Heat or Cold Stress: [Section 8, Chapter 11 "Thermal Stresses"] Heat Stress is the most common, occurring when the body is overheated due to exertion and environmental conditions (hot, humid air). Heat stress can lead to heat stroke, a serious condition. When working in hot weather, dress appropriately in light clothing, take frequent rest breaks in cool areas, and drink plenty of electrolyte replacement fluids or water. Avoid drinking fluids with caffeine such as coffee or colas. Cold stress can take the form of hypothermia or frostbite. Dress warmly and keep clothes dry.

Steam: Working on or around steam pipes, valves or exhausts poses a number of unique hazards due to the extreme temperatures and pressures found in these systems. Shut down, lock and tag steam systems whenever possible before working on them. Wear insulating gloves and clothing to prevent skin burns. Eye and face protection should also be worn.

Electrical: [Section 2 "Electrical Safety"] Systems should always be locked and tagged out before working on them. No live electrical work above 50 volts shall be performed without an Energized Electrical Work Permit. Zero Voltage Testing and Troubleshooting on live circuits above 50 volts requires qualified persons trained for the tasks they are to perform, including, at a minimum, Electrical Utilization Training, and performance of Arc Flash Analysis per NFPA 70E, Section 130. All personnel working with electricity must have at least the Basic Electrical Safety training.

Confined Space / Oxygen Deficiency: [Section 8, Chapter 5 "Confined Spaces"] A confined space is an enclosed or partially enclosed space with limited or restricted means of entry or egress, is large enough to bodily enter, and is not designed for regular human occupancy. Entering one of these spaces can present a life-threatening situation. Work in confined spaces requires training, a safety watch, and a Confined Space Entry Permit available from the Safety Division Oxygen Deficiency can occur in any area where air is removed or a gas is introduced. Common occurrences can be from the use of Cryogenics (see above) or compressed gas cylinders (see below).

Machinery / Machine tools: [Section 9, Chapter 6 "Machine Guarding" and Section 9, Chapter 7 " Machine Tools"] Machinery or Machine Tools generally refers to fixed in place equipment such as: bench grinders, HVAC equipment, large power saws, presses, shears, etc. Typical hazards include: flying parts or particles from grinders and saws, getting body parts or clothing caught in the moving machinery and severe lacerations. Machines must have the proper guards installed to prevent injuries. If

performing maintenance on a machine, the equipment must be locked and tagged out. Safety glasses are frequently required. Loose clothing and gloves should never be worn around moving machinery.

Hand Tools / Power Tools: [Section 9, Chapter 12 "Safe Use of Tools"] A very common source of injury, hand tools (including powered hand tools) must be used properly, and with proper protective measures. Use the proper tool for the job (never use a wrench as a hammer). Cut away from your body/hands, not towards them. Wear proper PPE such as safety glasses when hammering, cut resistant gloves when using knives, ear protection for loud tools such as hammer drills, face shields (with safety glasses underneath) for grinders, etc. Use GFCI on power tools to prevent shocks.

Eye Hazards: [Section 8, Chapter 6 "Personal Protective Equipment"] Hazards to the eyes can include flying particles from grinding or cutting, dust in the air, bright light from environmental conditions or from welding arcs, UV light from welding arcs, chemical splashes, and laser light. Choose the proper PPE to protect the eyes from the potential hazards. Remember that face shields are NOT eye protection, and if eye and face hazards both exist, as from working with acids (corrosive burns), or grinding (hot sparks), a face shield must be worn over the appropriate eye protection such as goggles for chemicals and dusts or safety glasses from particles.

Respiratory Hazards: [Section 8, Chapter 7 "Respiratory Protection"] To control occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective is to prevent atmospheric contamination. This can be accomplished by good engineering control measures such as local exhaust ventilation and administrative controls such as wetting dusts to keep them from becoming airborne. If the combination of engineering and administrative controls is not effective enough, or while they are being instituted, respirators can be used. "Dust Masks" or disposable N95 respirators may be worn voluntarily to protect against nuisance dusts. For potentially toxic hazards, a cartridge air purifying or a supplied air respirator must be worn. To wear one of these respirators, training, a medical evaluation, and a fit test must be completed annually. The Safety Division must be involved in the decision to wear a respirator.

Falling Objects: [Section 9, Chapter 16 "Fall Protection"]When people are working overhead, or if there are loose objects overhead, protection needs to be provided to people below. This can be accomplished by: installing roofs or canopies over people below, moving loose equipment away from exposed edges where it might fall off, installing toeboards on elevated platforms, or by requiring hard hats for people working below.

Potential / Stored Energy: [Section 2, Chapter 6 "Capacitors and Capacitor Banks", Section 8, Chapter 9 "Housekeeping and Sanitation", Section 9, Chapter 9 "Office Safety", ESH-016 "Control of Hazardous/Energy Sources-Safing /Lockout /Tagout" and others]. Potential energy is any form of energy that exists but is not yet released. Examples include charged capacitor banks (the electrical energy is stored in the banks, and will be released if conductive material contacts them), electrical storage batteries, leaning or unstable objects (the energy comes from gravity and would be released in the object falling), coiled springs (the energy is released when the spring is freed), gas pressure (such as the pressure in cylinders, steam, water or air lines, etc. The pressure is released when the container is punctured, opened or broken, and the force can be very high. Controls can include a controlled release of the energy (draining the capacitor banks, lowering unstable objects to the floor, opening pressurized

valves) and using lock out and tag out to control activation of stored energy. Additionally, PPE can be used to prevent injury, including safety glasses, safety shoes, face shields, hard hats, etc.

Foot Hazard: [Section 8, Chapter 6 "Personal Protective Equipment"] Hazards to the feet include: objects falling on or rolling over the foot, objects that can pierce the sole, chemical or electrical exposures, and slipping hazards. Proper footwear is important for each hazard. "Safety Shoes" typically only have protection for the toes from crushing hazards (dropping on or rolling over). There are shoes available with: metatarsal guards for protecting the upper portion of the foot, steel shanks for protection from objects penetrating the sole, electrical insulation, chemical resistance or slip resistant soles.

Trenching / Digging: [Section 1, "Construction Safety" and ENG-024 "Digging Permits"] Digging into the ground poses multiple hazards, the two most significant are: cutting power lines, water lines, gas lines, steam lines, etc. and cave-ins trapping or injuring personnel who have entered the excavation. In order to dig more than 12 inches at PPPL, a Dig Permit must be obtained. For people to enter an excavation, sloping or shoring of the walls of the excavation is normally required, and approval of a safety representative must be obtained.

Wall / Floor Penetrations: [ENG-028 "Core Boring, Cutting and Drilling"] Drilling, cutting, or core boring of partial or full-through penetrations to any depth in walls, floors, and ceilings requires wearing of Class "0" gloves, scanning of the wall/floor/ceiling by a qualified person (or AC Power concurrence for metal walls/floors/ceilings), and may require a Coring/Drilling Permit. The hazards mainly include cutting into active utility lines or rebar. Be aware of other potential associated hazards such as noise, eye hazards, falling objects, etc.

Access / Escape / Communications Concerns: Attention must be paid to getting to and from the work location. If there are difficulties in accessing the area, there is also likely to be a problem leaving the area, especially in emergency situations. Plan for access and escape routes before beginning the work. Be aware of difficulties in communicating work between workers. This is very important when directions are being passed between personnel, such as between a crane operator and a rigger. Consider the use of relay people, radios, cell phones, or other communication methods.

Biological (Bodily fluids, Insects, Poison plants): Bodily fluids can contain hazardous pathogens (viruses or bacteria) that can be spread through contact. Handle these fluids only if trained and equipped with the proper PPE. The most common insect hazards come from mosquitoes, ticks, bees, and wasps. Mosquitoes and ticks are disease carriers, while bees and wasps can cause painful stings or bites, and can be especially dangerous if the worker is allergic. If working in the fields or woods surrounding the Lab, use insect repellent regularly. If allergic, consider carrying an epi-pen or similar treatment. Spray bee and wasp nests from a safe distance using approved pesticides. Poison plants such as poison ivy, oak or sumac are found throughout the wood surrounding the Lab. Use a barrier cream designed for protection, wear gloves, and wash thoroughly upon returning to prevent symptoms caused by these plants.

Vehicle Use / Fuel / Exhaust: [Section 1 "Construction Safety," and Section 9, Chapter 8 "Forklifts, Work Platforms, and Special Purpose Vehicular Requirements"] There are many hazards associated with vehicle use including: hitting a pedestrian, other vehicles or objects; rollover or tip-over hazards; getting caught in vehicle machinery; visibility hazards; and breakdowns or equipment failures. In

addition, refueling or fuel leaks pose the hazards of flammability and toxicity. Using gasoline, diesel, or propane powered vehicles indoors can cause a build-up of toxic gases including carbon monoxide (CO). Plan the use of the vehicles keeping this in mind. Be sure the driving and working surfaces are flat, level and stable. Do not pour fuel directly into a hot engine (such as happens with lawnmowers and generators). Clean up fuel leaks immediately, or contact ESU for an environmental spill. Leaking propane cylinders should be moved immediately outside when first noticed, and ESU should be contacted. Do not start vehicles with leaking fuel tanks as this will provide an ignition source. Only trained personnel may operate any vehicle.

Illumination (inadequate lighting): Working in a poorly lit area can pose hazards including slips and trips, bumps and bruises, cuts, and eye strain. If the general area lighting is inadequate, provide task lighting in the form of temporary lights, desk lamps, or spotlights.

Working Alone: [Policy P-017 "Working Alone"] No kinds of hazardous work may be performed when alone without a JHA form signed by the Safety Division. Working alone is defined as being out of visual or audible range of another employee. Certain kinds of hazardous work including, but not limited to, working with live voltage over 50 volts, confined space entry, work requiring supplied air respiratory protection or fall protection, or tritium line breaks may never be conducted while alone. Other hazardous work may be performed alone if the Job Hazard Analysis (JHA) allows for it and determines the hazard potential is minimal.

Pressure (gas cylinders, pressure testing): [Section 9, Chapter 2 “Compressed Gas Cylinder Safety,” Section 9, Chapter 11 “Pressure Systems” and ENG-014 "Hydrostatic and Pneumatic Testing”] High pressure can cause serious injury if released in an uncontrolled fashion. Be sure that all cylinders, hoses, and valves are secured. Safety glasses and face shields are normal PPE for working with pressurized systems. Pneumatic (air) pressure is generally more hazardous than hydraulic (fluid) or hydrostatic (water) pressure because of greater energy storage in the air form. Rope off areas to keep unnecessary personnel away from pressurized systems.

Others: While the above list might seem comprehensive, there are always hazards that may not fall into any other category. Do not use this list and this procedure as a substitute for staying alert for hazards. Any hazards that do not easily fit into one of the other categories can be listed in this box, or in the comments box below this one. Be sure to identify controls for the hazards identified.

ESH-004,R6-TCR-001

JOB HAZARD ANALYSIS

Reference:
*Work Order #*_____ *Work Permit #*_____ *Work Planning #*_____ *Procedure #*_____ *Other*_____

Written by *(Print)*:_____ *Date:*_____ *Division/Branch/Org:*_____

***Description* of job/work to be performed:**

***Location* of job/work to be performed:**

Hazard (Check-off and **Describe** the source of the hazard)	**Control Measures** (or Write # of Control(s) in Box)	**See Back**
☐ Chemicals	☐ MSDS's Available ☐ Training Provided ☐ Goggles ☐ Chemical Gloves	
☐ Ergonomic Issues (Repetitive Motion, Lifting, Physical Stresses, etc.)	☐ Contact Safety for briefing ☐ Worker Rotation ☐ Rest Breaks	
☐ Ionizing Radiation ***[Health Physics-HP]***	☐ Radiation Work Permit (RWP)	
☐ Non-Ionizing Radiation (Lasers, Magnetic Fields (EMF), RF, etc.)	☐ Contact Safety for high power lasers/EMF/RF ☐Laser Safety Training ☐ Laser Permit (3b & 4)	
☐ Environmental Impacts (Environmental Release, Hazardous Wastes, etc.) ***[ES]***	☐ Contact ES for guidance ☐ Spill Protection ☐ Waste Containers	
☐ Noise	☐ Hearing Protection ☐ Signs	
☐ Sharp objects/tools	☐ Cut Resistant Gloves ☐ Edge Protection ☐ Proper Use	
☐ Walking / Working Surfaces (Slips, Trips, Falls)	☐ Slip Resistant Shoes ☐ Tape/Cover Cords ☐ Cones/Marking	
☐ Falls / Elevated Work (6' above surface)	☐ Fall Protection Training ☐ Personal Fall Arrest ☐ Guard Rails ☐ Approved Anchor Point (5,000 lbs.) ☐ Contact Safety for Review	
☐ Ladders / scaffolds / manlifts	☐ Inspection ☐ Training ☐ Secure Ladders ☐ Personal Fall Arrest	
☐ Cranes / rigging / Forklifts	☐ Trained/Qualified Personnel ☐ Lift Procedure *ENG-021* ☐ Hard Hats ☐ Safety Shoes	
☐ Welding / cutting / grinding / open flame	☐ Hot Work Permit *[ESU]* ☐ Face Shield ☐ Goggles ☐ Welding Gloves	
☐ Impairing a Security / Fire System ***[ESU]***	☐ Contact Security ☐ Fire Door Permit *ENG-025*	
☐ Hot Surfaces / Cryogenics	☐ Cryogenic Training ☐ Insulated Gloves ☐ Face Shield ☐ Goggles	
☐ Heat or Cold Stress	☐ Rest Breaks ☐ Drinking Liquids Provided ☐ Proper Clothing	
☐ Steam	☐ Lockout/Tagout *ESH-016*	
☐ Electrical ***[Electrical Safety]***	☐ Lockout/Tagout *ESH-016* ☐ Arc Flash Analysis ☐ GFCI ☐Trained Personnel ☐ Approved Equipment *ENG-023*	
☐ Confined Space / Oxygen Deficiency	☐ Confined Space Permit	
☐ Machinery / Machine tools	☐ Machine Guards ☐ Chip Guards ☐ Safety Glasses	
☐ Hand Tools / Power Tools	☐ GFCI ☐ Safety Glasses	

For questions about these topics, contact the Safety Division except where noted in *[brackets]*.
Safety = 2533, 2531, 2832 %546,. HP = 2311, 2315. ES = 3380. ESU/Security = 2536, Electrical Safety = 3740

Hazard (Check-off and **Describe** the source of the hazard)	**Control Measures** (or Write # of Control(s) in Box)	#
☐ Eye Hazards	☐ Safety Glasses ☐ Goggles	
☐ Respiratory Hazards	☐ Ventilation ☐ Wet Methods ☐ Dust Mask/N95 (Voluntary Use Only) ☐ Respirator (Training, Medical, Fit Test, Contact Safety)	
☐ Falling Objects / Bumping Hazards	☐ Hard Hats ☐ Toe Boards ☐ Bump Caps ☐ Object Protection	
☐ Potential / Stored Energy (Springs, instability, capacitors, batteries, fans, hydraulics)	☐ Lockout/Tagout *ESH-016* ☐ Grounding ☐ Securing Objects	
☐ Foot Hazard	☐ Safety Shoes ☐ Boots	
☐ Trenching / Digging	☐ Digging Permit *ENG-024* ☐ Shoring/Shielding/Sloping	
☐ Wall / Floor Penetrations	☐ Penetration Permit *ENG-028* ☐ Class '0' Electrical Gloves	
☐ Access / Escape / Communications Concerns	☐ Cell Phone/Radio	
☐ Biological (Bodily fluids, Insects, Poison plants)	☐ Insect Repellant ☐ Long Sleeves/Pants ☐ Gloves	
☐ Vehicle Use (include Construction & Special Purpose) / Fuel / Exhaust	☐ Vehicle Inspection *ENG-021* ☐ Trained Operator ☐ Spotter/Safety Watch ☐ Exhaust Control ☐ Spill Protection	
☐ Illumination (inadequate lighting)	☐ Temporary Lighting ☐ Flashlight	
☐ Working Alone (Requires Safety Approval)	☐ Safety Must Review/Approve ☐ Buddy System ☐ Contact Site Protection	
☐ Pressure / Vacuum (cylinders, pressure tests)	☐ Compressed Gas Training ☐ Face Shield ☐ Safety Glasses ☐ *ENG-014* Pressure Test Procedure	
☐ Others:		
Comments:		

Control Measures (Write the number of the appropriate control next to the hazard to which it applies)

Engineering Controls	***Administrative Controls***	***Personal Protective Equipment (PPE)***	
01 - Platforms, Scaffolds	**12** - Procedures	**23** - Hard Hats	**29** Safety Glasses/Goggles
02 - Use less hazardous chemicals	**13** - Specific training for job/location	**24** - Face Shields	**30** - Coveralls
03 - Machine Guards, Chip Guards	**14** - Worker Rotation, Rest Breaks	**25** - Safety Shoes	**31** - Boots / Booties
04 - Ventilation (fume hoods, elephant trunks, local exhaust systems)	**15** - Permits (Confined Space, RWP, Hot Work, Digging, Penetrations, Flame)	**26** - Ear Plugs/ Muffs	**32** - Gloves (leather, kevlar, neoprene, nitrile, voltage rated)
05 - Fall Protection (Guardrails, toe boards)	**16** - Signs & Labels, Warning alarms ("high level")	**27** - Respirator / Dust Mask	**33** - Full Body Harness & lanyards
06 - Engineered Equipment Design	**17** - System or Job Walk down	**28** - Lab Coat / Apron	**34** - Flame retardant / flash resistant clothing
	18 - Safety watch, Buddy System	**35** – Electrically insulated Mat / Tools	
07 - Noise enclosure, absorption, mufflers	**19** - Lockout/Tagout	***Emergency Equipment:***	
08 - Vibration dampeners	**20** - Spill Containment	**36** - Fire Extinguishers	**40** - Retrieval Gear.
09 - Temporary lights	**21** - Barricades	**37** - Telephones/Radios	**41** - First Aid Equip,
10 - Welding Screens	**22** - Training / Qualification / Certification	**38** - Sprinkler System	**42** - Alarms
11 - Mechanical lifting aids		**39** - Eye Washes & Safety Showers	

☐ **Safety Division Review Required | Safety Signature:** _____ **Date** _____

☐ **Other Review Required | Who?** _____ **Signature:** _____ **Date** _____

RLM / Supervisor or Designee Approval (Always Required) Signature: _____ **Date:** _____

Personnel Briefed on this JHA (print): _____

JHA Forms must be kept for a minimum of one year after completion of work

Examples of Low Hazard Activities

Low Hazard Activities

The following activities are inherently low hazard activities, presenting hazards of a type and magnitude routinely encountered and/or accepted by the general public. If the proposed activity is listed below, and if there are no additional hazards, preparation of a JHA for the activity is not required unless otherwise determined by the ATI or RLM for the activity.

- Office work, including the use of common office machines, such as copiers, typewriters, personal computers, printers, etc. Also including computer operation, reading, filing, and typing.
- Routine Control Room activities, including the use of consoles, terminals, printers, etc.
- Routine technician hand work that is not part of a larger activity, including the use of hand tools, use of portable power tools, desktop computer installation, etc. [Note: provided these activities are performed by a qualified technician for whom these activities would be considered "skill of the trade" activities.]
- Drafting activities, including the use of computer assisted design terminals and workstations, drafting tables, stick files, etc.
- Meetings, classes, seminars, and colloquia, provided no hazards are introduced.
- Administrative procurements, including but not limited to general administrative supplies and computer systems.
- Personnel actions and contracts for personal services, including technical support contracts and contracts for management and operation.
- Information gathering (including, but not limited to: literature surveys; inventories; audits), analysis (including computer modeling), and dissemination (including, but not limited to: document mailings; publication; and distribution).
- Actions consisting solely of document preparation (including, but not limited to: conceptual design, feasibility, energy supply and demand, and other studies).
- Routine security patrols.
- Conducting inspections.
- Routine mail delivery.

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, 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 USE DURING WORK ACTIVITIES

Encourage Self-Checking: Think about the intended action, understand the expected outcome and verify the result after the action.

Use Peer Checking: Before taking a critical step, consider having a co-worker agree that the action is the correct one.

Use Flagging: Mark components using labeling or color-coding to ensure that the correct one is used or an incorrect one is not used during an activity.

Utilize Independent Verification: When work presents a high risk, a person not directly involved in the work should verify the work at a separate time. (See PPPL policy P-096)

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?