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Standard Operating Procedure
for

Non-Routine Hazardous Work Permit

REVISION

Rev No.	DCN No.	Change Summary	Release Date	DCN Initiator	Document Owner
2	DCN0895	Added NOTE in Section 5.6 indicating employee(s) leaving a work area unattended must post signage with work date & estimated completion time, and contact information	3-4-13	Lilia Chen	Robert Segura

Prior revision history, if applicable, is available from the Document Control Office.

1. PURPOSE AND SCOPE

This document establishes the requirements for performing a Risk Assessment prior to performing a non-routine task, experiment or unplanned maintenance that involves Hazardous Production Materials (HPMs). To define safety instructions to ensure permits are obtained information is communicated, and activities are completed safely at College of Nanoscale Science and Engineering (CNSE). It also describes the instructions for completion of the Hazardous Work Permit (HWP) form and steps required for the related process flow.

1.1 Scope

This requirement is applicable to service engineers, tool owners, chemical and gas service suppliers, equipment technicians, and facility operators who perform hazardous work activities on functional tools and equipment at the CNSE site.

2. DEFINITIONS

2.1 **ERT:** Emergency Response Team. Trained employees who respond to chemical and medical emergencies.

2.2 **Hazards:** Potential exposure to high temperature, high pressure, high voltage, previously contaminated sub-systems, and hazardous energy including mechanical, electrical, pneumatic, hydraulic, chemical, or thermal energy.

2.3 **Hazardous Production Materials (HPMs):** A solid, liquid or gas associated with semiconductor manufacturing that has a degree-of-hazard rating in health, flammability or reactivity of Class 3 or 4 as ranked by NFPA 704 and which is used directly in research, laboratory or production processes which have as their end product materials that are not hazardous.

2.4 **LO/TO:** Lock-Out/Tag-Out. The method to control hazardous energy including electrical, pneumatic, hydraulic, chemical, or thermal. Ensuring equipment is turned off through shut down procedures, then isolating equipment from harmful energy.

2.5 **HWP:** “Hazardous Work Permit”; authorized form (EHS-00062-F1) that allows hazardous work to be done.

2.6 **Non-Routine Work**: Modifications, experiments or maintenance tasks performed on equipment that house or use HPMs that carry a high level of risk and are considered unusual or non-routine.

2.7 **PPE:** Personal Protective Equipment -Used to protect personnel from chemical and physical hazards. Includes safety glasses, respiratory protection, and protective clothing.

2.8 **Routine Work:** Modification or maintenance tasks performed on modules or tools that been determined to be non-risk or documented in work instructions.

2.9 **Risk Assessment:** A sequential process that identifies the hazards associated with a task, indentifies the control measures to be put in place (including detailed work activities, PPE, and training requirements) to eliminate or control the hazard(s) by identifying monitoring requirements and maintenance requirements. Provides the information necessary to complete the HWP.

2.10 **Risk Assessment Team:** Consists of the EHS Manager or their designee, and necessary support personnel. Teams are allowed to add any additional members who have knowledge, experience or expertise that could benefit the outcome of the assessment. The risk assessment teams are as follows:

2.10.1 **For Cleanroom Related Activities**: IBM Equipment Engineer, CNSE Equipment Engineer, TEL Equipment Engineer, Chemical and Gas Services Manager, CNSE EHS Manager or Senior Safety Engineer.

2.10.2 **For CNSE College Experiments/Activities**: Principal Investigator (PI), CNSE Equipment Service Group Manager, Researcher, CNSE EHS Manager or Senior Safety Engineer.

2.10.3 **For Facility Activities**: Facility Engineering Manager Engineer, Facility Engineer, System Owner, IBM Equipment Engineer, CNSE Equipment Engineer, CNSE EHS Manager or Senior Safety Engineer.

2.11 **Tool Owner:** Engineer, technician, or facility operator who is responsible for the safe operation of the equipment, process module, or tool running process in the lab or facility.

3. RESPONSIBILITIES

3.1 Tool Owner/Researcher/Engineer/Requestor Responsibilities for:

3.1.1 Following this instruction and completing the HWP as necessary.

3.1.2 Coordinating the subcontractor’s activities including the action for obtaining an HWP.

3.1.3 Conducting Risk Assessments for hazards anticipated while performing the task prior to performing work.

3.1.4 Obtaining written approval (by completing EHS-00062-F1 Hazardous Work Permit) prior to beginning work.

3.1.5 Having a safe condition verified after work as been completed.

3.2 CNSE Management Responsibility for:

3.2.1 Enforcing the requirements of this document.

3.3 Environmental, Health and Safety (EHS) Responsibilities for:

3.3.1 Assisting with the hazard assessment and HWP process and ensuring that preventive activities taken will prevent unsafe conditions to humans, the facility, and the environment.

3.3.2 Verifying completion of work and closing the HWP.

4. ASSOCIATED DOCUMENTS

4.1	**CFM-00004**	Obtaining a Work Permit Procedure
4.2	**OPS-00001-F1**	Cleanroom Tool Maintenance Form
4.3	**EHS-000010**	Personal Protective Equipment
4.4	**EHS-00062-F1**	Hazardous Work Permit

5. INSTRUCTION STEPS

5.1 Routine Work

5.1.1 If the work is routine or determined to be *non-hazardous*, then the previously documented work instructions for this routine work shall be followed. Examples of hazardous work with a procedure/checklist would include pump changes, chamber open/cleans, commissioning/turning on new HPM lines, Scrubber preventative maintenance, etc. See specific procedures that have been developed for the aforementioned activities.

5.1.2 However, if the work is hazardous or non-routine and **no** work instruction, procedure, or checklist exists, then an HWP **is** required. Examples of hazardous work that require a permit include cold trap cleaning and opening process lines that previously contained hazardous chemicals,

experimental activities, VMB/GIB stick removal, chamber opening, purifier change out, foreline cleaning, etc.

5.1.3 Table 1 gives examples of hazardous non-routine work activities requiring the use of a Hazardous Work Permit (EHS-00062-F1).

Table 1: Hazardous Work versus Non-Hazardous Work

Type	Hazard Criteria	Example of Activities
Hazardous Non-Routine Tasks	**Chemical Hazard:** - Presence of by-products that can react with air and produce hazardous vapors.	- Traps change
	Chemical Hazard: - Gas lines, chambers or foreline still containing vapor of hazardous gases. - New chemical experiments	- Opening a charged line - Exposure to unknown chemical reaction/concentration
	High Pressure: - Gas lines containing neutral or reactive gas under high pressure.	- Change a pressure regulator and open high-pressure leg.
	Gravity: - Manipulation of heavy objects located at high altitude position.	- Change a heavy target. - Remove pump from top of a pump rack.
	Electrical Power: - Exposing high voltage wiring or components.	- Opening an AC distribution panel.
Non-Hazardous Tasks/ Routine Tasks	- No hazardous chemical involved or chemicals have been removed/contained. - System is not electrically energized. - Manipulation of light parts from/to low altitude position. - Low pressure is present in the component to be opened.	- Change O-ring from transport vacuum cassette elevator (VCE). - Installation of equipment not energized. - Installation of MFC. - Vent VCE. - Chamber opening or cleaning - Routine scrubber maintenance - Gas cylinder or chemical/waste drum change out

5.2 Hazardous Work

5.2.1 If the work meets the definition of hazardous activity or no procedure exists, and a hazard is present, the requestor will contact the Risk Assessment Team. The Risk Assessment Team consists of the EHS Manager or their designee, and necessary support personnel. Teams are allowed to add any additional members who have knowledge, experience or expertise that could benefit the outcome of the assessment. The risk assessment teams are as follows:

5.2.1.1 For Cleanroom Related Activities: IBM Equipment Engineer, CNSE Equipment Engineer, TEL Equipment Engineer, Chemical and Gas Services Manager, CNSE EHS Manager or Senior Safety Engineer.

5.2.1.2 For CNSE College Experiments/Activities: Principal investigator (PI), CNSE Equipment Service Group Manager, Researcher, CNSE EHS Manager or Senior Safety Engineer.

5.2.1.3 For Facility Activities: Facility Engineering Manager Engineer, Facility Engineer, System Owner, IBM Equipment Engineer, CNSE Equipment Engineer, CNSE EHS Manager or Senior Safety Engineer.

5.2.2 The Risk Assessment is conducted prior to the work commencing. This Assessment determines the hazards and assesses the preventive and protective measure needed to reduce risk and complete the Hazardous Work Permit, including signatures. The Risk Assessment procedure is outlines in 6.5.

5.3 Risk Assessment

5.3.1 The Tool Owner contacts the Risk Assessment Team and identifies the risks associated with the work to be performed. The Team will need to identify:

- Hazards associated with performing the task.
- Control measures to be taken to eliminate or control the hazards.
- Work methods.
- Personal Protective Equipment.
- Training required.
- Facility/Safety systems affected.
- Activities required.
- Monitoring requirements.
- Supervision.
- Notification/posting.
- Standing guard.
- Maintenance requirements.

5.3.2 Upon completion of the assessment, the requestor is responsible for generating the HWP.

5.4 HWP Form Completion

5.4.1 The Hazardous Work Permit shall specify:

- Work Title
- Department
- Requestor/Phone Number
- Area Group Leader
- Location defining hazardous areas, warning signs, notifications, etc.
- Start Time
- End Time
- Facility/Life Safety Systems (gas, monitoring, exhausts, energy control)
- Safety-Related Activities (ERT, personal protective equipment, air monitoring)
- Training Requirements (LO/TO, Forklift, and PPE)
- Detail of work to be performed including PPE required
- Responsible person for each activity defined on the form
- Employees involved (who is affected)
- Additional safety requirements or related checklists (chamber cleaning)

NOTE: The requestor must submit the form before the work begins. The completed HWP Form shall contain signatures from the risk assessment team members.

5.5 HWP Form Routing

5.5.1 Upon obtaining all approval signatures, the requestor will provide a copy of the signed HWP to the EHS Manager. The requestor will post a copy of the signed HWP form in the affected work area(s).

5.6 Perform Hazardous Work

5.6.1 The work schedule/permit is posted in the area, and the individuals working in the area are notified of upcoming activity.

5.6.2 The requestor organizes the appropriate persons to perform the tasks according to the description of work to be performed on the permit.

5.6.3 Qualified people may only perform the work, using appropriate monitoring, PPE, and controls as required.

5.6.4 Upon completion of the work, the EHS Manager or designee-at a minimum- will verify that the work is completed correctly.

NOTE: Operation of the module, tool, lab, experiment or system may not start up until EHS Manager or designee has verified proper completion.

NOTE: If workers leave the work area unattended, they must post signage with date and time of work start and completion, and a contact name and phone number.

5.7 Work Permit Closure

5.7.1 When work is complete, the requestor contacts EHS Manager or designee to verify service or repair.

5.7.2 The requestor removes the posted permit after work has been completed and forwards the signed original HWP to the EHS Manager.

5.7.3 The requestor and the EHS Manager or designee verifies completion of work.

5.7.4 After verifying that the service or repair is complete, the EHS Manager or designee marks the “OK” column, signs, and dates the form marking the closure of the HWP.

5.7.5 The EHS Manager maintains the closed-out HWP for two (2) years.

6. APPENDICES

6.1 **Figure 1**: Hazardous Work Permit Process Flow

6.2 **Figure 2**: Hazardous Work Permit Sample

Figure 1 - Hazardous Work Permit Process Flow

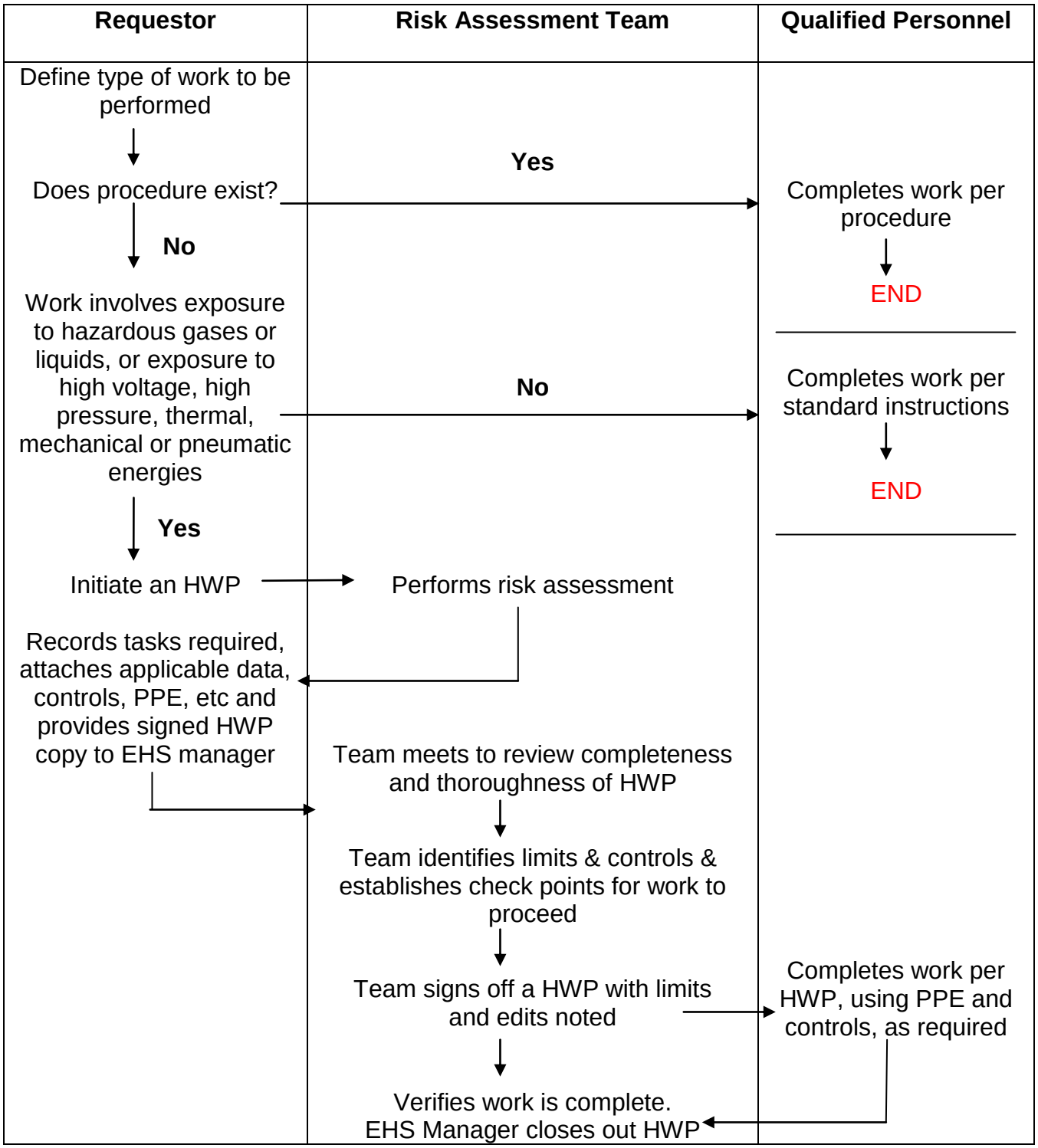

Figure 2 - Hazardous Work Permit Sample

Work Title:		**Date**:	
Requestor:	**Phone:**	Start Time:	End Time:
Area Group Leader:	Location: (post form prior to work)	System, Tool or Module Affected:	
Facility/ Safety Systems: ☐ Life Safety (Toxic Gas Monitoring) ☐ Fire Safety (Sprinklers and Exits) ☐ Ventilation/ Exhausts ☐ Electrical (Hazardous Energy Control) ☐ Other_____	Activities: ☐ Confined Space Entry ☐ Hot Work (Welding/ Burning) ☐ Hazardous Fumes/ Odors ☐ Respiratory Protection ☐ Emergency Response Team	Training Requirements: ☐ Personal Protective Equipment ☐ Electrical Safety, LO/TO ☐ Forklift ☐ Laser ☐ Fall Protection	

Describe in detail the work to be performed:

No.	Work Detail	Responsible Person	OK	Comments
1				
2				
3				
4				
5				
6				

Employees involved:

EHS Requirements:

Function Responsible	Approval Signature	Date
IBM Equipment Engineer		
CNSE Equipment Engineer		
TEL Equipment Engineer/ Equipment Service Group Manager		
Chemical and Gas Services Manager		
Principal investigator (PI)		
Researcher		
Facility Engineering Manager Engineer		
Facility Engineer		
System Owner		
CNSE EHS Manager		

Closure:		
	Requestor **Date**	**EHS Manager** **Date**