

Sandia National Laboratories
Primary Hazard Screening (PHS)
PHS Number: SNL06A00448-011
CINT (clean room, all labs) - Integration Lab

I. Signatures (Electronic signature dates shown)

Risk Management Determination

Hazard Classification: **Low**
Operations with hazards that have the potential for significant local impacts.

Required Documentation: **A PHS with Integral HA is required**

Facility/Project Designator: **Radiological Facility** Date Created: **09/21/2015**

Results as of: **06/22/2016**

Submitted for Review by: **Nogan,John** Org: **01132** Date: **09/23/2015**

Author / Technical Review

Assignment Completed

I am knowledgeable of the activities and hazards covered by this PHS and, after doing due diligence, the description, notes, identified hazards, analyses, and other information contained in this PHS are complete and accurate.

Please also review any other information in the PHS (e.g. description, notes, hazard tables, hazard assessments) necessary to perform your review assignment.

I have performed the review assignments shown above and concur that the document is complete and accurate.

Author: **Nogan,John** Org: **01132** CONCUR ON SUBMIT:
09/23/2015

Assignment Completed

Review Question 5c(1) for classification of UNP use

Review Questions 21a, 21a(1) and hazard-specific questions that relate to the user-specified hazards identified in Question 21a for hazard classification and the need for a standalone hazard analysis.

Review Question 5i for classification of energetic use

Please also review any other information in the PHS (e.g. description, notes, hazard tables, hazard assessments) necessary to perform your review assignment.

I have performed the review assignments shown above and concur that the document is complete and accurate.

Industrial Facility Safety Basis SME: **Curran,Kelsey** Org: **04126** CONCUR: **10/06/2015**
Leigh Forde

ES&H Coordinator Review

Assignment Completed

The description and notes describe and scope the activities performed under this PHS. All hazards have been identified. Questions are answered correctly and, as necessary, rationale or clarification is provided. All hazards in the HA have been analyzed, including the identification of controls for each hazard. I have performed the above reviews and concur that those items are complete and accurate.

Please also review any other information in the PHS (e.g. description, notes, hazard tables, hazard assessments) necessary to perform your review assignment.

I have performed the review assignments shown above and concur that the document is complete and accurate.

ES&H Coordinator: **Nelson, John Seth**

Org: **01100**

CONCUR: **10/08/2015**

Quality Review

Assignment Completed

This PHS meets minimum Corporate standards for 1) description/notes and 2) required information. There are no gross inconsistencies. I have performed the above reviews and concur that those items are complete and accurate.

Please also review any other information in the PHS (e.g. description, notes, hazard tables, hazard assessments) necessary to perform your review assignment.

I have performed the review assignments shown above and concur that the document is complete and accurate.

PHS Team: **Costanzo, Jessica Amoret**

Org: **04126**

CONCUR: **10/12/2015**

Approver

Assignment Completed

The description and notes describe and scope the activities performed under this PHS. All hazards have been identified. Questions are answered correctly and, as necessary, rationale or clarification is provided. All hazards in the HA have been analyzed, including the identification of controls for each hazard. I have reviewed this PHS and concur that its contents are accurate and complete.

Please also review any other information in the PHS (e.g. description, notes, hazard tables, hazard assessments) necessary to perform your review assignment.

I have performed the review assignments shown above and concur that the document is complete and accurate.

Approving Manager: **Hearne, Sean J.**

Org: **01132**

APPROVE: **10/20/2015**

II. PHS Purpose, Limitations, and Use in Work Planning and Control

Purpose of the PHS

For the scope of work documented, the PHS identifies:

- High-level (primary) hazards (e.g. chemicals, toxic gasses, explosives)
- Some, but not all controls
 - The PHS "Controls" questions identify controls which have Corporate Policy System (CPS) requirements directly associated with their use (e.g. PPE, respirators, local exhaust ventilation, lockout/tagout, and NEPA)
 - Some controls are identified during completion of the hazard analysis for the select hazards that are analyzed.
- A Hazard Classification
- Requirements associated with the hazards and controls identified by answers to PHS questions.
 - Requirements documents (such as Corporate Policy System subject-specific procedures) that must be reviewed to determine specific requirements applicable to the work.
 - Corporate-required training
 - Action and Warning messages that highlight key requirements.
- ES&H personnel who are notified/involved for select hazards.

The Hazard Analysis section of the PHS is used to perform a high-level hazards analysis and controls selection for hazards with a hazard classification of "Low" and, optionally, for "Standard Industrial Hazards (SIH)"

Limitations of the PHS for Use in Activity-level Work Planning and Control

Unless additional information is specifically included, a PHS does not contain all of the detail necessary to identify and control hazards at the activity/task level. The reasons for this include:

- PHSs are typically written at the project or work-area level and therefore, do not contain sufficient detail about individual tasks or the hazards/controls associated with them.
- While the PHS provides requirements for the hazards and controls identified, it does not provide a comprehensive list of all requirements from the Corporate Policy System and related documents. Furthermore, many of the requirements are identified through reference to Corporate Policy System subject-specific procedures, which must be evaluated for requirements applicable to the specific work being performed.
- It is impractical to ask enough questions to generate the level of detail necessary for activity/task-level hazard identification and control; human analysis must be employed. Consequently, details must be developed by a work planner, including:
 - Specific details about the hazard (e.g. what chemical, which laser, when, under what conditions, and where)
 - Other controls needed, since all controls may not be identified in the PHS (as discussed under "Purpose of the PHS"). Important controls, such as access control, interlocks, shielding, monitoring, and personnel qualifications may not be identified.
 - Specificity about controls (e.g. type of PPE, ventilation specifications)
 - Details on how and when to implement each control
- The HA performed in the PHS module is high-level, therefore the hazard analysis cannot be used in place of the failure mode analysis required in MN471021, Work Planning and Control Criteria for Safe Design and Operations for the development of the Safety Case.

Recommended Use of the PHS to Support Activity-Level Work Planning & Control

Information from the PHS may be used as a starting point for developing activity-level safety cases required by MN471021, *Work Planning and Control Criteria for Safe Design and Operations*. The safety case utilizes the hazards identified in the PHS to address the consequences related to the hazards, the system, and application of controls with emphasis on engineered controls.

The information developed in the PHS should be utilized when performing the subsequent task of activity-level hazard identification, analysis, and control selection, where (1) the major work steps are identified; (2) the hazards associated with each major step are identified and analyzed; and (3) the controls for each hazard are identified and verified to be adequate to protect the involved workers. For the vast majority of work performed at Sandia, the Job Safety Analysis form (SF 2001-JSA) or equivalent is the recommended tool to use for this purpose. The JSA provides a systematic process for a team of involved workers, work planners, managers and SMEs to ensure the activity-level work scope is rigorously analyzed to identify all potential hazards and to specify the appropriate controls for each hazard.

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III. General Information

Document Status

Question Set Version: **N**

Status: **Inactive**

Expiration Date: **2016-06-22 15:40:39**

Responsible Organization: **01132**

Operation Type: **Facility or Lab**

Radiological Protection Level

Radiological Protection Level for this facility or project: **Normal**

Description

The integration wing of the CINT Core facility is a clean room where the bays are class 1000 and the chases, gowning room (1508), and parts clean room (1511) are class 10,000. The operations in the clean room are focused on micro- and nano-fabrication of devices for the study and development of nano-technology. These processes include, but are not limited to, wet and dry etching of Si and GaAs, deposition of metal, insulators and semiconductors, contact mask photo-lithography, electro-beam lithography, and focus ion beam machining. These processes will require the use of both gaseous and liquid hazardous chemicals that are typically used in microfabrication.

Room 1501: The Electron Beam Lithography Area. This encompasses the tools and support equipment needed to form patterned structures on substrates down to the nanometer scale. These patterns are formed using high-energy electrons that impinge upon charge-sensitive resist materials. Upon exposure and development of the resist, these patterns can be transferred to the underlying substrate using additive or subtractive cleanroom techniques. Electron beam resist is spin-coated onto wafers or small substrates and baked. These samples are loaded into the electron beam lithography system (JEOL JBX-6300FS) where they are written with the electron beam. After pattern development, additive or subtractive methods can be used to transfer the pattern to the substrate. Other cleanroom tools and techniques are generally combined with the electron beam lithography process area to realize nanofabrication on various material systems. Only authorized users of the electron beam lithography system are allowed to work under this PHS. Users can be authorized through an extensive On The Job Training (OJT) program. This is an ongoing activity at the CINT facility and it is anticipated to continue throughout the lifetime of the e-beam system.

Room 1504 - HIRES SEM/Mask Writer Area. This room contains a FEI focused ion beam (FIB)/ scanning electron microscopy (SEM) tool. The primary function of this tool is to micro machine surfaces using a 10 nm wide stream of gallium ions in high vacuum. The system is also used for the visual analysis of materials and surfaces down to 20 nm. Although the SEM/FIB is a registered radiation generating device (RGD) it contains the proper level of shielding to make it inherently safe for individuals working in the area. A Heidelberg Instruments Inc. DWL 66-fs Lithography Mask laser writer is located adjacent to the SEM. The laser writer contains a class 3B Diode laser, 80 mW @ 400 nm that is interlocked to be inherently safe during normal operation.

Room 1506 is the central storage area for general laboratory supplies and serves as a pass through for the transfer of processing chemicals into the cleanroom. No lab work done in this area.

Room 1507 is the pregowning room where the activities are restricted to the initial gowning and there will be no lab work done in this area.

Room 1508 is the gowning room where the activities are restricted to the final gowning and there will be no lab work done in this area.

Room 1511 is the parts clean and assembly area. The wet processing bench in 1511 supports etching of Si using TMAH or KOH solutions, and supports general base etch and cleaning processes. The solvent bench provides a ventilated workspace for removing photoresist or for general surface cleaning and degreasing. Two high speed diamond saws and a scribe and break tool support back end of line (BEOL) dicing of Si, ceramic and glass substrates. The lapping tool allows materials such as glass and silicon to be thinned and or polished.

Room 1512 is the Flex Bay designated for specialized processing techniques and basic device characterization. The most hazardous operation in the bay is an Atomic-Precision Fabrication Tool (APFT) that utilizes phosphine gas and hydrogen to electronically dope a silicon surface. The phosphine gas is sourced from a safe-source SDS delivery cylinder. The SDS cylinder contains a small amount of phosphine (PH₃) absorbed into a carbon media. This highly toxic substance (PH₃) in carbon is designed to be desorption limited in order to prevent a high level release. Hydrogen is also sourced from a small sample container that is integrated into the tool. Other operations in the area include a probe station for both semiconductor analysis and for the electro-deposition of bound engineered nanomaterials in an ethanol solution.

Room 1515 is the main equipment pass through for the cleanroom. Equipment entering the cleanroom is wiped down in this area in preparation for entry. Equipment leaving the cleanroom also pass through this area. Heat transfer fluids, pump oils and other flammable materials in support of cleanroom operations are stored in the flammable storage cabinet. No lab work is done in this area.

Room 1517 is the house keeping room, where the sink and supplies for cleaning of the Integration Lab are stored. No lab work done in this area.

Room 1516 is the chemical and integration lab storage room, which is used to store silicon substrates, temperature sensitive polymers and solvents that require refrigeration, non-precious deposition metals and targets, and diagnostic equipment. Chemicals and materials are segregated and stored in properly designated locations. No lab work done in this area.

Rooms 1522 and 1523: Designated as the chase and lithography room, respectively. Chase 1522 function is to provide space for the storage of personal protective equipment (chemical aprons and face shields) and provide service access to back of the 1523 processing equipment. No laboratory experiments will be performed in this area. Room 1523 will be used for the process and associated metrology of contact mask lithography. This includes processing of industry standard photoresist, which typically requires spinning the photoresist on a wafer followed by exposing using a NUV 365-400 nm or DUV 260 nm contact mask aligner, or ebeam writer and baking at up to 400C on a hot plate or up to 200C in an oven. After pattern exposure and soft bake, the photoresist is then developed at the base bench using a dilute TMAH or KOH solution. An O₂ barrel ash reactor and UV ozone cleaner are used for the purpose of cleaning light organic materials from a substrate's surface following the develop operation. Solvents are used at the solvent bench for the purpose of degreasing a surface or for the removal of photoresist. Metrology equipment includes an optical microscope for visual inspection.

Room 1525: This bay contains multiple vacuum deposition systems (base pressure 10⁻⁷ torr) which include PVD by electron beam and PVD by sputter or reactive sputter. The ebeam allows for the deposition of high purity material typically used in lift-off and subtractive etching processes. The sputtering system provides a means to

deposit conformal metal, semimetal or insulating (dielectric) thin films typically for subtractive etch processes. A profilometer located in the bay provides a method for the measurement of post PVD deposition film thickness.

The chemical benches will be used for standard processing of devices fabricated on Si wafers. Typical processes will include metal lift-off by the removal of photoresist and degreasing using solvents, acid and base wet chemical etching of metals, Si, and SiO₂ and other common processes. The rapid thermal anneal (RTA) uses a set of lamps to rapidly heat silicon wafers to temperatures in excess of 1000C in an inert environment, such as Argon. Additionally, forming gas (3% H₂ in nitrogen) can be used in the RTA to prevent oxide formation during annealing.

Chase 1526: Support equipment such as pumps, cryo compressors, 3.8% hydrogen/balance nitrogen compressed gas supply for RTA and cold storage for 1527 ALD reactor precursors. Precursors are stored in quantities of less than 100g each in stainless steel containers at 5C in an appropriately identified explosion proof refrigerator.

Room 1527: Bay 1527 has two inductively coupled plasma (ICP) etch reactors and a plasma enhanced chemical vapor deposition (PECVD) reactor. The PECVD reactor allows the conformal deposition of hydrogenated amorphous poly-Si, silicon nitride, and silicon oxides. The ICP etch reactors are used for dry etching of materials such as aluminum, titanium, tungsten, carbon, oxides, nitrides, polysilicon, among other materials. Opposite the etch reactors is an atomic layer deposition (ALD) apparatus that deposits monolayers of aluminum oxide, platinum, titanium nitride, zirconium oxide, hafnium oxide, and others. This bay also contains a combination electron beam/thermal evaporation deposition system (base pressure 10⁻⁷ torr) for high quality metal depositions. A spectroscopic reflectometer also located in the bay provide a means for dielectric thin film measurement. Additionally, a scanning laser 3a tool, called a Flexus, is located in 1527 and used to measure wafer curvature. The system is interlocked for safety purposes.

Chase #1528: The toxic gasses are self-contained within built-in toxic gas cabinets in each tool supporting room #1527. Silane (100%) is contained in a fully automatic gas cabinet that is located next to the PECVD reactor pumps. There are toxic gas monitoring sensors located in each of the gas cabinets and in the vicinity of the tools to detect leaks and shut down the gas at the cylinder in the event of a leak.

Room 1530: Bay 1530 contains a Inductively Coupled Plasma Silicon Deep Reactive Ion Etch system (ICP SiDRIE) for the purpose of high aspect ratio Si etching, a fluorine reactive ion etch (F-RIE) for the purpose of etching some metals, organics and various dielectrics, and a Down Stream Low Frequency (DSLRF) ash system for surface cleaning and to strip organic polymers such as photoresist. A discrete wavelength ellipsometer allows for refractive index and dielectric thin film measurement and a profilometer provides a contact method for measuring step height and surface roughness. A critical point dryer located in the bay allows delicate structures and membranes to be dried without risking damage to the device.

Chase #1531: The Non-toxic gasses are stored in chase #1531 and plumbed into bays throughout the cleanroom, the chase environment is monitored for oxygen deficiency.

Room 1532: Bay 1532 contains a furnace configured for Low Pressure Chemical Vapor Deposition (LPCVD) and thermal oxidation of thin films including, polysilicon, silicon dioxide and silicon nitride. Toxic gas monitoring for hydrogen chloride, silane and ammonia is integrated into the furnace's source cabinet and interfaces with the facility TGMS.

Chase #1533: Vacuum pumps, point of use fume scrubber, dichlorosilane and ammonia gas cabinets supporting the LPCVD furnace are all located in this chase. The chase environment is monitored for hydrogen chloride, silane and ammonia.

The Toxic Gas Monitoring System (TGMS) system is comprised of a decentralized Life Safety Network based on the LonWorks Technology with intelligent network nodes. The digitally networked input/output devices will notify personnel and shut down equipment based on a program customized for the requirements of the CINT Integration Labs. Network devices include Honeywell (MST Technology) Satellite FTT gas monitors, Echelon digital interface modules, bus monitors, a Local Information Display and DVS (Data Visualization System). Output devices include beacons/horns, relay shut down of gases and signals to the Sandia Fire Protection panel for notification to the Sandia Emergency Operation Center.

Chemical hazards have been evaluated in the following ESHERs. No concerns were identified.

ER2007-2552 - Lab 1504

ER2007-2559 - Lab 1501

ER2007-2646 - Lab 1522

ER2007-2630 - Lab 1525

Notes

General Document Notes

9/28/09 - Mike Starr entry:

The environmental hazard table notes "Sterilized Bio Wastes" which is incorrect. There isn't any biological work performed in the integration lab. This entry will be deleted during the next review.

Locations

Site	Area	Building	Room	Description
Primary Location				
SSTP	No Tech Area	518	1501	
Other Locations				
SSTP	No Tech Area	518	1504	
SSTP	No Tech Area	518	1511	
SSTP	No Tech Area	518	1512	
SSTP	No Tech Area	518	1513	Room 1513
SSTP	No Tech Area	518	1519	
SSTP	No Tech Area	518	1522	
SSTP	No Tech Area	518	1523	
SSTP	No Tech Area	518	1524	

SSTP	No Tech Area	518	1525	
SSTP	No Tech Area	518	1526	
SSTP	No Tech Area	518	1527	
SSTP	No Tech Area	518	1528	
SSTP	No Tech Area	518	1530	
SSTP	No Tech Area	518	1531	
SSTP	No Tech Area	518	1532	
SSTP	No Tech Area	518	1533	

Responsible Organization History

Organization Number	Effective (Starting) Date	This Org. Submitted Document for Review
01132	09/21/2015	Y

Planned Changes

Annual review only, added UNP handling information that is identified in other PHS documents for areas already covered by this PHS (redundancy).

IV. Identified Hazards

Hazard Name	Hazard Description	Source
Radiation generating devices	Potential for minor injury or illness	QUESTION 1
RGD (inherently safe)	Potential for minor injury or illness	QUESTION 1b(1)
Chemicals	Potential personnel exposure to chemicals & fire protection regulatory requirements	QUESTION 5
Unevaluated chemical use	Potential chemical overexposure	QUESTION 5a
Unbound Engineering Nanoscale particles	Unbound Engineered Nanoscale Particles(UNP); Potential inhalation and dermal exposure to UNP.	QUESTION 5c
Unbound Nanoscale Particles (UNP)	Potential exposure to unbound nanoparticles	QUESTION 5c(1)a(1)
Asphyxiant gas	Asphyxiant gas is present	QUESTION 5d(1)
Corrosive chemical	Corrosive chemical; Potential exposure to skin and eyes.	QUESTION 5e
Hydrofluoric Acid	Potential exposure to skin and eyes	QUESTION 5e(1)
Noncompliant storage, dispensing, or use of flammable or combustible liquids	Fire/Explosion Hazard	QUESTION 5g
Chemical physical hazards	Hazards from fires, reactions, and explosions	QUESTION 5h
Flammable gasses 500-1000 CF	Potential fire and explosion	QUESTION 5h(1)a
Energetic Chemicals greater than 100g	Increased hazards from fires, reactions, and explosions	QUESTION 5i(1)a
Toxic materials	Potential exposure to toxic gases/liquids/vapors in the event of a release	QUESTION 5k(1)
General Electrical Hazard	Potential for electrical shock	QUESTION 6
Exposed, energized electrical equipment	Entry into limited approach boundary of exposed energized circuits	QUESTION 6c
Exposed energized circuits	Potential electrical shock or arc flash	QUESTION 6c(1)
Exposed, energized electrical equipment	Entry by electrical worker into limited approach boundary of exposed energized circuits	QUESTION 6c(2)
Circuit breakers, disconnect switches, or pin and sleeve type connectors	Potential electrical arc from operating circuit breakers or disconnect switches; or installing/removing pin and sleeve type electrical connectors >50 V and 5 mA or greater	QUESTION 6d
Mechanical hazards	Potential injury from mechanical forces	QUESTION 7
Portable power tools	Potential injury from portable power tools	QUESTION 7b
Nonionizing radiation	Potential exposure to nonionizing radiation.	QUESTION 8a
Nonionizing radiation	Potential exposure to nonionizing radiation below exposure limits.	QUESTION 8a(1)
Thermal hazard	Contact with hot or cold objects	QUESTION 9a
Pressure source	Injury or damage	QUESTION 10

Hazard Name	Hazard Description	Source
Potential environmental concerns	Potential for regulatory action	QUESTION 15
Wastewater discharge	Potential to exceed permitted quantities	QUESTION 15a
Air discharge	Potential to emit regulated contaminants	QUESTION 15b
Hazardous waste	Potential for regulatory action	QUESTION 15d
Low - Offsite Work Condition -MOW	Hazards from work conducted offsite by Members of the Workforce	QUESTION 21a(1)a
Exposure to hazardous energy	Potential injury to personnel from exposure to hazardous energy	QUESTION C3

V. Required Actions

Reviewer Imposed Requirements

1. Required to initiate update to CINT stand alone HA to complete hazard classification with IFSB (Curran/Stirrup) currently on schedule to begin March 2016.

Imposed by reviewer in role: ISMS_IFSBReviewer. Concerning: QUESTION 21a(1).

2. Required to initiate update to CINT stand alone HA to complete hazard classification with IFSB (Curran/Stirrup) currently on schedule to begin March 2016.

Imposed by reviewer in role: ISMS_IFSBReviewer. Concerning: QUESTION 5c(1)a.

3. Required to initiate update to CINT stand alone HA to complete hazard classification with IFSB (Curran/Stirrup) currently on schedule to begin March 2016.

Imposed by reviewer in role: ISMS_IFSBReviewer. Concerning: QUESTION 5i(1).

Readiness Messages

Readiness Review Requirements: Prior to start or restart of Low Hazard operations, the manager shall ensure that a Low hazard review (LR) is completed in accordance with Tool RR-02-T, "Startup/Restart Review for Standard Industrial Hazard and Low Hazard Operations Checklist," of MN471017, *Safety Basis Manual*. Restart, in this context, is the resumption of operations after any change that modified:

- Hazards
- Controls, engineered or administrative (e.g., Safety Management Programs, TWDs)
- Physical configuration of the facility or laboratory
- Training for workers

It is a manager's responsibility to grade the readiness review in accordance with the magnitude and significance of the changes that have occurred.

Warning Messages

1. Radiological safety training shall include procedures specific to an individual's job assignment. See MN471016, Section 3.4.3.2, "Job-Specific Training," for requirements and guidance. (QUESTION 1)
2. RGDs returned from storage to active status may require an updated or new PHS. Please contact Radiation Protection for assistance. (QUESTION 1)
3. There are a variety of requirements applicable to chemicals. Refer to the portions of Corporate Policy: ESH100, Environment, Safety and Health relevant to the activities being performed for requirements. (QUESTION 5)
4. 10 Code of Federal Regulations Part 851, Worker Safety and Health Program, as implemented through various SNL requirement documents (e.g., PG470246, "10 CFR 851 Worker Safety and Health Program Plan"), requires an exposure assessment of chemical hazards to ensure hazards have been identified and prevented or abated (QUESTION 5a)
5. Members of the Workforce and Visitors meeting any of the following criteria are required to participate in SNL's UNP Worker Registry:
 - 1) Have the potential for inhalation or dermal exposure to UNP;
 - 2) Routinely spend time in an area in which UNP have the potential to become dispersed in the air or on surfaces; or
 - 3) Perform work on equipment that might contain or bear UNP and that could release UNP during servicing or maintenance (QUESTION 5c)
6. **WARNING:** Work on energized electrical circuits is restricted to certain individuals. Ensure only qualified personnel perform work on electrical equipment/systems at SNL. It is the responsibility of the department manager to determine an employee's electrical qualifications. Managers may contact Electrical Safety personnel for assistance with determining worker qualifications or additional information. To become qualified to perform electrical work a person shall do the following:
 - # Demonstrate a familiarity, through interview, demonstrated experience (i.e., resume/review) or direct observation, with the hazards of the workplace and the specific equipment to be worked on, as well as any associated ES&H Procedures.
 - # Demonstrate a familiarity, through interview, demonstrated experience (i.e., resume/reference) or direct observation, with electrical maintenance techniques, codes and other general electrical knowledge.
 - # Have qualifications reviewed and approved by their department manager to ensure they are qualified for a particular job assignment.Note: A person qualified to work with certain equipment may be considered "unqualified" to work on similar equipment without first being advised of any differing hazards involved. (QUESTION 6c)
7. **WARNING:** An evaluation should be conducted using the Energized Work Decision tool each time electrical equipment is either added or existing energized equipment is manipulated or reconfigured. (QUESTION 6c)
8. **WARNING:** An evaluation should be conducted using the Energized Work Decision Tool to determine appropriate electrical PPE prior to work on each energized system. Prior to PPE use, workers shall receive site-specific PPE training. The Energized Work Decision Tool is located on the Electrical Safety Homepage under Decision Trees. See Corporate Procedure: ESH100.2.IS.8, "Assess Workplace Hazards and Provide and Maintain Personal Protective Equipment" for requirements regarding site-specific PPE training. Refer to MN471004, Electrical Safety Manual, Section 2.10, "Electrical Personal Protective Equipment" for additional information as needed. (QUESTION 6c)
9. Energized work activities are any activities performed within the limited approach boundary of exposed (able to be contacted) and energized (> 50 volts) electrical conductors or circuit parts. Simply entering the limited approach boundary invokes the requirements identified in question 6b. (QUESTION 6c)

- 10.** Prior to performing maintenance activities, ensure an approved lockout/tagout procedure is developed and used. (QUESTION 6c(1))
- 11.** Energized work operating procedures must be approved by a senior manager and are required for entry. These activities are always considered high rigor. (QUESTION 6c(2))
- 12.** Manager or appropriate individual may require specific training such as OJT, etc. This training should be included as part of the work planning and control process. (QUESTION 6e)
- 13.** All operators of the system must be qualified according to the requirements of the Pressure Safety Manual. The Pressure Operator Qualification Form (SF 2001-PQF) is available as an optional tool for documenting the applicable training and qualification requirements for pressure applications. See MN471000, Pressure Safety Manual, Chapter 2, "The Pressure Safety Program," for requirements and guidance on qualification of pressure operators. (QUESTION 10a)
- 14.** All installers of the system must be qualified according to the requirements of the Pressure Safety Manual. The Pressure Operator Qualification Form (SF 2001-PIQ) is available as an optional tool for documenting the applicable training and qualification requirements for pressure applications. See MN471000, Pressure Safety Manual, Chapter 2, "The Pressure Safety Program," for requirements and guidance on qualification of pressure installers. (QUESTION 10b)
- 15.** All operators who work with cryogenics must be qualified according to the requirements of the Pressure Safety Manual. The Pressure Operator Qualification Form (SF 2001-PQF) is available as an optional tool for documenting the applicable training and qualification requirements for cryogen applications. See MN471000, Pressure Safety Manual, Chapter 2, "The Pressure Safety Program," for requirements and guidance on qualification of cryogen system operators. (QUESTION 10c)
- 16.** There are requirements for waste minimization and documentation of waste minimization efforts/results. Contact the Pollution Prevention (P2) Team and/or refer to website <http://info.sandia.gov/esh/p2/TechnicalAssistance.html> if assistance with waste minimization documentation is needed. (QUESTION 15d)
- 17.** All contractors performing servicing and maintenance on SNL-owned equipment shall perform LOTO when required in accordance with 29 CFR 1910.147 (OSHA Standards for General Industry) and comply with the following two additional requirements: (1) The contractor shall be briefed on SNL-specific LOTO devices and procedures applicable to the equipment under maintenance. (2) The contractor shall inform the SNL equipment owner and other authorized or affected workers of the contractor's energy control procedure/process, including any differences between that process and SNL-specific requirements. (QUESTION C3a(1)a)
- 18.** Ensure periodic inspections are appropriately documented and retained by appropriate LOTO administrator or ES&H Coordinator. (QUESTION C3a(1)c)
- 19.** LTO RTC tracks periodic inspections for authorized workers. (QUESTION C3a(1)c)
- 20.** Outside contractors may impact work activities/work activities may impact outside contractors. Flow down of ES&H requirements is required per 10 CFR 851. (QUESTION C5)
- 21.** Contracted service and maintenance plans (CSSP, etc.) must be reviewed and accepted for SNL equivalency. (QUESTION C5)

Action Messages

- 1.** RGD Operators must be declared radiological workers using the Radiological Worker Status Form located on the Dosimetry Website. Contact Radiation Protection for assistance with the form. (QUESTION 1)
- 2.** Contact Radiation Protection to conduct a radiation survey (QUESTION 1a)
- 3.** Contact your Division ES&H Team Industrial Hygienist to evaluate exposure to chemicals and determine control measures, prior to working with chemicals. (QUESTION 5a)
- 4.** Ensure suitable facilities for emergency quick drenching or flushing of the eyes and body are provided within the work area for immediate emergency use, where eyes or body of any person may be exposed to injurious corrosive materials. See Corporate Procedure: ESH100.2.IH.13, "Work with Injurious Corrosive Materials and Manage Safety Shower and Eyewash Use," as needed for requirements. (QUESTION 5e)
- 5.** Store, dispense and bond flammable or combustible liquids in accordance with the requirements in the SNL, "Record of Code Decision." (QUESTION 5g)
- 6.** Identify PPE, shock approach, and arc flash boundary prior to operating disconnect switches. In addition, personnel shall be trained on safe switching techniques/hazards. See MN471004, Electrical Safety Manual, Sections: 2.1, "Electrical Work Requirements - General," 2.2 "Qualifications and Training," 2.9 "Facilities owned equipment" and 2.10, "Electrical Personal Protective Equipment," as needed for requirements and guidance. (QUESTION 6c)
- 7.** Implement actions and control measures specified in the applicable Industrial Hygiene exposure assessment. (QUESTION 8a)
- 8.** Obtain a National Environmental Policy Act (NEPA) checklist determination for all activities. Contact your ES&H Coordinator, NEPA Subject Matter Expert (SME), or Qualified NEPA Reviewer (QNR) if assistance is desired with this determination and/or process. (QUESTION 15)
- 9.** Complete Wastewater Discharge Approval Application for all process discharges. Contact the Waste Water Subject Matter Expert or the appropriate wastewater contact under the ES&H/EM Contact List if assistance is needed. (QUESTION 15a)
- 10.** Contact your Environmental Compliance Coordinator (ECC) or the Hazardous Waste Management Facility (HWMF) at (505) 844-3470 (SNL/NM only) to determine how to appropriately manage hazardous waste. (QUESTION 15d)
- 11.** Develop equipment specific procedures for servicing and maintenance according to the requirements of Corporate Procedure: ESH100.2.IS.2, "Control Hazardous Energy (Lockout/Tagout)" (QUESTION C3a(1)b)
- 12.** Identify PPE, shock approach, and arc flash boundary prior to operating disconnect switches. In addition, personnel shall be trained on safe switching techniques/hazards. See MN471004, Electrical Safety Manual, Sections: 2.1, "Electrical Work Requirements - General," 2.2 "Qualifications and Training," 2.9 "Facilities owned equipment" and 2.10, "Electrical Personal Protective Equipment," as needed for requirements and guidance. (QUESTION 6d)
- 13.** Perform a pre-job brief with outside contractors and perform and document oversight of contractor activities. Additionally, a Health and Safety Plan (HASP) may be required. (QUESTION C5)

Required Training

PHS Identified Training

[Note: This training is a regulatory requirement for one or more people involved in operations associated with identified hazards. Each class may not be required by all people working in the area. Please note that some training classes are only provided occasionally. Please be sure to allow adequate lead-time for personnel to schedule and complete training.]

Course Code	Course Title	Exclusions	Training Interval (years)	One-time Training
CHM100	CHEMICAL SAFETY TRAINING		3	No
	Required by: QUESTION 5			
CHM103	SITE-SPECIFIC CHEMICAL SAFETY TRAINING		3	No
	Required by: QUESTION 5			
ELC130	MANAGING ENERGIZED ELECTRICAL WORK	Managing Energized Electrical Work (required for all Managers and Senior Managers who supervise electrical workers)	3	No
	Required by: QUESTION 6c			
ELC200	ELECTRICAL SAFETY FOR ELECTRICAL WORKERS	Electrical Safety for Electrical Workers; ELC200 Clause 1 (for unrestricted access)	3	No
	Required by: QUESTION 6c			
ELC901	SAFE SWITCHING BRIEFING		--	Yes
	Required by: QUESTION 6d			
ENV112	HAZARDOUS WASTE & ENVIRONMENTAL MANAGEMENT TRAINING	(all locations other than SNL/CA will take ENV112)	1	No
	Required by: QUESTION 15d			
ESH100	ES&H AWARENESS		1	No
	Required by: general corporate business process			
ESH200	SAFETY MANAGEMENT	ESH200 for new managers only	--	Yes
	Required by: general corporate business process			

LTO210	LOCKOUT/TAGOUT FOR AUTHORIZED WORKERS	Clause 1 - LOTO RTC; Roles, Tasks and Competency; Authorized Worker Qualification	5	No
	Required by: QUESTION 6c(1), QUESTION C3a(1)b			
MCH200	HAND AND POWER TOOL SAFETY	MCH200, unless approved OJT has been completed	--	Yes
	Required by: QUESTION 7b			
MED105 HF	HYDROFLUORIC ACID SAFETY		3	No
	Required by: QUESTION 5e(1)			
NANO101	NANOTECHNOLOGY SAFETY AWARENESS TRAINING		3	No
	Required by: QUESTION 5c			
PPE106	PERSONAL PROTECTIVE EQUIPMENT TRAINING		3	No
	Required by: QUESTION C2a(1)a			
PRS115	CRYOGEN SAFETY	for all operators of the system who work with cryogenes	--	Yes
	Required by: QUESTION 10c			
PRS115R	CRYOGEN SAFETY REFRESHER		3	No
	Required by: QUESTION 10c			
PRS150	PRESSURE SAFETY ORIENTATION	for all operators of the system	--	Yes
	Required by: QUESTION 10a, QUESTION 10b			
PRS150R	PRESSURE SAFETY ORIENTATION REFRESHER		3	No
	Required by: QUESTION 10a, QUESTION 10b			
PRS250	ADVANCED PRESSURE SAFETY	for all installers of the system	--	Yes
	Required by: QUESTION 10b			
PRS250R	PRESSURE SAFETY ORIENTATION REFRESHER		3	No
	Required by: QUESTION 10b			
RAD102	GENERAL EMPLOYEE RADIOLOGICAL TRAINING	RAD102 unless RAD210, RAD214 (recommended), RAD230, or SNL qualified RCT training.	2	No
	Required by: QUESTION 1b(1)			
RAD219	RADIATION-GENERATING DEVICE CUSTODIAN TRAINING	for both primary and alternate custodians	2	No
	Required by: QUESTION 1			
RAD250	MANAGEMENT OF RADIOLOGICAL OPERATIONS		2	No
	Required by: QUESTION 1			

RSP215	AIR-PURIFYING RESPIRATORY PROTECTION	RSP215 (only for operations which require the use of air purifying respirators)	1	No
	Required by: QUESTION C2a(1)b			
RSP217	COMPREHENSIVE RESPIRATORY PROTECTION	RSP217 (only for operations which require the use of air-supplying respirators) or (air-supplying respirators and air purifying respirators)	1	No
	Required by: QUESTION C2a(1)b			
RSP230	RESPIRATORY PROTECTION FOR SUPERVISORS	RSP230 (only for manager overseeing individuals authorized for respirator use)	1	No
	Required by: QUESTION C2a(1)b			

Regulatory Requirements

Regulatory and Standards Drivers for this Facility or Lab. [Note: CPS Manual sections listed below contain requirements and guidance that pertain to the hazards you have identified in this PHS. It is your responsibility to ensure these requirements have been fulfilled.]

1. (QUESTION 15) Corporate Procedure: ESH100.1.EP.2, "Implement NEPA, Cultural Resources, and Historic Properties Requirements"
2. (QUESTION C4) Corporate Procedure: ESH100.1.EP.2, "Implement NEPA, Cultural Resources, and Historic Properties Requirements"
3. (QUESTION C5) Corporate Procedure: ESH100.1.GP.1, "Manage Safety for Contracted Activities"
4. (QUESTION 15b) Corporate Procedure: ESH100.2.ENV.12, "Obtain and Comply with Air Permits"
5. (QUESTION 15d) Corporate Procedure: ESH100.2.ENV.15, "Manage Hazardous Waste at SNL/CA"
6. (QUESTION 15d) Corporate Procedure: ESH100.2.ENV.20, "Manage Other Waste at SNL/CA"
7. (QUESTION 15d) Corporate Procedure: ESH100.2.ENV.22, "Manage Hazardous Waste at SNL/NM"
8. (QUESTION 5) Corporate Procedure: ESH100.2.ENV.27, "Maintain an Accurate Chemical and Biological Material Inventory"
9. (QUESTION 15a) Corporate Procedure: ESH100.2.ENV.6, "Control Discharges to the Sanitary Sewer System"
10. (QUESTION 5g) Corporate Procedure: ESH100.2.FP.1, "Manage Fire Protection Requirements"
11. (QUESTION 8) Corporate Procedure: ESH100.2.IH.10, "Evaluate and Control Nonionizing Radiation"

12. (QUESTION 8a(1)) Corporate Procedure: ESH100.2.IH.10, "Evaluate and Control Nonionizing Radiation"
13. (QUESTION 5e) Corporate Procedure: ESH100.2.IH.13, "Work with Injurious Corrosive Materials and Manage Safety Shower and Eyewash Use"
14. (QUESTION C1) Corporate Procedure: ESH100.2.IH.15, "Control Hazards Using Local Exhaust Ventilation and High Efficiency Particulate Air Filters"
15. (QUESTION 5c) Corporate Procedure: ESH100.2.IH.16, "Evaluate and Control Unbound Engineered Nanoscale Particles"
16. (QUESTION 5d(1)) Corporate Procedure: ESH100.2.IH.19, "Evaluate and Control Asphyxiant Hazards"
17. (QUESTION C2a(1)b) Corporate Procedure: ESH100.2.IH.3, "Control Inhalation Hazards Using Respiratory Protection"
18. (QUESTION 5) Corporate Procedure: ESH100.2.IH.4, "Evaluate and Control Chemical Hazards"
19. (QUESTION 5d(1)) Corporate Procedure: ESH100.2.IH.9, "Enter Confined Spaces Safely"
20. (QUESTION 7b) Corporate Procedure: ESH100.2.IS.10, "Manage Industrial Machine and Portable Power Tool Safety"
21. (QUESTION C3a(1)a) Corporate Procedure: ESH100.2.IS.2, "Control Hazardous Energy (Lockout/Tagout)"
22. (QUESTION C3a(1)b) Corporate Procedure: ESH100.2.IS.2, "Control Hazardous Energy (Lockout/Tagout)"
23. (QUESTION 6d) Corporate Procedure: ESH100.2.IS.8, "Assess Workplace Hazards and Provide and Maintain Personal Protective Equipment"
24. (QUESTION C2) Corporate Procedure: ESH100.2.IS.8, "Assess Workplace Hazards and Provide and Maintain Personal Protective Equipment"
25. (QUESTION 6c) Corporate Procedure: ESH100.2.IS.8, "Assess Workplace Hazards and Provide and Maintain Personal Protective Equipment"
26. (QUESTION 5d(1)) Corporate Procedure: ESH100.2.PS.1, "Control Pressure Safety Hazards"
27. (QUESTION 10c) MN471000, Pressure Safety Manual, Chapter 2, "The Pressure Safety Program"
28. (QUESTION 10a) MN471000, Pressure Safety Manual, Chapter 2, "The Pressure Safety Program"
29. (QUESTION 10b) MN471000, Pressure Safety Manual, Chapter 2, "The Pressure Safety Program"
30. (QUESTION 10f) MN471000, Pressure Safety Manual, Chapter 6, "Testing and Evaluating Pressure Systems"
31. (QUESTION 10f) MN471000, Pressure Safety Manual, Chapter 7, "Verifying the Safe Operation of Pressure Systems"
32. (QUESTION 10f) MN471000, Pressure Safety Manual, Chapter 8, "Servicing Pressure Vessels and Components"
33. (QUESTION 10d) MN471000, Pressure Safety Manual, Chapter 9, "Documenting the Operational Safety of Pressure Systems"
34. (QUESTION 10e) MN471000, Pressure Safety Manual, Chapter 9, "Documenting the Operational Safety of Pressure Systems"

35. (QUESTION 6c) MN471004, Electrical Safety Manual, Section 2.10, "Electrical Personal Protective Equipment"
36. (QUESTION 6d) MN471004, Electrical Safety Manual, Section 2.10, "Electrical Personal Protective Equipment"
37. (QUESTION 6d) MN471004, Electrical Safety Manual, Section 2.2, "Qualifications and Training"
38. (QUESTION 1) MN471016, Radiological Protection Procedures Manual, Chapter 1, "Radiological Work Management."
39. (QUESTION 1) MN471016, Radiological Protection Procedures Manual, Chapter 3, "Radiological Training Program"
40. (QUESTION 1) MN471016, Radiological Protection Procedures Manual, Chapter 10, "Radiation Generating Devices"
41. (general corporate business process) Corporate Procedure: ESH100.2.ELC.1, "Manage Electrical Hazards"
42. (general corporate business process) Corporate Procedure: ESH100.2.GEN.3, "Develop and Use Technical Work Documents"
43. (general corporate business process) Corporate Procedure: ESH100.2.IS.7, "Implement Traffic Safety"
44. (general corporate business process) MN471018, Work Planning and Control Manual

VI. Related Documents

Permits

Document Title	Number	Type	End Date
CINT's Authority-to-Construct Permit No. 1725 Actual Date of Initial Start-up	No. 1725	Air	
Discharge of Wastewater at 518/All (CINT)	14-112	Water	03/13/2016

NEPA Documents

Document Title	Number	Project End Date
CINT Bldg. 518/1527 Installation and Operation of Atomic Layer Deposition (ALD) Reactor	SNA10-0098	03/15/2015
CINT Bldg. 518/1532 Installation and Operation of Low Pressure Chemical Vapor Deposition Furnace	SNA10-0201	03/11/2015
Routine Operation of CINT Integration Laboratories (1501, 1504, 1523, 1525, and 1527)	NM13-0117	02/01/2018
CINT Integration Lab - Parts Clean Room (Bldg. 518/Rm. 1511) Continuing Ops	NM13-0328	09/23/2018

Other Documents

Document Title	Number	Type	Published Date
Environmental Assessment for CINT at SNL/NM	DOE/EA-1457	EA	03/01/2006
Operating Procedure for Toxic/Pyrophoric/Inert Gas Cylinders Change-Out	OP1100.189	OP	01/17/2008
Standard Operating Procedure for Working with Hazardous and Particularly Hazardous Chemicals in Center 1100 Laboratories	SOP1100.001 Issue D	SOP	11/01/2010
Operating Procedure for the Formation, Handling and Processing of Engineered Nanoparticles within the CINT Integration Lab (1500 Wing)	OP1100.310	OP	11/11/2014
Operating Envelope Bldg 518 Integration Lab	OE 1132-IL	OE	09/17/2014

VII. Primary Hazard Screening Worksheets

Interview Worksheet

Questions

Answers

- 1 **Radiation-Generating Devices (RGDs):** Is there a radiation-generating-device (RGD)? (Answer this question "no" if all RGDs are registered as in-storage status.) Yes

RGDs					
RGD Name	RGD #	RGD Class	RGD Type	Accl. Voltage	SNL/NM Owned
Dual Beam FIB/SEM	216	Exempt Shielded	Inherently Safe	30	----
Location: Site: SSTP, Area: N/A, Building: N/A, Room: N/A Location Details: NE corner Comments: ----					
Footnotes					
Comments: (Note:comments size is limited to 650 characters, extra will not be saved)					

Questions

Answers

- 1a Unless exempt, is the RGD **registered** with the Device Control Program? Yes
- 1b Are there any of the following radiation-generating devices (RGDs)/operations? Place a check mark to the right of all that apply.
- 1b(1) Inherently safe Yes
- 1b(2) Certified cabinet No
- 1b(3) X-ray Diffraction or fluorescence analysis equipment No
- 1b(4) Other exempt-shielded RGD No
- 1b(5) X-ray generator or particle accelerator No
- 1b(6) Other shielded RGD No
- 1b(7) Portable or mobile radiography RGD not using a radioactive source No
- 1b(8) Fixed device with partial shielding No
- 1b(9) Portable analytical device with an open-beam configuration No
- 1b(10) Open Installation not in the preceding classes No
- 1b(11) Unattended Installations No
- 1b(12) Neutron Generator Operations No
- 1b(13) Medical Installation No
- 1c Will anyone enter any of the following areas?
- 1c(1) Controlled Area (unescorted access to do radiological work) No
- 1c(2) Radiation Area No
- 1c(3) High Radiation Area No
- 1c(4) Very High Radiation Area No
- 1d Are routine exposures **above 100 mrem** per year likely? No
- 1e Could anyone who is not a Member of the Workforce be **exposed** by the operation? (this usually involves portable or mobile radiography operations). No

	Questions	Answers
1f	Will there be radiological work in a foreign country or territory?	No
1g	Will the activity involve an RGD owned or operated by a party other than SNL or SNL subcontractors?	No
1h	Is there an RGD or a facility for an RGD acquired, built, or modified on or after January 1, 1996-excluding those RGDs classified as inherently safe or a certified cabinet?	No
Notes: All the RGDs utilized in the integration laboratory are classified as inherently safe.		
1i	Will radiation monitoring instruments be used in this activity by Members of the Workforce other than qualified Radiological Control Technicians?	No
1j	Will scrap metal generated from the project or activity come from a radiological area?	No
1k	Does the operation involve a device capable of creating a radiological area? Note: By definition, radiological areas must be accessible to individuals - otherwise the area is not a radiological area.	No
2	Radioactive Materials: Is radioactive material present?	No
3	Explosives and Ammunition: Are any explosives or ammunition (i.e., Hazard Class 1 materials) including explosive waste managed, handled, processed, used, or stored?	No
4	Lasers: Do the activities covered by this PHS involve: <ul style="list-style-type: none"> •Regulated laser activities. Please review the definition of regulated laser activities before answering this question. •Directing the beam of any class of visible laser (400-700 nanometer) into navigable airspace or where the beam could affect personnel not associated with this activity. 	No
5	Chemicals: Do the activities involve chemicals? (Review the Help Text before answering this question.)	Yes
5a	Has the Industrial Hygiene Program performed an exposure assessment of the current activities conducted on Sandia-controlled premises involving chemicals that are covered by this PHS?	No
5b	Do any of the activities include? <ul style="list-style-type: none"> •Hazardous waste cleanup operations (e.g., environmental restoration [ER] sites) •Treatment, storage, and disposal (TSD) facilities •Emergency response 	No
5c	Will activities have, use, synthesize, or liberate unbound engineered nanoscale particles (UNP)?	Yes
5c(1)	Assuming that controls are not in place , could anyone who is not involved with these activities be exposed to unbound engineered nanoscale particles (UNP)?	Yes
5c(1)a	Has the use of unbound engineered nanoscale particles (NP) been reviewed by the SNL Safety Basis Department?	Yes
5c(1)a(1)	What hazard classification was determined by the SNL Safety Basis Department?	Low
5d	Do the activities involve storage or utilization of simple asphyxiants in any quantity?	Yes
5d(1)	Do the activities involving asphyxiants require an exposure assessment? (Review the exposure assessment exemption criteria presented in the Help Text)	No

	Questions	Answers
5e	Are the hazardous chemicals, hazardous substances, or hazardous waste involved in these activities considered injurious corrosive materials?	Yes
5e(1)	Do these activities involve the use of hydrofluoric acid?	Yes
5f	Do these activities involve the use of new chemicals (a substance which has not been listed on the TSCA Inventory List)?	No
5g	Do the activities involve the storage, dispensing, or use of flammable or combustible liquids?	Yes
5h	Do the activities involve any of the following? <ul style="list-style-type: none"> •Flammable chemicals in quantities greater than 5 liters of liquid, 1 kg of solid, or 500 cubic feet of gas (at STP) in any single container or manifolded series of containers •Equipment connected to a house system for flammable gases •Reactive chemicals in quantities greater than 1 liter of liquid, 100 g of solid, or 500 cubic feet of gas in any single container or manifolded series of containers •Oxidizers, other than nitric acid, in quantities greater than 5 liters of liquid, 1 kg of solid, or 500 cubic feet of gas in any single container or process 	Yes
5h(1)	Is a flammable gas used for purposes other than comfort heating or non-process hot water (e.g., restroom use)?	Yes
5h(1)a	Could more than 1000 cubic feet of flammable gas be released from a single container, manifolded series of containers, or house gas system?	No
5i	Do activities involve any of the following chemicals in total quantities greater than 100g? Please refer to the help text before answering the question. <ul style="list-style-type: none"> •Pyrophoric chemicals •Metal powders •Peroxides in concentrations of 50% or greater. •Chemicals that are categorized as peroxidizable organic chemicals. •Heat powders. 	Yes
5i(1)	Has the use of these chemicals been reviewed by the SNL Safety Basis Department?	Yes
5i(1)a	What hazard classification was determined by the SNL Safety Basis Department?	Low
5j	Do the activities include a process that involves highly hazardous chemicals at or above twenty-five percent of the Process Safety Management standard threshold quantities, or are there flammable liquids or gases involved in a process with a quantity of greater than 2,500 pounds?	No
5k	Do activities use or store toxic gases/liquids/vapors in quantities greater than the de minimis quantities listed in the Help Text?	Yes
5k(1)	Do the activities use or store toxic gases/liquids/vapors in quantities equal to or greater than the threshold (total)quantities listed in the Help Text?	No
5l	Do the activities use or store hazardous chemicals in quantities equal to or greater than the Emergency Management screening threshold quantities? (Refer to Help Text to determine if quantities have been exceeded.)	No

	Questions	Answers
6	<p>Electrical: Do Members of the Workforce:</p> <ul style="list-style-type: none"> • Operate or maintain electrically powered equipment at 50 Volts or greater for alternating current (AC) or direct current (DC), other than general office equipment or, • Have the potential to come into contact with live electrical sources at 50 Volts or greater, other than plugging/unplugging common 120 V wall sockets? 	Yes
6a	Is there any electrical equipment operating at 50 Volts or greater, that has either not been certified by a Nationally Recognized Testing Laboratory (NRTL), or that is not Sandia approved?	No
6b	Could non-electrical Members of the Workforce enter the limited approach boundary for any reason? Note: The limited approach boundary can be determined from the applicable tables located in the Help Text.	No
6c	Do electrical workers enter the limited approach boundary of exposed, energized electrical equipment for any reason (including zero energy verification)? Note: The limited approach boundary can be determined from the applicable tables located in the Help Text.	Yes
6c(1)	Is the limited approach boundary entered by an electrical worker for the performance of zero energy verification?	Yes
6c(2)	Is the limited approach boundary entered by an electrical worker to perform troubleshooting and diagnostic measurements, calibration, or visual inspections?	Yes
6c(3)	Is the limited approach boundary entered by an electrical worker to perform live electrical work, including circuit manipulations?	No
6d	Do equipment operations involve electrical workers operating circuit breakers or disconnect switches, or installing/removing pin and sleeve type electrical connectors? (See the Help Text for pin and sleeve examples)	Yes
6e	Do the line qualification process(es) require additional Electrical Safety training or site specific Electrical Safety training such as OJT?	Yes
7	<p>Mechanical: Does the facility or activity involve the use of any of the following tools, equipment or activities?</p> <ul style="list-style-type: none"> •machine shop equipment •portable power tools •powder-actuated tools •centrifuge operations •forklifts •motorized hand trucks •cranes/hoists, miscellaneous lifting devices, •industrial robots or industrial robotic systems •operate light or heavy earth-moving equipment •excavations/trenches •floor or wall penetrations •stored or kinetic mechanical energy that could cause an injury during normal working conditions 	Yes
7a	Do Members of the Workforce operate machine shop equipment?	No
7b	Do Members of the Workforce operate portable power tools?	Yes
7c	Do Members of the Workforce operate powder-actuated tools (also known as explosive-actuated fastening tools)?	No
7d	Does this facility or project activity use centrifuges?	No

	Questions	Answers
7e	Are forklifts used in any operations?	No
7f	Are motorized hand trucks used in any operations?	No
7g	Are overhead cranes/hoists, mobile cranes, miscellaneous lifting devices, (shop or gantry crane), or rigging used in any operations?	No
7h	Are industrial robots or industrial robotic systems used in this project or activity?	No
7i	Do Members of the Workforce operate light or heavy earth moving equipment?	No
7j	Do Members of the Workforce perform or come into close proximity to any of these activities: <ul style="list-style-type: none"> •Excavations/Trenches •Floor and/or Wall Penetrations 	No
7k	Do activities involve stored or kinetic mechanical energy that could cause an injury under normal working conditions?	No
8	Nonionizing Radiation: At any time, do activities produce nonionizing radiation (NIR) (excluding lasers and the low-power emitters specifically exempted in the help text)?	Yes
8a	Has the Industrial Hygiene Program performed an exposure assessment of the source(s) of nonionizing radiation on Sandia-controlled premises that are covered by this PHS?	Yes
Notes: See ALD Hazard Assessment Survey Report SNLNM02066.		
8a(1)	Based on the exposure assessment performed by the Industrial Hygiene Program, are nonionizing radiation sources capable of resulting in an exposure above the applicable exposure limits?	No
8b	Are any of the nonionizing radiation sources intentional emitters, (e.g., transmitters)?	No
9	Thermal: Do thermal hazards or thermal stressors exist in the work area? Please review the definition of thermal stressors before answering this question.	Yes
9a	Do thermal hazards exist in the work area in such a manner that Members of the Workforce may be exposed under normal conditions or in a foreseeable emergency?	Yes
9b	Do thermal stressors exist in the work area?	No
10	Pressure: Are Members of the Workforce involved in the design, installation, operation, or maintenance of a pressure system (including pressure, vacuum, cryogenic fluid applications)?	Yes

Pressure Hazards	
Source	Description
Ultra high vacuum systems	---- Location: none Location Details: --- Comments: ----
Footnotes	
Comments: (Note:comments size is limited to 650 characters, extra will not be saved)	

	Questions	Answers
10a	Do Members of the Workforce function as pressure system operators?	Yes
10b	Do Members of the Workforce function as pressure installers?	Yes
10c	Do Members of the Workforce handle cryogenic fluids, or design install or operate cryogenic fluid-handling systems?	Yes
10d	Do all systems meet the documentation requirements of the Pressure Safety Manual, Chapter 9? Note: Data packages for Pressure Safety Analysis Reports must reflect the current system configuration and personnel.	Yes
10e	Do supplier-established pressure ratings exist for all systems and system components?	Yes
10f	Are pressure system (or component) reevaluations being performed according to the requirements of the Pressure Safety Manual? (A common example would be the replacement or retesting of pressure relief valves.)	Yes
11	Noise: At any time, do sources of noise hazards exist during activities covered by this PHS?	No
12	Miscellaneous Hazards: Does the facility or activity involve any of the following hazards or activities? <ul style="list-style-type: none"> •Ergonomic or musculoskeletal stressors •Construction-like activities •Work with and around asbestos •Elevated work •Underwater diving •Animals and hazardous plants •Aircraft •Airborne objects (other than aircraft) •Firearms •Use of human subjects •Use of sealed drum(s) 	No
13	Outside of Manufacturer's Recommendations: Does this work involve the use of equipment, tools, or materials outside of their design specifications or outside of the manufacturer's recommendations? (See Help Text for examples). Please enter each item into the hazard table.	No
14	Noncommercial Equipment: Does this work involve the use of noncommercial equipment or apparatus (excluding robots, robotics systems, and equipment where the only hazard is a pressure system that has a pressure safety data package)? Please enter each noncommercial piece of equipment into the hazard table.	No
15	Environmental Concerns: Are there any potential environmental concerns with this activity that align with the Sandia National Laboratories (SNL) Environmental Management System (EMS) aspects, such as chemical use, fuel or oil storage, waste generation (except sanitary trash), construction activities, outdoor test activities, disturbance to habitat or protected species, or discharges to the air, ground surface, ground water, or the sewer systems?	Yes

Notes: This facility will generate less than 100 kg/month of hazardous waste.

Environmental Concerns Hazards		
Source	Type	Est. Quantity
Evaporated organic solvents	air	100 l/yr
	Location: Site: SSTP, Area: No Tech Area, Building: 518, Room: N/A Location Details: --- Comments: ----	
Hazardous Waste	liquid and solid	<100 kg/mo
	Location: Site: SSTP, Area: No Tech Area, Building: 518, Room: N/A Location Details: --- Comments: The labs will generate small quantities of hazardous waste including organic solvents, acids, and bases.	
Water from acid neutralizer	Water	100 gal/day
	Location: Site: SSTP, Area: No Tech Area, Building: 518, Room: N/A Location Details: --- Comments: There will be water discharged to the sanitary sewer from the acid neutralizer system.	
Footnotes		
Comments: (Note:comments size is limited to 650 characters, extra will not be saved)		

Questions

Answers

15a	Wastewater: Are there any wastewater discharges from this activity?	Yes
15b	Air: Are there any air discharges or emissions at this activity?	Yes
15b(1)	Ozone Depleting Substance (ODS): Are there any ODSs at this activity?	No
15b(2)	Will this activity include the installation and or use of combustion equipment ? (Combustion equipment includes boilers and internal combustion engines, such as generators.)	No
15b(3)	Will this activity involve open-burn activities?	No
15b(4)	Will this activity involve soil disturbance, building demolition, or construction that disturbs soil , including access roads and staging areas?	No
15b(5)	Radionuclide National Emissions Standards for Hazardous Air Pollutants (NESHAP): Are there any radionuclide air discharges or use of radionuclides in gaseous form or at elevated temperatures from this activity?	No
15c	Radioactive Waste: Will this activity generate any radioactive waste, or will Members of the Workforce be required to handle radioactive waste?	No
15d	Hazardous Waste: Will this activity generate any hazardous waste, or will Members of the Workforce be required to handle hazardous waste?	Yes
15d(1)	Hazardous Waste Accumulation Area: Will this activity have the potential to accumulate greater than 55 gallons of any hazardous waste at any one given time?	No
15d(2)	Acutely Hazardous Waste: Will this activity generate any acutely hazardous waste ?	No
15e	Mixed Waste: Will this activity generate any mixed waste , or will Members of the Workforce be required to manage mixed waste?	No
15f	Infectious / Biohazardous Waste: Will this activity generate any infectious or biohazardous waste, or will Members of the Workforce be required to handle infectious or biohazardous waste?	No

	Questions	Answers
15g	Material or Waste of Unknown Origin: Will this activity require handling material or waste of unknown origin?	No
15h	Fuels or Oil Storage: Does this activity use a fuel or oil storage container capable of containing 55 gallons or more?	No
15i	Discharges to Ground Surface: Does this activity have discharges (liquid or solid) to the ground surface? Note: Discharges are commonly associated with outdoor testing and maintenance activities.	No
15j	Improvements/modifications to structure/building exteriors and landscaping: Will this project involve activities that require modifications to the exteriors of structures and buildings or modification to existing landscape, including removal of vegetation?	No
15k	Disturbance to habitat or protected species: Will this project involve activities that will disturb habitat or protected species, including wildlife management and outdoor projects or testing activities?	No
16	Movement of Hazardous Material: Will any activities covered by this PHS involve the packaging, shipping or transportation of hazardous material (including explosives or radioactive material) outside of a building using motorized equipment?	No
17	Fire Protection Concerns: Will the activity include any of the following? <ul style="list-style-type: none"> •Members of the Workforce modifying in any way any fire suppression or life safety system (fire rated walls, fire doors, fire sprinklers, fire alarm devices, fire extinguishers, or means of egress). •Members of the Workforce performing any hot work that requires a hot work permit (Consult the help text for clarification on hot work requiring a permit). 	No
18	Biological Agents: Do activities involve the use of or potential exposure to biological agents? (see Help Text before answering this question.)	No
19	Confined Spaces: Are confined spaces present in the work area?	No
20	Beryllium: Do operations include any activities that? (Review the Help Text before answering this question) <ul style="list-style-type: none"> •Use or handle beryllium, beryllium-containing alloys or beryllium oxides? •Create or work with beryllium ceramics? •Handle waste potentially-contaminated with beryllium or waste containing beryllium? •Perform decontamination of beryllium contamination? •Entail work in a beryllium contaminated building or area? •Apply abrasive or destructive methods to metal objects, articles, weapon components or bar stock, potentially containing beryllium? •Use non sparking tools containing beryllium? 	No
21	Offsite Locations: Does this PHS include work at locations other than KAFB, SNL/CA, NNSS (NTS), or TTR, regardless of whether or not the worksite is on Sandia-controlled Premises?	Yes
21a	Does work performed by Members of the Workforce at locations other than KAFB, SNL/CA, NNSS (NTS), or TTR involve any of the hazards listed in the table?	Yes

WARNING: A "yes" or "no" answer is required for each potential hazard listed in the table.

Offsite Hazards			
Offsite Hazard	Reference Question	Occurs Offsite (Y or N)	Offsite Activity Description
Radiation-generating devices	1	Yes	Please refer to OE 1132-IL Operating Envelope Bldg 518 Integration Lab for detailed information.
Radioactive Materials	2	No	----
Explosives	3	No	----
Lasers in Navigable air space of affecting other operations	4b	No	----
HAZWOPER operations	5b	No	----
Unbound engineered nanoscale particles	5c	Yes	Please refer to OP1100.310 Operating Procedure for the Formation, Handling and Processing of Engineered Nanoparticles within the CINT Integration Lab (1500 Wing) for detailed information.
Newly developed chemical substance	5f	No	----
Chemical physical hazards	5h	Yes	Please refer to OE 1132-IL Operating Envelope Bldg 518 Integration Lab for detailed information
Pyrophorics, metal powders, peroxides 50% concentration or greater, peroxide formers or heat powder	5i	Yes	Please refer to OE 1132-IL Operating Envelope Bldg 518 Integration Lab for detailed information.
>25% PSM quantities	5j	No	----
Toxic gases/liquids/vapors	5k	Yes	Please refer to OE 1132-IL Operating Envelope Bldg 518 Integration Lab for detailed information.
>Emergency Management screening quantities	5l	No	----
Personnel exposure to nonionizing radiation	8a(1)	No	----
Public exposure to nonionizing radiation	8b(1)	No	----
Non-routine aircraft	12g(1)	No	----
Airborne objects other than aircraft (e.g., projectiles, fragments)	12h	No	----
Firearms	12i	No	----
Equipment used outside of manufacturer recommendations with the potential to cause injury	13b	No	----
Non-commercial equipment with the potential to cause injury to co-located workers or public	14b	No	----
Offsite transportation of hazardous materials	16b	No	----

Offsite Hazards			
Offsite Hazard	Reference Question	Occurs Offsite (Y or N)	Offsite Activity Description
Human or primate prions, vertebrate laboratory animals, RG3 agents, RG4 agents, BSL-3 or BSL-4	18c	No	----

	Questions	Answers
21a(1)	Has the SNL Safety Basis Department determined a hazard classification for these activities?	Yes
21a(1)a	What hazard classification was determined by the SNL Safety Basis Department?	Low
21b	Do these activities involve foreign travel?	No
22	Roving: Will any Member of the Workforce enter into non-office work areas with operations controlled by others while conducting activities covered by this PHS? Include all work activities meeting these criteria, including research. Do not include personnel from other organizations, whose work is not covered by this PHS, who enter your workspace (e.g., custodial personnel)?	Yes
22a	Do the entries include non-office work areas on Sandia-controlled premises?	No
22b	Do the entries include work areas on non-Sandia-controlled premises?	No
23	Emergency Response: Do activities include emergency response operations (e.g., confined space rescue, hazardous materials response, emergency medical services, natural disaster, Radiological Assistance Program, Accident Response Group, Joint Tactical Operations Team, Nuclear Emergency Search Team)?	No
24	Off-Hour Activities: Could Members of the Workforce conduct activities covered by this PHS outside the hours of 0700 to 1700 or on weekends/holidays? Note: These are the hours without full emergency response or medical coverage at SNL/NM.	Yes
24a	Will the need to perform work off-hours present increased risks or additional hazards that would necessitate implementation of additional controls? Note: Include increased risks and hazards from the work being performed, personnel working alone, decreased emergency response support, general work area hazards, potential loss of utilities, and natural phenomena.	No
24b	Could off-hour activities require emergency response support beyond the normal off-hours support listed in the help text? If "yes," describe the applicable activities in the note for this question.	No
25	Other Hazards: Do the activities have important hazards not specifically identified elsewhere in this PHS?	No

Controls Worksheet

	Questions	Answers
C1	Local Exhaust Ventilation: Do the activities covered by this PHS use local exhaust ventilation (LEV) on Sandia-controlled premises (e.g., laboratory hoods, glove boxes, downdraft tables, "elephant trunks," canopy hoods, paint booths, slot ventilation, portable welding ventilation, etc.)?	Yes
C2	Personal Protective Equipment (PPE): Are hazards (e.g., chemicals radiological, electrical, mechanical, thermal, flying particles and/or falling or rolling objects) encountered that are capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact?	Yes
C2a	Has a workplace hazard assessment been performed for these activities on Sandia-controlled premises?	Yes
C2a(1)	Did the workplace hazard assessment determine that PPE will be required?	Yes
C2a(1)a	Did the workplace hazard assessment determine that hard hats, safety glasses, face shields, safety shoes and/or gloves are required for mechanical hazards and have not been covered by other task/site specific training?	Yes
C2a(1)b	Has the workplace hazard assessment determined respiratory protection is required?	Yes
C3	Hazardous Energy Control: (including but not limited to: electrical, pressure, pneumatic, mechanical, cryogenic, chemical, fire, radiation, laser, gravity, high temperature). Do you have any equipment in your operations that requires any of the following service and maintenance activities? <ul style="list-style-type: none"> •Construction •Installation •Setup •Adjustment •Inspection •Modification •Maintenance •Service •Lubrication •Cleaning •Un-jamming •Making adjustments or tool changes 	Yes
C3a	While performing any of the servicing and maintenance activities listed above, is there potential for injury from the unexpected energization or startup of the machines, equipment, or process, or from a release of stored energy?	Yes
Notes: Individuals performing these tasks have completed the appropriate training for Lockout/Tagout.		
C3a(1)	Will service or maintenance be done on a machine, equipment, or a process by the Members of the Workforce within your organization?	Yes
C3a(1)a	Will all service or maintenance be done on a machine, equipment, or a process by Members of the Workforce within your organization ?	No
C3a(1)b	During the service or maintenance can all the equipment be controlled by cord and plug?	No
C3a(1)c	Have periodic inspections of hazardous energy control (lockout/tagout) procedures and LOTO authorized workers been completed for all workers and procedures, as required?	Yes

	Questions	Answers
C3b	Are there any activities where control of hazardous energy sources is only necessary for protection of configuration, equipment, or property (i.e., not for personnel protection)?	No
C4	NEPA Compliance: Has this project or activity been reviewed for National Environmental Policy Act (NEPA) compliance in the ISMS NEPA Module? Note: NEPA Checklists should be amended at least every three years, or as required.	Yes
C4a	Are all relevant NEPA documents listed in the Documents section of this PHS?	Yes
C5	Contracted Activities: Will contracted personnel perform work on DOE or SNL-controlled premises who do not work under the SNL ES&H Corporate Policy?	Yes

VIII. Hazard Analysis (HA) Section

Hazard Analysis

Source Name or Question: QUESTION 5a

Source Reason: Unevaluated chemical use
--

Hazardous Condition: Potential chemical overexposure

PHS Identified 'Low' Hazard.**Author's Comment:****Cause:** Human Error

Personnel do not use chemicals in designated space (i.e. wet bench/fume hood)

Consequence: Major Illness/Injury

Personnel could become exposed to chemicals being used if not in a well ventilated proper LEV system.

Mitigation: Active Engineering Control-Air Flow Control System

It is a requirement for personnel to use chemicals in a wet bench or fume hood during use.

Mitigation: Procedural/TWD (SOP/OP/RWP)-Other**Document Id:** SOP1100.001 Issue D, **Title:** Standard Operating Procedure for Working with Hazardous and Particularly Hazardous Chemicals in Center 1100 Laboratories

The SOP provides information on the use of chemicals including the hazards and controls.

Mitigation: Training-Other**Course Id:** LAB100, **Title:** LABORATORY STANDARD INFORMATION AND TRAINING

All personnel with access to the clean room are required to complete this course.

Mitigation: Training-Other**Course Id:** LAB103, **Title:** SITE-SPECIFIC LABORATORY SAFETY TRAINING

All personnel with access to the clean room are required to complete this course.

Mitigation: Training-Other

ILUA - Integration Lab Unescorted Access training is provided to all personnel working in the clean room. This training is supplemental to the LAB100 and LAB103 providing training on specific activities.

Mitigation: Procedural/TWD (SOP/OP/RWP)-Other

An SWP has been written which also addresses the hazards and controls when working with chemicals. This will be reviewed by IH.

Author Assessment of Adequacy: Applied Mitigation and Prevention are sufficient.

Adequacy Explanation: The active engineering control, procedures and training are deemed adequate for these chemical operations.

Source Name or Question: QUESTION 5h(1)a
Source Reason: Use or storage of flammable gasses
Hazardous Condition: Fire or explosion

PHS Identified 'Low' Hazard.

Author's Comment: The gases of concern are Silane (8 lbs) and Dichlorosilane (8 lbs). All are contained within gas cabinets are designed to shut down upon detection of any leaks. Metal organic and metal halide precursors in less than 100g quantities are contained in an exhausted equipment enclosure. Sources are automatically isolated in the event that a leak is detected.

Cause: System/Component/Equipment Failure

An equipment failure may lead to release of flammable gasses, such as oxygen, or pyrophoric gasses, such as disilane.

Consequence: Death [Worker]

Accidental release of flammable and/or pyrophoric gasses may lead death in an explosion and fire.

Mitigation: Active Engineering Control-Fire Suppression System

The IL fire alarm and suppression system, in conjunction with the Toxic Gas Monitoring System (TGMS) is effective in detecting leaks, battling small fires, and alerting users to an emergency that requires evacuation of the facility.

Author Assessment of Adequacy: Applied Mitigation and Prevention are sufficient.

Adequacy Explanation: The TGMS and fire alarm and suppression systems are adequate to protect the safety of persons and property in the event of a fire or explosion.

Source Name or Question: QUESTION 5k(1)
Source Reason: Toxic gases/liquids/vapors
Hazardous Condition: Inhalation / Potential for environmental release

PHS Identified 'Low' Hazard.

Author's Comment:

Cause: Human Error

Insufficient purging of cylinder connection.

Consequence: Negligible ES&H Impact

Release of small quantity of chemical into exhausted gas cabinet.

Mitigation: Active Engineering Control-Air Flow Control System

Cabinet is operated at a face velocity of 100 fpm when the door is opened. All cabinets are covered by Sandia's LEV program. Refugee chemicals are introduced into the lab's acid exhaust system where they are mixed with a 10,000 cfm control air flow stream and directed out the stack. quantities released would be insignificant.

Mitigation: Personal Protective Equipment-Other

Personnel performing bottle changes involving hazardous gasses wear either an SCBA or air purifying respirator. Requirements for respiratory protection are outlined in the Industrial Hygiene Exposure Assessment for the given hazards and area.

Author Assessment of Adequacy: Applied Mitigation and Prevention are sufficient.

Adequacy Explanation: Activities follow standard practices outlined by Sandia IH to protect the worker from accidental inhalation. Environmental effects associated with the release of a particular substance into the environment were analyzed and approved by the appropriate compliance monitoring authorities at Sandia.

Source Name or Question: QUESTION 5i(1)a
Source Reason: Energetic chemicals in quantities greater than 100g
Hazardous Condition: Fire/Explosion Hazard

PHS Identified 'Low' Hazard.

Author's Comment:

Cause: Human Error

Failure to properly execute SiH₄ (Silane) purge sequence during bottle change.

Consequence: Minor Property Damage

Release of silane during cylinder disconnect.

Mitigation: Active Engineering Control-Other

Several, ventilated exhaust enclosure with safety shields, excess flow trigger based on pressure drop, IR fire detection.

Mitigation: Procedural/TWD (SOP/OP/RWP)-Other

Document Id: OP1100.189, **Title:** Operating Procedure for Toxic/Pyrophoric/Inert Gas Cylinders Change-Out

Operating procedure for silane specific bottle exchange.

Author Assessment of Adequacy: Applied Mitigation and Prevention are sufficient.

Adequacy Explanation: Clear identification of the hazard to the worker, proper training when handling and SEMI S2 hardware designed to protect the individual from the hazard.

Source Name or Question: QUESTION 5c(1)a(1)
Source Reason: Unbound nanoparticles
Hazardous Condition: Unbound nanoparticle exposure

PHS Identified 'Low' Hazard.**Author's Comment:**

Cause: Human Error

Inhalation of a nano material.

Consequence: Negligible ES&H Impact

At this time sufficient data has not been collected to determine the long term impact of exposure to these materials will have on the human body. As a precautionary measure, various engineered and administrative controls have been incorporated into the work place.

Mitigation: Active Engineering Control-Air Flow Control System

Nano material workers are required to handle unbound nano materials at designated ventilated workstations. These workstations are covered and monitored as part of the Sandia LEV program.

Mitigation: Procedural/TWD (SOP/OP/RWP)-Other

Document Id: OP1100.310, **Title:** Operating Procedure for the Formation, Handling and Processing of Engineered Nanoparticles within the CINT Integration Lab (1500 Wing)

Handling procedure for UNP handling in the areas covered under this PHS

Author Assessment of Adequacy: Applied Mitigation and Prevention are sufficient.

Adequacy Explanation: Nano material workers have been given the necessary guidance with adequately controlled work space to control the hazard and to reduce the potential for unintended exposure.

Source Name or Question: QUESTION 21a(1)a
Source Reason: Low-Level Offsite Hazardous Work Condition
Hazardous Condition: Potential for worker exposure

PHS Identified 'Low' Hazard.

Author's Comment: Please refer to OE 1132-IL Operating Envelope Bldg 518 Integration Lab and OP1100.310 Operating Procedure for the Formation, Handling and Processing of Engineered Nanoparticles within the CINT Integration Lab (1500 Wing) for detailed information.

Cause: Human Error

Worker not wearing PPE when directly handling chemical hazards.

Consequence: Major Illness/Injury

Covered with hydrofluoric acid

Author Assessment of Adequacy: Applied Mitigation and Prevention are NOT sufficient.

Note: 25 hazard analysis(es) were not reported, because no (optional) hazard analysis was performed for them.

IX. Supplemental Information

PHS Input

Notes from Interview Questions

Q 1h - All the RGDs utilized in the integration laboratory are classified as inherently safe.

Q 8a - See ALD Hazard Assessment Survey Report SNLNM02066.

Q 15 - This facility will generate less than 100 kg/month of hazardous waste.

Notes from Controls Questions

Q C3a - Individuals performing these tasks have completed the appropriate training for Lockout/Tagout.

User Entered Hazard Tables

RGDs					
RGD Name	RGD #	RGD Class	RGD Type	Accl. Voltage	SNL/NM Owned
Dual Beam FIB/SEM	216	Exempt Shielded	Inherently Safe	30	----
Location: Site: SSTP, Area: N/A, Building: N/A, Room: N/A Location Details: NE corner Comments: ----					
Footnotes					
Comments: (Note:comments size is limited to 650 characters, extra will not be saved)					

Pressure Hazards	
Source	Description
Ultra high vacuum systems	---- Location: none Location Details: --- Comments: ----
Footnotes	
Comments: (Note:comments size is limited to 650 characters, extra will not be saved)	

Environmental Concerns Hazards		
Source	Type	Est. Quantity
Evaporated organic solvents	air	100 l/yr
Location: Site: SSTP, Area: No Tech Area, Building: 518, Room: N/A Location Details: --- Comments: ----		

Environmental Concerns Hazards		
Source	Type	Est. Quantity
Hazardous Waste	liquid and solid	<100 kg/mo
	Location: Site: SSTP, Area: No Tech Area, Building: 518, Room: N/A Location Details: --- Comments: The labs will generate small quantities of hazardous waste including organic solvents, acids, and bases.	
Water from acid neutralizer	Water	100 gal/day
	Location: Site: SSTP, Area: No Tech Area, Building: 518, Room: N/A Location Details: --- Comments: There will be water discharged to the sanitary sewer from the acid neutralizer system.	
Footnotes		
Comments: (Note:comments size is limited to 650 characters, extra will not be saved)		

Offsite Hazards			
Offsite Hazard	Reference Question	Occurs Offsite (Y or N)	Offsite Activity Description
Radiation-generating devices	1	Yes	Please refer to OE 1132-IL Operating Envelope Bldg 518 Integration Lab for detailed information.
Radioactive Materials	2	No	----
Explosives	3	No	----
Lasers in Navigable air space of affecting other operations	4b	No	----
HAZWOPER operations	5b	No	----
Unbound engineered nanoscale particles	5c	Yes	Please refer to OP1100.310 Operating Procedure for the Formation, Handling and Processing of Engineered Nanoparticles within the CINT Integration Lab (1500 Wing) for detailed information.
Newly developed chemical substance	5f	No	----
Chemical physical hazards	5h	Yes	Please refer to OE 1132-IL Operating Envelope Bldg 518 Integration Lab for detailed information
Pyrophorics, metal powders, peroxides 50% concentration or greater, peroxide formers or heat powder	5i	Yes	Please refer to OE 1132-IL Operating Envelope Bldg 518 Integration Lab for detailed information.
>25% PSM quantities	5j	No	----
Toxic gases/liquids/vapors	5k	Yes	Please refer to OE 1132-IL Operating Envelope Bldg 518 Integration Lab for detailed information.
>Emergency Management screening quantities	5l	No	----
Personnel exposure to nonionizing radiation	8a(1)	No	----

Offsite Hazards			
Offsite Hazard	Reference Question	Occurs Offsite (Y or N)	Offsite Activity Description
Public exposure to nonionizing radiation	8b(1)	No	----
Non-routine aircraft	12g(1)	No	----
Airborne objects other than aircraft (e.g., projectiles, fragments)	12h	No	----
Firearms	12i	No	----
Equipment used outside of manufacturer recommendations with the potential to cause injury	13b	No	----
Non-commercial equipment with the potential to cause injury to co-located workers or public	14b	No	----
Offsite transportation of hazardous materials	16b	No	----
Human or primate prions, vertebrate laboratory animals, RG3 agents, RG4 agents, BSL-3 or BSL-4	18c	No	----

Assigned Reviewers

Review Type	Role	Person	Required/Requested
Technical SME	Industrial Facility Safety Basis SME	Curran, Kelsey Leigh Forde	Required review by business rule.
	Required Assignment: Review Questions 21a, 21a(1) and hazard-specific questions that relate to the user-specified hazards identified in Question 21a for hazard classification and the need for a standalone hazard analysis.		
	Required Assignment: Review Question 5c(1) for classification of UNP use		
	Required Assignment: Review Question 5i for classification of energetic use		

	<p>Comment: [KLFC 10052015] IFSB classification review of PHS Q5c1 UNP with potential to become dispersible. Ensure UNP is utilized in closed systems, glove boxes when in use and weighing operations are performed within enclosure. Suggest expanding UNP activities within notes section of PHS in next revision based on broad UNP usage across "all labs" at CINT. Also suggest referencing applicable IH EAs in notes section.</p> <p>IFSB classification review of PHS Q5i energetic chemicals >100g in quantity. Suggest updating notes section to include expansion of activities in association with energetic activities and associated IH EAs; too broad to list "all labs" with no notes.</p> <p>IFSB classification review of PHS Q 21a NMOW performing hazardous activities at offsite locations listed as RGD (Q1), UNP (Q5c), chemical physical hazards (Q5h), energetic chemicals (Q5i), and toxics (Q5k).</p> <p>Required to initiate update to CINT stand alone HA to complete hazard classification with IFSB (Curran/Stirrup) currently on schedule to begin March 2016.</p>		
ES&H Coordinator	ES&H Coordinator	Nelson, John Seth	Required review by business rule.
	Comment:		
Safety Basis	PHS Team	Costanzo, Jessica Amoret	Required review by business rule.
	Comment: Reviewed and concur.		
Manager	Line Manager	Hearne, Sean J.	Required review by business rule.
	Comment:		

PHS Output

Major Safety Concerns

The hazard classification is: Low

The required documentation is: A PHS with Integral HA is required

Safety Concerns at this Low level include:

- (QUESTION 5a) Potential chemical overexposure
- (QUESTION 5c(1)a(1)) Potential exposure to unbound nanoparticles
- (QUESTION 5h(1)a) Potential fire and explosion
- (QUESTION 5i(1)a) Increased hazards from fires, reactions, and explosions
- (QUESTION 5k(1)) Potential exposure to toxic gases/liquids/vapors in the event of a release
- (QUESTION 21a(1)a) Hazards from work conducted offsite by Members of the Workforce

Other Safety Concerns

Other Safety Concerns (potential hazard sources) for this: Facility or Lab

- (QUESTION 1) Potential for minor injury or illness
- (QUESTION 1b(1)) Potential for minor injury or illness
- (QUESTION 5) Potential personnel exposure to chemicals & fire protection regulatory requirements
- (QUESTION 5c) Unbound Engineered Nanoscale Particles(UNP); Potential inhalation and dermal exposure to UNP.
- (QUESTION 5d(1)) Asphyxiant gas is present
- (QUESTION 5e) Corrosive chemical; Potential exposure to skin and eyes.
- (QUESTION 5e(1)) Potential exposure to skin and eyes
- (QUESTION 5g) Fire/Explosion Hazard
- (QUESTION 5h) Hazards from fires, reactions, and explosions
- (QUESTION 6) Potential for electrical shock
- (QUESTION 6c) Entry into limited approach boundary of exposed energized circuits
- (QUESTION 6c(1)) Potential electrical shock or arc flash
- (QUESTION 6c(2)) Entry by electrical worker into limited approach boundary of exposed energized circuits
- (QUESTION 6d) Potential electrical arc from operating circuit breakers or disconnect switches; or installing/removing pin and sleeve type electrical connectors >50 V and 5 mA or greater
- (QUESTION 7) Potential injury from mechanical forces
- (QUESTION 7b) Potential injury from portable power tools
- (QUESTION 8a) Potential exposure to nonionizing radiation.
- (QUESTION 8a(1)) Potential exposure to nonionizing radiation below exposure limits.
- (QUESTION 9a) Contact with hot or cold objects
- (QUESTION 10) Injury or damage
- (QUESTION 15) Potential for regulatory action
- (QUESTION 15a) Potential to exceed permitted quantities
- (QUESTION 15b) Potential to emit regulated contaminants
- (QUESTION 15d) Potential for regulatory action
- (QUESTION C3) Potential injury to personnel from exposure to hazardous energy

PHS Identified Training, by Source

[Note: This training is a regulatory requirement for one or more people involved in operations associated with identified hazards. Each class may not be required by all people working in the area. Please note that some training classes are only provided occasionally. Please be sure to allow adequate lead-time for personnel to schedule and complete training.]

CHM100: CHEMICAL SAFETY TRAINING (QUESTION 5)
CHM103: SITE-SPECIFIC CHEMICAL SAFETY TRAINING (QUESTION 5)
ELC130: MANAGING ENERGIZED ELECTRICAL WORK (QUESTION 6c)
ELC200: ELECTRICAL SAFETY FOR ELECTRICAL WORKERS (QUESTION 6c)
ELC901: SAFE SWITCHING BRIEFING (QUESTION 6d)
ENV112: HAZARDOUS WASTE & ENVIRONMENTAL MANAGEMENT TRAINING (QUESTION 15d)
ESH100: ES&H AWARENESS (general corporate business process)
ESH200: SAFETY MANAGEMENT (general corporate business process)
LTO210: LOCKOUT/TAGOUT FOR AUTHORIZED WORKERS (QUESTION C3a(1)b)
LTO210: LOCKOUT/TAGOUT FOR AUTHORIZED WORKERS (QUESTION 6c(1))
MCH200: HAND AND POWER TOOL SAFETY (QUESTION 7b)
MED105HF: HYDROFLUORIC ACID SAFETY (QUESTION 5e(1))
NANO101: NANOTECHNOLOGY SAFETY AWARENESS TRAINING (QUESTION 5c)
PPE106: PERSONAL PROTECTIVE EQUIPMENT TRAINING (QUESTION C2a(1)a)
PRS115: CRYOGEN SAFETY (QUESTION 10c)
PRS115R: CRYOGEN SAFETY REFRESHER (QUESTION 10c)
PRS150: PRESSURE SAFETY ORIENTATION (QUESTION 10a)
PRS150: PRESSURE SAFETY ORIENTATION (QUESTION 10b)
PRS150R: PRESSURE SAFETY ORIENTATION REFRESHER (QUESTION 10b)
PRS150R: PRESSURE SAFETY ORIENTATION REFRESHER (QUESTION 10a)
PRS250: ADVANCED PRESSURE SAFETY (QUESTION 10b)
PRS250R: PRESSURE SAFETY ORIENTATION REFRESHER (QUESTION 10b)
RAD102: GENERAL EMPLOYEE RADIOLOGICAL TRAINING (QUESTION 1b(1))
RAD219: RADIATION-GENERATING DEVICE CUSTODIAN TRAINING (QUESTION 1)
RAD250: MANAGEMENT OF RADIOLOGICAL OPERATIONS (QUESTION 1)
RSP215: AIR-PURIFYING RESPIRATORY PROTECTION (QUESTION C2a(1)b)
RSP217: COMPREHENSIVE RESPIRATORY PROTECTION (QUESTION C2a(1)b)
RSP230: RESPIRATORY PROTECTION FOR SUPERVISORS (QUESTION C2a(1)b)

Results Based on Answers and User-Entered Hazards

The results in this PHS were based on the following answers to interview questions and user-entered hazards:

Q 0 answered: Y; Q 1 answered: Y; Q 1a answered: Y; Q 1b(1) answered: Y; Q 5 answered: Y;
Q 5a answered: N; Q 5c answered: Y; Q 5c(1)a answered: Y; Q 5c(1)a(1) answered: Low; Q 5d(1) answered: N;
Q 5e answered: Y; Q 5e(1) answered: Y; Q 5g answered: Y; Q 5h answered: Y; Q 5h(1)a answered: N;
Q 5i answered: Y; Q 5i(1) answered: Y; Q 5i(1)a answered: Low; Q 5k(1) answered: N; Q 6 answered: Y;
Q 6c answered: Y; Q 6c(1) answered: Y; Q 6c(2) answered: Y; Q 6d answered: Y; Q 6e answered: Y;
Q 7 answered: Y; Q 7b answered: Y; Q 8 answered: Y; Q 8a answered: Y; Q 8a(1) answered: N;
Q 9a answered: Y; Q 10 answered: Y; Q 10a answered: Y; Q 10b answered: Y; Q 10c answered: Y;
Q 10d answered: Y; Q 10e answered: Y; Q 10f answered: Y; Q 15 answered: Y; Q 15a answered: Y;
Q 15b answered: Y; Q 15d answered: Y; Q 21a(1) answered: Y; Q 21a(1)a answered: Low; Q C1 answered: Y;
Q C2 answered: Y; Q C2a(1)a answered: Y; Q C2a(1)b answered: Y; Q C3 answered: Y; Q C3a(1)a answered: N;
Q C3a(1)b answered: N; Q C3a(1)c answered: Y; Q C4 answered: Y; Q C5 answered: Y;