



Worker Package

Title	Facility Hazard Analysis		
Document No.	19202.4	Status	Approved as of 05/04/2017
Complexity Determination	Moderate	Consequence Determination	Moderate
Planned Start Date	03/01/2017	Planned End Date	03/01/2020
Scope Summary	Work activities associated with the experiments and instrumentation used on the Advance Photon Source beam lines, and the associated support, control and common areas within the APS.		
Type	Task-based Hazard Analyses	Rigor Level	Medium
Approving Division	PSC	Approving Department	<i>Not Applicable</i>
NEPA Number	B3.6 - Siting/construction/operation/ decommissioning of facilities for bench-scale research, conventional laboratory operations, small-scale research and development and pilot projects	Person in Charge	Barkalow, Thomas

Task Summary	
Task #	Task
1	Beam Line, Experimental Hutches, and Common Areas
2	Dry Lab Activities
3	Wet Lab Activities

Attachments			
File Name	Description	Date	Attached By

Assets	
CODE	DESCRIPTION

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Permits Summary	
Code	
ANL-609A ANL Laser Operating Permit	http://www.tis.anl.gov/db/forms/template/DDD/ANL-609A_20120725_PDF5.pdf

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Task 1 Beam Line, Experimental Hutches, and Common Areas			
Task Description	Experimental work activities associated with the experiments and instrumentation used on beam lines. The scope covers activities and instrumentation within beam lines, experimental hutches and associated control and common areas. In addition to the experiment enclosures, beam line instrumentation is used to transport x-ray beams from the APS shield wall to the experimental enclosures. Typical beam line activities include vacuum work, alignment & mechanical adjustments, and electronic interfacing on equipment such as slits, mirrors, monochromators, beam position monitors, cryo-cooled optics, and the associated motion control, vacuum, robotic, laser, mechanical and electrical systems.		
Planned Start Date	03/01/2017	Planned End Date	03/01/2020
Scope Limits	Work covered under an approved ESAF is outside the scope of this module. Radiation protection provided through shielding, RSS components, and the Personal Protection System (PSS) are not included within the scope of this module, but are considered within the APS Accelerator SAD.		
Task Attachments	File Name	Date	Attacher
External Training	Training identified and required in an employee's job hazard questionnaire.		
On the Job Training	APS Sector Specific Orientation		
Response to Unplanned Events	Stop work immediately and contact the supervisor. In case of emergency dial 911.		
Worker Proficiencies	<i>Not Applicable</i>		

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Task 1 Beam Line, Experimental Hutches, and Common Areas

Hazard Detail	Controls	Training
<p>/Physical safety hazards Crush hazard</p> <p>Task Hazard Relationship Operations of robotic equipment in "teach" mode.</p>	<p>administrative control only - Operate robotic equipment in accordance with manufactures instructions at the slowest possible speed. Ensure personnel remain clear of all ranges of the equipment.</p> <p>Additional Requirements Operate robotic equipment in accordance with manufactures instructions at the slowest possible speed. Ensure personnel remain clear of all ranges of the equipment.</p>	
<p>/Physical safety hazards/Hand tool hazards/Non-powered hand tool GENERIC (use for all hand tools - select this in addition to those below, if appropriate)</p> <p>Task Hazard Relationship Experimental work activities in this area often require use of common hand tools.</p>	<p>do not carry hand tools in pockets - carry in hands, tool pouches, bags, or boxes</p> <p>do not place tools where they can cut, fall on, or trip someone</p> <p>do not use "cheater bars" to increase leverage, torque, or extend handle of tool</p> <p>follow LMS-PROC-153</p> <p>inspect tools before each use - never use broken or damaged tools</p> <p>only use tools you have been trained to use</p> <p>verify handles are tight and free of grease or oil</p> <p>safety glasses with sideshields (ANSI Z87.1)</p> <p>shoes that cover the entire foot</p> <p>sturdy work gloves when handling rough or sharp material</p>	

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Task 1 Beam Line, Experimental Hutches, and Common Areas

Hazard Detail	Controls	Training
<p>/Physical safety hazards/Hand tool hazards/Powered hand tool (e.g., electric, pneumatic, battery powered) Electric power tool</p> <p>Task Hazard Relationship Experimental work activities in this area often require use of common portable power tools.</p>	<p>GFCI (fixed or portable) - test at start of each shift before use apply "Do Not Use" tag to damaged or unguarded tools, notify supervisor caution when wearing gloves while operating power tools dead front plugs, receptacles, connectors (remove open face plugs from service) disconnect source of power before changing accessories do not lay cords or air hose across floor - suspend or mark area with signs/barricades grounding prong must be present if the plug is equipped with one if it is necessary to lay power cords and air hoses along the ground, protect them from vehicles and pedestrians by laying two planks on either side of cord/hose or by building a runway over it perform electrical tool inspection: check for chafing, cracking, poor cord insulation, missing/faulty grounding conductor/prong, missing/bent/damaged switch or trigger, damaged motor housing, missing cover plates, exposed live parts, signs of overheating or excessive sparking power cords may not have cuts/nicks or be wrapped with tape pull back long hair to keep from getting caught in tools set down portable power tool only after it has come to a complete stop hearing protection no jewelry safety glasses with sideshields (ANSI Z87.1) shoes that cover the entire foot work gloves</p>	

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Hazard Detail	Controls	Training
<p>/Physical safety hazards/ Hoisting and rigging - mechanically-assisted material handling equipment Manual or power-operated hoist, winch, jib, or floor crane</p> <p>Task Hazard Relationship Experimental hutches and optics hutches have permanently installed chain-fall hoists mounted to the enclosure that are used to secure and lift experimental equipment.</p>	<p>operator must be trained and authorized for equipment use by Argonne - APS21111 APS Incidental Crane Operator Training is an approved alternate to PFS21111</p> <p>hard hat when overhead hazard exists</p> <p>safety glasses with sideshields (ANSI Z87.1)</p> <p>safety-toe protective footwear (e.g., composite or steel-toe)</p> <p>sturdy work gloves when handling rigging equipment or rough or sharp material</p> <p>Additional Requirements</p> <p>Hoisting and rigging activities can pose potential risks, so whenever practical, the services of rigging professionals provided through ANL-FMS will be used.</p> <p>All hoisting and rigging activities shall have the approval of the sector's Hoisting and Rigging Coordinator. The Sector Hoisting and Rigging Coordinator is appointed to supervise the safe operation of cranes and hoists throughout the sector. He or she is in charge of the pre-use inspection of all cranes and hoisting equipment and the training of the sector staff and users in the safe use of such equipment.</p> <p>The Sector Hoisting & Rigging Coordinator provides qualified candidates with an orientation to the hoisting and rigging equipment they need to use and describes the applicable requirements and limitations. Rigging equipment (for example hutch cranes and synthetic slings) that are not utilized on a regular schedule may remain unavailable for use until inspected by the Hoisting and Rigging Coordinator.</p>	<p>ESH436 Chain Fall Operator Training</p>
<p>/Physical safety hazards/ Protruding object or impalement hazard Bump (e.g., from pipes, cabinets)</p> <p>Task Hazard Relationship Instruments, beamline components, and infrastructure can present protruding parts that can result in physical injury.</p>	<p>cushion protruding object</p> <p>warning tape</p> <p>hard hat</p> <p>safety glasses with sideshields (ANSI Z87.1)</p>	

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Hazard Detail	Controls	Training
<p>/Physical safety hazards/Sharps hazard - cut/puncture/abrasion (non-biological) Working with small hand tools (e.g., utility knives, screwdrivers, scissors, etc.)</p> <p>Task Hazard Relationship Experimental work activities in this area often require use of common hand tools and portable power tools.</p>	<p>see Physical safety hazards/Hand tool use for controls</p>	
<p>/Physical safety hazards/Stored energy/Differential pressure system (excluding vacuum) Use or storage of DOT cylinders</p> <p>Task Hazard Relationship High pressure gas cylinders are used in various applications to supply non-hazardous gases such as N2, He, Ar, air, etc... to experimental equipment including detectors, flight paths, beam line sections, chambers, etc...</p>	<p>gas pressure regulators inspected in last 5 years verify piping/tubing compliant with ESH 13.1 and ESH 13.2 verify piping/tubing rated for operating temperature and pressure simultaneously</p>	<p>ESH810 Argonne Pressure Systems Safety Manual Information</p>

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Hazard Detail	Controls	Training
<p>/Physical safety hazards/Stored energy/Differential vacuum system Category II - differential pressure across the vacuum system can exceed 15 psi, but is protected from credible failure using engineered controls (e.g., pressure relief)</p> <p>Task Hazard Relationship Many experimental activities require vacuum conditions to reduce the influence of air on measurements, sample preparations, or characterization. For example, the beam line environment must be maintained as vacuum to assure efficient delivery of x-rays to the experimental station, and reduce the effects of ozone interactions with beam line components such as optics and windows.</p>	<p>verify pressure relief devices have ASME "UV" certification mark or documentation of operability tests demonstrating function and flow capacity available</p> <p>verify vessel stamped with ASME Code Symbol or allowable compressive stresses calculated using ASME Code Case 2286 July 17 1998</p> <p>Argonne Pressure System Safety Manual may be used as guidance when evaluating pressure system hazards - see http://inside.anl.gov/pages/fms-division-documents</p> <p>verify fabrication by sound engineering practices as defined by a responsible design engineer</p> <p>verify pressure relief device inspection and testing current per NBIC</p> <p>safety glasses with sideshields (ANSI Z87.1)</p>	

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Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Physical agents/Hot or cold surfaces/Hot object or substance > 100°C (212°F) and ≤ 1000° C (1832°F)</p> <p>Task Hazard Relationship Experimental activities in this area often require extreme temperature environments and/or conditions. Extreme temperatures present conditions that could result in burns or damage to equipment. For example, vacuum vessels often require bake-out to achieve acceptably low levels, beam line optics are cooled to liquid nitrogen temperatures, and displax coolers and cryo-pumps are used in various applications in the sector.</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>	<p>grabber-type hand tools</p> <p>allow object to cool before handling without gloves or tools</p> <p>post signage "CAUTION - HOT SURFACE"</p> <p>insulated gloves intended for hot surfaces (i.e., no cryogenic gloves)</p>	

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Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Physical agents/Hot or cold surfaces/Cold object or substance $\leq -100^{\circ}\text{C}$ (-148°F) (see: Industrial hygiene hazards/ Toxic chemicals and dusts/ Cryogenic material/Using cryogenic material)</p> <p>Task Hazard Relationship Experimental activities in this area often require extreme temperature environments and/or conditions. Extreme temperatures present conditions that could result in burs or damage to equipment. For example, vacuum vessels often require bake-out to achieve acceptably low levels, beam line optics are cooled to liquid nitrogen temperatures, and displax coolers and cryo-pumps are used in varous applications in the sector.</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>	<p>ventilation to prevent oxygen deficiency (may need to be calculated by an SME)</p> <p>follow ESH-4.10 Hazardous Materials - Cryogenic Liquid Safety</p> <p>tongs or long handled tools</p> <p>cryogenic gloves</p> <p>full face shield</p> <p>long sleeves</p> <p>safety glasses with sideshields (ANSI Z87.1)</p> <p>shoes made of nonabsorbent material uppers, e.g., leather, and cuffless trousers</p>	

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Task 1 Beam Line, Experimental Hutches, and Common Areas		
Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Physical agents/Laser/Class 1, Class 2, or Class 2M Per manufacturer</p> <p>Task Hazard Relationship Lasers are frequently used for alignment of instruments and samples. Only class 2 lasers are permitted for alignment applications.</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>	<p>refer to manufacturer specification</p>	
<p>/Industrial hygiene hazards/ Physical agents/Laser/Class 3A or 3R Permanent use</p> <p>Task Hazard Relationship Installation, setup, testing, alignment, and use of Class 3a lasers</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>	<p>ANL-609A - Laser Operating Permit follow LMS-PROC-285 Laser Safety</p> <p>Permits ANL-609A ANL Laser Operating Permit http://www.tis.anl.gov/db/forms/template/DDD/ANL-609A_20120725_PDF5.pdf</p>	<p>ESH121 Low-Power Laser Safety</p>

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Task 1 Beam Line, Experimental Hutches, and Common Areas		
Hazard Detail	Controls	Training
/Industrial hygiene hazards/ Physical agents/Laser/Class 3B Permanent use Task Hazard Relationship Installation, setup, testing, alignment, and use of Class 3b lasers IH Monitoring Requested No IH Recommendations	ANL-609A - Laser Operating Permit follow LMS-PROC-285 Laser Safety Permits ANL-609A ANL Laser Operating Permit http://www.tis.anl.gov/db/forms/template/DDD/ANL-609A_20120725_PDF5.pdf	ESH120 Web Based Laser Safety ESH120 Laser Safety
/Industrial hygiene hazards/ Physical agents/Laser/Class 4 Permanent use Task Hazard Relationship Installation, setup, testing, alignment, and use of Class 4 lasers IH Monitoring Requested No IH Recommendations	ANL-609A - Laser Operating Permit follow LMS-PROC-285 Laser Safety Permits ANL-609A ANL Laser Operating Permit http://www.tis.anl.gov/db/forms/template/DDD/ANL-609A_20120725_PDF5.pdf	ESH120 Web Based Laser Safety ESH120 Laser Safety

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Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Physical agents/Static magnetic field Magnetic field > 2 T (per IH survey)</p> <p>Task Hazard Relationship Fields may be present from both high-field superconducting magnets and lower-field electromagnets. Stray fields can adversely affect personnel with pacemakers and can cause the inadvertent movement of loose hand tools and other metal objects.</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>	<p>access controls</p> <p>shielding as feasible</p> <p>IH survey</p> <p>warning sign for medical implant wearers, supplied by ESQ-IH</p>	

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Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Toxic chemicals and dusts/Lead/ Inorganic Assembly or disassembly of shielding</p> <p>Task Hazard Relationship Pb is often used as a shielding material to reduce the background signal in x-ray measurements. Pb adhesive tape, Pb sheets, or bulk Pb blocks are often used to improve experiment data quality. The Pb materials used for these purposes are not highly dispersible. Pb materials such as bricks are also used in shielding and as counter-weights.</p> <p>IH Monitoring Requested Yes</p> <p>IH Recommendations Personal air monitoring for lead and surface wipe sampling needed for large jobs and unusual jobs such as handling lead shot.</p>	<p>HEPA filtered vacuum cleaner</p> <p>establish a lead control area for exposures expected to exceed PEL of 50 ug/m3 of air, isolate and post work area: "WARNING, LEAD WORK AREA, POISON, NO SMOKING OR EATING"</p> <p>no compressed air blowoff or dry sweeping</p> <p>waste: establish satellite accumulation area (LMS-PROC-103), use compatible container (max: 55 gal hazardous or 1 qt acutely hazardous), container in good condition or overpacked in secondary, label as "hazardous waste", "mixed waste" or other to identify contents, maintain auditable record of contents for WMO-195/197, notify NWM at closeout</p> <p>written procedure - APS Lead Handling APS_1201511</p> <p>Argonne-issued work clothes or disposable clothing</p> <p>work gloves (leather or equivalent)</p> <p>Additional Requirements</p> <p>Pb handling will be performed in accordance with the APS Lead Handling Procedure APS_1201511</p>	<p>ESH171 Lead: Hazards and Controls Training</p>

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Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Toxic chemicals and dusts/ Cryogenic material/Filling and/ or transporting of dewars or cylinders (includes equipment reservoirs such as squids, cold traps, detectors, etc.) Utilizing a fixed piping system</p> <p>Task Hazard Relationship Liquid cryogenes are used for various experimental activities including cooling samples, detectors, and x-ray optical components. For example, many beam lines use a closed loop, liquid nitrogen cryo-cooler to supply liquid cryogen to beam line optical components. Direct contact with cryogenic materials can result in frostbite and serious burns or damage to eyes and other tissue. In addition, release into confined spaces may result in oxygen deficient atmosphere, and confined liquid or solid cryogenes may produce explosive expansion upon warming. The activities addressed here</p>	<p>ventilation to prevent oxygen deficiency (may need to be calculated by an SME) follow ESH-4.10 Hazardous Materials - Cryogenic Liquid Safety cryogenic gloves full face shield long sleeves long trousers without cuffs over shoe tops safety glasses with sideshields (ANSI Z87.1) shoes made of nonabsorbent material uppers, e.g., leather, and cuffless trousers</p>	<p>ESH433 Tilting Dewar Cart Training ESH433PR Tilting Dewar Cart Practical Factor</p>

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Hazard Detail	Controls	Training
include non-flammable, inert cryogens such as liquid nitrogen and helium that are used to cool components such as detectors and the monochromator crystals contained in the beam line. IH Monitoring Requested No IH Recommendations		

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Task 1 Beam Line, Experimental Hutches, and Common Areas

Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Toxic chemicals and dusts/ Cryogenic material/Filling and/ or transporting of dewars or cylinders (includes equipment reservoirs such as squids, cold traps, detectors, etc.) Utilizing a non-fixed or portable piping system</p> <p>Task Hazard Relationship Liquid cryogens are used for various experimental activities including cooling samples, detectors, and x-ray optical components. For example, many beam lines use a closed loop, liquid nitrogen cryo-cooler to supply liquid cryogen to beam line optical components. Direct contact with cryogenic materials can result in frostbite and serious burns or damage to eyes and other tissue. In addition, release into confined spaces may result in oxygen deficient atmosphere, and confined liquid or solid cryogens may produce explosive expansion upon warming.</p>	<p>ventilation to prevent oxygen deficiency (may need to be calculated by an SME)</p> <p>avoid awkward body position</p> <p>follow ESH-4.10 Hazardous Materials - Cryogenic Liquid Safety</p> <p>cryogenic gloves</p> <p>full face shield</p> <p>long sleeves</p> <p>long trousers without cuffs over shoe tops</p> <p>safety glasses with sideshields (ANSI Z87.1)</p> <p>shoes made of nonabsorbent material uppers, e.g., leather, and cuffless trousers</p>	<p>ESH433 Tilting Dewar Cart Training</p> <p>ESH433PR Tilting Dewar Cart Practical Factor</p>

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Hazard Detail	Controls	Training
<p>The activities addressed here include non-flammable, inert cryogens such as liquid nitrogen and helium that are used to cool components such as detectors and the monochromator crystals contained in the beam line.</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>		

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Task 1 Beam Line, Experimental Hutches, and Common Areas

Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Toxic chemicals and dusts/ Cryogenic material Using cryogenic materials</p> <p>Task Hazard Relationship Liquid cryogens are used for various experimental activities including cooling samples, detectors, and x-ray optical components. For example, many beam lines use a closed loop, liquid nitrogen cryo-cooler to supply liquid cryogen to beam line optical components. Direct contact with cryogenic materials can result in frostbite and serious burns or damage to eyes and other tissue. In addition, release into confined spaces may result in oxygen deficient atmosphere, and confined liquid or solid cryogens may produce explosive expansion upon warming. The activities addressed here include non-flammable, inert cryogens such as liquid nitrogen and helium that are are used to cool</p>	<p>ventilation to prevent oxygen deficiency (may need to be calculated by an SME)</p> <p>follow ESH-4.10 Hazardous Materials - Cryogenic Liquid Safety</p> <p>tongs or long handled tools</p> <p>cryogenic gloves</p> <p>full face shield</p> <p>long sleeves</p> <p>long trousers without cuffs over shoe tops</p> <p>safety glasses with sideshields (ANSI Z87.1)</p> <p>shoes made of nonabsorbent material uppers, e.g., leather, and cuffless trousers</p>	<p>ESH195 Personal Protective Equipment</p>

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Hazard Detail	Controls	Training
<p>components such as detectors and the monochromator crystals contained in the beam line.</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>		
<p>/Industrial hygiene hazards/ Toxic chemicals and dusts Industrial chemicals (e.g., solvents, strippers, paints, adhesives, industrial cleaners)</p> <p>Task Hazard Relationship Common industrial chemicals such as solvents, detergents, aerosols, paints, adhesives, epoxies, etc... are often required for routine use in this area.</p>	<p>follow MSDS</p> <p>safety glasses with sideshields (ANSI Z87.1) or safety goggles</p>	

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Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Toxic chemicals and dusts/ Beryllium (excludes finished articles with no potential for dispersal) Work with manufactured articles</p> <p>Task Hazard Relationship Be window materials are widely used on APS beam lines as vacuum barriers, detector covers, etc... In normal use, these do not present significant potential for exposure. However, Be is a brittle metal, and may fracture into small pieces if dropped or mishandled. The broken Be fragments may pose exposure risk.</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>	<p>ANSI-compliant eyewash (able to be reached in < 10 sec. and path of travel shall be free of obstructions) safety shower</p> <p>waste: establish satellite accumulation area (LMS-PROC-103), use compatible container (max: 55 gal hazardous or 1 qt acutely hazardous), container in good condition or overpacked in secondary, label as "hazardous waste", "mixed waste" or other to identify contents, maintain auditable record of contents for WMO-195/197, notify NWM at closeout</p> <p>chemical-resistant gloves (nitrile or neoprene)</p> <p>full face shield OR indirectly ventilated safety goggles - safety glasses are required when working directly with materials</p> <p>labcoat</p>	<p>ESH211 Beryllium Hazard Awareness</p> <p>ESH246 Safe Handling of Carcinogens</p>

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Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Toxic chemicals and dusts/ Beryllium (excludes finished articles with no potential for dispersal)</p> <p>Cleanup of fractured manufactured articles</p> <p>Task Hazard Relationship Be window materials are widely used on APS beam lines as vacuum barriers, detector covers, etc... In normal use, these do not present significant potential for exposure. However, Be is a brittle metal, and may fracture into small pieces if dropped or mishandled. The broken Be fragments may pose exposure risk.</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>	<p>written procedure - Broken Be materials require specific cleanup in accordance with APS _1191124 Procedure for the Management of Broken Beryllium Windows and Equipment Contaminated with Beryllium Oxide</p> <p>Additional Requirements Broken Be materials require specific cleanup in accordance with APS _1191124 Procedure for the Management of Broken Beryllium Windows and Equipment Contaminated with Beryllium Oxide</p>	<p>ESH211 Beryllium Hazard Awareness</p> <p>ESH246 Safe Handling of Carcinogens</p>

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Hazard Detail	Controls	Training
<p>/Fire and life safety hazards/ Flammable or combustible storage - liquid or solid ≤ 5 gallons, in an approved safety can</p> <p>Task Hazard Relationship Common chemicals such as solvents, aerosols, paints, adhesives, epoxies, etc... are often required in small quantities for routine use in this area. Some of these materials may be flammable or combustible.</p>	<p>must not have > than 5 gallons in use and/or in UL listed refrigerator AND must not exceed 120 gallons total per flammable liquids cabinet and 240 gallons total for a fire area (combined in use and in storage cabinets)</p>	

Locations

Building	Room	Location	Task
400	BLDG	Beam Lines, Experimental Hutches, and Common Areas	Task # 1

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Task 2 Dry Lab Activities			
Task Description	Dry labs are used primarily for mechanical and electrical (non-energized) work on components and equipment to support experimental activities. Typical work conducted in this area involves assembly, repair, and testing of beam line equipment. This includes activities such as mechanical work with hand tools and/or small power tools; fabricating and testing signal and motor cables; configuration and repair of beam line equipment such as vacuum pumps, motors, actuators, amplifiers, compressors, and sample stages; soldering of electrical connections; testing of software communication with beamline equipment; unpacking and assembly of beamline components.		
Planned Start Date	03/01/2017	Planned End Date	03/01/2020
Scope Limits	Work covered under an approved ESAF is outside the scope of this module.		
Task Attachments	File Name	Date	Attacher
On the Job Training	APS Sector Specific Orientation		
Response to Unplanned Events	Stop work immediately and contact the supervisor. In case of emergency dial 911.		
Worker Proficiencies	<i>Not Applicable</i>		

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Task 2 Dry Lab Activities		
Hazard Detail	Controls	Training
<p>/Physical safety hazards/Hand tool hazards/Non-powered hand tool</p> <p>GENERIC (use for all hand tools - select this in addition to those below, if appropriate)</p> <p>Task Hazard Relationship Experimental work activities in this area often require use of common hand tools.</p>	<p>do not carry hand tools in pockets - carry in hands, tool pouches, bags, or boxes</p> <p>do not place tools where they can cut, fall on, or trip someone</p> <p>do not use "cheater bars" to increase leverage, torque, or extend handle of tool</p> <p>follow LMS-PROC-153</p> <p>inspect tools before each use - never use broken or damaged tools</p> <p>only use tools you have been trained to use</p> <p>verify handles are tight and free of grease or oil</p> <p>safety glasses with sideshields (ANSI Z87.1)</p> <p>shoes that cover the entire foot</p> <p>sturdy work gloves when handling rough or sharp material</p>	

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Task 2 Dry Lab Activities		
Hazard Detail	Controls	Training
<p>/Physical safety hazards/Hand tool hazards/Powered hand tool (e.g., electric, pneumatic, battery powered)</p> <p>Electric power tool</p> <p>Task Hazard Relationship Experimental work activities in this area often require use of common portable power tools,</p>	<p>GFCI (fixed or portable) - test at start of each shift before use</p> <p>apply "Do Not Use" tag to damaged or unguarded tools, notify supervisor</p> <p>caution when wearing gloves while operating power tools</p> <p>dead front plugs, receptacles, connectors (remove open face plugs from service)</p> <p>disconnect source of power before changing accessories</p> <p>do not lay cords or air hose across floor - suspend or mark area with signs/barricades</p> <p>grounding prong must be present if the plug is equipped with one</p> <p>if it is necessary to lay power cords and air hoses along the ground, protect them from vehicles and pedestrians by laying two planks on either side of cord/hose or by building a runway over it</p> <p>perform electrical tool inspection: check for chafing, cracking, poor cord insulation, missing/faulty grounding conductor/prong, missing/bent/damaged switch or trigger, damaged motor housing, missing cover plates, exposed live parts, signs of overheating or excessive sparking</p> <p>power cords may not have cuts/nicks or be wrapped with tape</p> <p>pull back long hair to keep from getting caught in tools</p> <p>set down portable power tool only after it has come to a complete stop</p> <p>hearing protection</p> <p>no jewelry</p> <p>safety glasses with sideshields (ANSI Z87.1)</p> <p>shoes that cover the entire foot</p> <p>work gloves</p>	

Title	Facility Hazard Analysis		
Document No.	19202.4	Status	Approved as of 05/04/2017

Task 2 Dry Lab Activities		
Hazard Detail	Controls	Training
<p>/Physical safety hazards/Hand tool hazards/Powered hand tool (e.g., electric, pneumatic, battery powered)</p> <p>Pneumatic tool</p> <p>Task Hazard Relationship Experimental work activities in this area often require use of common portable power tools,</p>	<p>apply "Do Not Use" tag to damaged or unguarded tools, notify supervisor</p> <p>carry air-powered tools in a manner that prevents accidental "triggering"</p> <p>caution when wearing gloves while operating power tools</p> <p>chip guarding and personal protective devices</p> <p>disconnect source of power before changing accessories</p> <p>do not lay cords or air hose across floor - suspend or mark area with signs/barricades</p> <p>if it is necessary to lay power cords and air hoses along the ground, protect them from vehicles and pedestrians by laying two planks on either side of cord/hose or by building a runway over it</p> <p>inspect air connections and hoses - do not use if damaged or cut</p> <p>maintain discharge pressure of air used for cleaning at or below 30 psi</p> <p>pull back long hair to keep from getting caught in tools</p> <p>secure compressed air hoses to air-powered tools to prevent accidental disconnection and whipping of the hose - use safety clips or pins per manufacturer</p> <p>set down portable power tool only after it has come to a complete stop</p> <p>shut off air, bleed pressure before disconnecting air hose from air supply</p> <p>no jewelry</p> <p>safety glasses with sideshields (ANSI Z87.1)</p> <p>shoes that cover the entire foot</p> <p>work gloves</p>	

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Document No.	19202.4	Status	Approved as of 05/04/2017

Task 2 Dry Lab Activities		
Hazard Detail	Controls	Training
<p>/Physical safety hazards/ Protruding object or impalement hazard Bump (e.g., from pipes, cabinets)</p> <p>Task Hazard Relationship Instruments, beamline components, and infrastructure can present protruding parts that can result in physical injury.</p>	cushion protruding object warning tape hard hat safety glasses with sideshields (ANSI Z87.1)	
<p>/Physical safety hazards/Sharps hazard - cut/puncture/abrasion (non-biological) Working with small hand tools (e.g., utility knives, screwdrivers, scissors, etc.)</p> <p>Task Hazard Relationship Research activities in this area frequently depend on sharp cutting tools such as razor blades, or on syringes for loading liquid sample cells that present risk of physical injury by cuts and scratches.</p>	see Physical safety hazards/Hand tool use for controls	

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Task 2 Dry Lab Activities		
Hazard Detail	Controls	Training
<p>/Physical safety hazards/Stored energy/Differential pressure system (excluding vacuum) Use or storage of DOT cylinders</p> <p>Task Hazard Relationship High pressure gas cylinders are used in various applications to supply non-hazardous gases such as N2, He, Ar, air, etc... to experimental equipment including detectors, flight paths, beam line sections, chambers, etc...</p>	<p>gas pressure regulators inspected in last 5 years</p> <p>verify piping/tubing compliant with ESH 13.1 and ESH 13.2</p> <p>verify piping/tubing rated for operating temperature and pressure simultaneously</p>	<p>ESH810 Argonne Pressure Systems Safety Manual Information</p>

Title	Facility Hazard Analysis		
Document No.	19202.4	Status	Approved as of 05/04/2017

Task 2 Dry Lab Activities

Hazard Detail	Controls	Training
<p>/Physical safety hazards/Stored energy/Differential vacuum system Category II - differential pressure across the vacuum system can exceed 15 psi, but is protected from credible failure using engineered controls (e.g., pressure relief)</p> <p>Task Hazard Relationship Many experimental activities require vacuum conditions to reduce the influence of air on measurements, sample preparations, or characterization. For example, the beam line environment must be maintained as vacuum to assure efficient delivery of x-rays to the experimental station, and reduce the effects of ozone interactions with beam line components such as optics and windows.</p>	<p>verify pressure relief devices have ASME "UV" certification mark or documentation of operability tests demonstrating function and flow capacity available</p> <p>verify vessel stamped with ASME Code Symbol or allowable compressive stresses calculated using ASME Code Case 2286 July 17 1998</p> <p>Argonne Pressure System Safety Manual may be used as guidance when evaluating pressure system hazards - see http://inside.anl.gov/pages/fms-division-documents</p> <p>verify fabrication by sound engineering practices as defined by a responsible design engineer</p> <p>verify pressure relief device inspection and testing current per NBIC</p> <p>safety glasses with sideshields (ANSI Z87.1)</p>	

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Document No.	19202.4	Status	Approved as of 05/04/2017

Task 2 Dry Lab Activities		
Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Toxic chemicals and dusts Industrial chemicals (e.g., solvents, strippers, paints, adhesives, industrial cleaners)</p> <p>Task Hazard Relationship Common industrial chemicals such as solvents, detergents, aerosols, paints, adhesives, epoxies, etc", are often required for routine use in this area.</p>	<p>follow MSDS safety glasses with sideshields (ANSI Z87.1) or safety goggles</p>	
<p>/Industrial hygiene hazards/ Toxic chemicals and dusts/Lead Soldering, less than 30 days per year</p> <p>Task Hazard Relationship Dry lab activities IH Monitoring Requested No IH Recommendations</p>	<p>collect spent solder and dispose properly perform housekeeping tasks no less frequently than at the end of each shift</p>	

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Task 2 Dry Lab Activities		
Hazard Detail	Controls	Training
<p>/Fire and life safety hazards/ Flammable or combustible storage - liquid or solid ≤ 5 gallons, in an approved safety can</p> <p>Task Hazard Relationship Common chemicals such as solvents, aerosols, paints, adhesives, epoxies, etc., are often required in small quantities for routine use in this area. Some of these materials may be flammable or combustible.</p>	<p>must not have > than 5 gallons in use and/or in UL listed refrigerator AND must not exceed 120 gallons total per flammable liquids cabinet and 240 gallons total for a fire area (combined in use and in storage cabinets)</p>	

Locations			
Building	Room	Location	Task
400	ALLAREAS	Dry Labs	Task # 2

Title	Facility Hazard Analysis		
Document No.	19202.4	Status	Approved as of 05/04/2017

Task 3 Wet Lab Activities			
Task Description	Activities in chemical laboratory space. These labs are used primarily for sample preparation for user experiments. This encompasses activities such as cleaning samples using common solvents; mounting of samples using various common adhesives; grinding of metallic powders using a mortar and pestle; and loading sample cells or mounts. The laboratory is also used for testing of beam line components. Typical work conducted in this area involves common solvents such as acetone, ethanol or methanol; heating of samples and/or adhesive mixtures using a hot plate or kiln; testing new beam line equipment such as sample cooling refrigeration units; unpacking and assembly of beam line components and user-provided instrumentation.		
Planned Start Date	03/01/2017	Planned End Date	03/01/2020
Scope Limits	Work covered under an approved ESAF is outside the scope of this module.		
Task Attachments	File Name	Date	Attacher
On the Job Training	APS Sector Specific Orientation		
Response to Unplanned Events	Stop work immediately and contact the supervisor. In case of emergency dial 911.		
Worker Proficiencies	<i>Not Applicable</i>		

Title	Facility Hazard Analysis		
Document No.	19202.4	Status	Approved as of 05/04/2017

Task 3 Wet Lab Activities		
Hazard Detail	Controls	Training
<p>/Physical safety hazards/Hand tool hazards/Non-powered hand tool</p> <p>GENERIC (use for all hand tools - select this in addition to those below, if appropriate)</p> <p>Task Hazard Relationship Experimental work activities in this area often require use of common hand tools</p>	<p>do not carry hand tools in pockets - carry in hands, tool pouches, bags, or boxes</p> <p>do not place tools where they can cut, fall on, or trip someone</p> <p>do not use "cheater bars" to increase leverage, torque, or extend handle of tool</p> <p>follow LMS-PROC-153</p> <p>inspect tools before each use - never use broken or damaged tools</p> <p>only use tools you have been trained to use</p> <p>verify handles are tight and free of grease or oil</p> <p>safety glasses with sideshields (ANSI Z87.1)</p> <p>shoes that cover the entire foot</p> <p>sturdy work gloves when handling rough or sharp material</p>	

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Task 3 Wet Lab Activities		
Hazard Detail	Controls	Training
<p>/Physical safety hazards/Hand tool hazards/Powered hand tool (e.g., electric, pneumatic, battery powered)</p> <p>Electric power tool</p> <p>Task Hazard Relationship Experimental work activities in this area often require use of common portable power tools</p>	<p>GFCI (fixed or portable) - test at start of each shift before use</p> <p>apply "Do Not Use" tag to damaged or unguarded tools, notify supervisor</p> <p>caution when wearing gloves while operating power tools</p> <p>dead front plugs, receptacles, connectors (remove open face plugs from service)</p> <p>disconnect source of power before changing accessories</p> <p>do not lay cords or air hose across floor - suspend or mark area with signs/barricades</p> <p>grounding prong must be present if the plug is equipped with one</p> <p>if it is necessary to lay power cords and air hoses along the ground, protect them from vehicles and pedestrians by laying two planks on either side of cord/hose or by building a runway over it</p> <p>perform electrical tool inspection: check for chafing, cracking, poor cord insulation, missing/faulty grounding conductor/prong, missing/bent/damaged switch or trigger, damaged motor housing, missing cover plates, exposed live parts, signs of overheating or excessive sparking</p> <p>power cords may not have cuts/nicks or be wrapped with tape</p> <p>pull back long hair to keep from getting caught in tools</p> <p>set down portable power tool only after it has come to a complete stop</p> <p>hearing protection</p> <p>no jewelry</p> <p>safety glasses with sideshields (ANSI Z87.1)</p> <p>shoes that cover the entire foot</p> <p>work gloves</p>	

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Task 3 Wet Lab Activities		
Hazard Detail	Controls	Training
<p>/Physical safety hazards/Stored energy/Differential pressure system (excluding vacuum) Use or storage of DOT cylinders</p> <p>Task Hazard Relationship High pressure gas cylinders are used in various applications to supply non-hazardous gases such as N2, He, Ar, air, etc... to experimental equipment including detectors, flight paths, beam line sections, chambers, etc...</p>	<p>gas pressure regulators inspected in last 5 years</p> <p>verify piping/tubing compliant with ESH 13.1 and ESH 13.2</p> <p>verify piping/tubing rated for operating temperature and pressure simultaneously</p>	<p>ESH810 Argonne Pressure Systems Safety Manual Information</p>

Title	Facility Hazard Analysis		
Document No.	19202.4	Status	Approved as of 05/04/2017

Task 3 Wet Lab Activities

Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Physical agents/Hot or cold surfaces/Hot object or substance > 100°C (212°F) and ≤ 1000° C (1832°F)</p> <p>Task Hazard Relationship Experimental activities in this area often require extreme temperature environments and/or conditions. Extreme temperatures present conditions that could result in burns or damage to equipment. For example, vacuum vessels often require bake-out to achieve acceptably low level</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>	<p>grabber-type hand tools</p> <p>allow object to cool before handling without gloves or tools</p> <p>post signage "CAUTION - HOT SURFACE"</p> <p>insulated gloves intended for hot surfaces (i.e., no cryogenic gloves)</p>	

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Document No.	19202.4	Status	Approved as of 05/04/2017

Task 3 Wet Lab Activities		
Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Physical agents/Hot or cold surfaces/Cold object or substance $\leq -100^{\circ}\text{C}$ (-148°F) (see: Industrial hygiene hazards/ Toxic chemicals and dusts/ Cryogenic material/Using cryogenic material)</p> <p>Task Hazard Relationship Experimental activities in this area often require extreme temperature environments and/or conditions. Extreme temperatures present conditions that could result in burns or damage to equipment. For example, beam line optics are cooled to liquid nitrogen temperatures, and displax coolers and cryo-pumps are used in various applications in the sector.</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>	<p>ventilation to prevent oxygen deficiency (may need to be calculated by an SME)</p> <p>follow ESH-4.10 Hazardous Materials - Cryogenic Liquid Safety</p> <p>tongs or long handled tools</p> <p>cryogenic gloves</p> <p>full face shield</p> <p>long sleeves</p> <p>safety glasses with sideshields (ANSI Z87.1)</p> <p>shoes made of nonabsorbent material uppers, e.g., leather, and cuffless trousers</p>	

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Document No.	19202.4	Status	Approved as of 05/04/2017

Task 3 Wet Lab Activities		
Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Toxic chemicals and dusts Common household chemicals (e.g., cleaning products, sprays, etc.)</p> <p>Task Hazard Relationship Common industrial chemicals such as solvents, detergents, aerosols, paints, adhesives, epoxies, etc... are often required for routine use in this area.</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>	<p>direct spray away from eyes, skin, body parts</p> <p>follow MSDS</p> <p>safety glasses with sideshields (ANSI Z87.1)</p>	

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Document No.	19202.4	Status	Approved as of 05/04/2017

Task 3 Wet Lab Activities

Hazard Detail	Controls	Training
<p>/Industrial hygiene hazards/ Toxic chemicals and dusts Carcinogen (refer to ESH-4.5)</p> <p>Task Hazard Relationship Common carcinogenic chemicals such as solvents, adhesives, epoxies, etc... are sometimes required in small quantities for routine use in this area.</p> <p>IH Monitoring Requested No</p> <p>IH Recommendations</p>	<p>ANSI-compliant eyewash (able to be reached in < 10 sec. and path of travel shall be free of obstructions)</p> <p>chemical exhaust hood</p> <p>safety shower</p> <p>written procedure - Work with class 1 and class 2 carcinogens having low to moderate risk of exposure per the APS Chemical Hygiene Plan APS_1258007</p> <p>post signage that states "DANGER - (CHEMICAL IDENTIFICATION) - MAY CAUSE CANCER - AUTHORIZED PERSONNEL ONLY"</p> <p>waste: establish satellite accumulation area (LMS-PROC-103), use compatible container (max: 55 gal hazardous or 1 qt acutely hazardous), container in good condition or overpacked in secondary, label as "hazardous waste", "mixed waste" or other to identify contents, maintain auditable record of contents for WMO-195/197, notify NWM at closeout</p> <p>chemical-resistant apron</p> <p>chemical-resistant gloves - (lamine film)</p> <p>full face shield</p> <p>labcoat</p> <p>safety glasses with sideshields (ANSI Z87.1) or indirectly-ventilated goggles</p>	<p>ESH246 Safe Handling of Carcinogens</p>

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Document No.	19202.4	Status	Approved as of 05/04/2017

Task 3 Wet Lab Activities		
Hazard Detail	Controls	Training
<p>/Fire and life safety hazards Flammable or combustible use - liquid or solid</p> <p>Task Hazard Relationship Common chemicals such as solvents, aerosols, paints, adhesives, epoxies, etc... are often required in small quantities for routine use in this area. Some of these materials may be flammable or combustible.</p>	<p>do not expose combustibles to high temperatures</p> <p>do not use in presence of flame, spark, heat, or other ignition source</p> <p>exercise caution - beware of flammable vapors</p> <p>smoking prohibited</p> <p>use in well-ventilated area</p>	
<p>/Fire and life safety hazards/ Flammable or combustible storage - liquid or solid ≤ 5 gallons, in an approved safety can</p> <p>Task Hazard Relationship Common chemicals such as solvents, aerosols, paints, adhesives, epoxies, etc... are often required in small quantities for routine use in this area. Some of these materials may be flammable or combustible.</p>	<p>must not have > than 5 gallons in use and/or in UL listed refrigerator AND must not exceed 120 gallons total per flammable liquids cabinet and 240 gallons total for a fire area (combined in use and in storage cabinets)</p>	

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Task 3 Wet Lab Activities

Locations			
Building	Room	Location	Task
400		Wet Labs	Task # 3

Title	Facility Hazard Analysis		
Document No.	19202.4	Status	Approved as of 05/04/2017

Reviews and Approval			
Type	Reviewer	Reviewer Comments	Completed
Draft	Rossi, Paul (#57494)(630) 252-4192		03/21/2017
Review Team Lead Signoff	Barkalow, Thomas (#44669)(630) 252-9243		03/28/2017
SME Review: Non-ionizing radiation	Murdoch, Bruce T. (#46491) null		06/04/2013
SME Review: Laser	Broocks, Bryan T. (#231998)(630) 252-3396		12/11/2014
SME Review: Industrial hygiene	Davis, John T. (#26106)(630) 252-2865	Personal air monitoring for lead and surface wipe sampling needed for large jobs and unusual jobs such as handling lead shot.	03/29/2017
SME Review: Physical safety	Clarke, Charles J. (#53042)(630) 252-5100		04/01/2014
ESH Coordinator Review	Barkalow, Thomas (#44669)(630) 252-9243		05/04/2017
Divisional Approval	Barkalow, Thomas (#44669)(630) 252-9243		05/04/2017