



**DRAFT**  
**RESEARCH SUPPORT BUILDING AND**  
**INFRASTRUCTURE MODERNIZATION PROJECT**

**Preliminary Hazard Analysis Report**



April 2009  
SLAC-I-050-07050-003



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## **1.0 Introduction**

A Hazard Analysis of the hazards anticipated in conjunction with the Research Support Building and Infrastructure Modernization Project (RSB) at the SLAC National Accelerator Laboratory was conducted. The risk level posed by the proposed relocation of personnel, demolition of existing structures, construction and relocation activities has been determined to be below regulatory thresholds for the general public. The potential hazards found in this modernization project would be the same as those typically found at peer industrial or research sites. Details of this hazard classification and analysis are presented in this report.

## **2.0 Project Description**

The RSB project consists of the demolition of ~20,000 square feet of trailer and modular type structures, renovation of three existing buildings; 003, 024, 041 and the construction of a new Research Support Building of approximately 53,000 – 58,000 square feet.

### **2.1 Research Support Building**

New two or three story building, approximately 53,000 – 58,000 gross square feet, to be erected on a site requiring demolition of 13 smaller existing structures as part of project scope.

### **2.2 Building 003 Renovation**

Renovate approximately 7,000 square feet of the third floor (at grade level) of an existing building currently housing a training classroom and legacy equipment racks. Finished project shall include a new training center with the remaining floor space converted to offices with the potential for a small conference room. Renovation is expected to be a wall to wall and floor to ceiling demolition and reconstruction. The renovation leaves the exterior shell intact except for modifications to ingress and egress, utilities, windows, and other necessary changes. The overall building electrical capacity appears to be adequate for the new occupancy, but due to their age consideration should be given to consider replacement of the service switchboard, feeders, conduit, and distribution network. The existing HVAC systems shall be evaluated to determine if they are suitable for the renovated space.

## 2.3 Building 024 Renovation

Renovate the occupied areas of an existing building with an open high bay and partial second floor totaling approximately 32,000 square feet. An ADA compliant elevator shall be added for second floor access. The existing areas shall be rearranged as necessary for optimum space and energy utilization. The existing restrooms shall be replaced with ADA compliant restrooms. The scope of work is focused on the renovation of ES&H laboratories. The existing shops and office areas on both first floor and second floor will have minor upgrade. The overall building electrical capacity appears to be adequate for the new occupancy, but due to their age consideration should be given to consider replacement of the service switchboard, feeders and conduit. The existing HVAC systems will be assessed for re-commissioning. The existing Radiation Calibration Facility will be upgraded.

## 2.4 Building 041 Renovation

The approximately 44,000 square feet of an existing two story building shall be renovated. An ADA compliant elevator shall be added for second floor access. The present usage is primarily office, but the arrangement and occupancy shall be evaluated to optimize the space and energy utilization. Revised occupancy requirements will likely change the configuration. Renovation is expected to be a wall to wall and floor to ceiling demolition and reconstruction on both floors; leaving the shell intact. The overall building systems such as electrical, mechanical, plumbing, fire protection will be replaced with new.

Those aspects of the RSB Project which pertain to Environmental, Health and Safety (ES&H) have been identified. The SLAC Worker Safety and Health Plan and the Integrated Safety and Environmental Management System (ISEMS) will be used to address these aspects throughout the design, relocations, renovations and construction activities of this project.

It is the policy of this laboratory to protect the environment and all persons, both employees and visitors, from accident or injury while they are on site. The SLAC Environmental, Safety and Health Manual (ESHM) specifies a comprehensive set of physical and administrative conditions that define safe operations at SLAC. Chapter 2 of the ESHM describes the processes for analyzing hazards and implementing tailored controls for projects such as RSB. The goal of these processes is to ensure that the project can be conducted in a manner that will limit risks to the health and safety of employees and the public and will adequately protect the environment.

The proposed project was reviewed for compliance with the National Environmental Protection Act (NEPA). In January of 2009 the proposed project was determined to be categorically excluded from further NEPA review.

## **3.0 Methodology**

A hazard analysis process was selected to provide a uniform and thorough means for identifying and assessing the hazards to people and the environment. The process consisted of three steps, which are described below:

### **3.1 Development of a list of potential significant hazards**

A list of potentially significant hazards associated with the relocation of personnel, the demolition of existing structures, the renovation of offices and laboratories, and the construction activities was compiled for use in assessing the RSB project. The resulting potential hazard list is included as Attachment A.

### **3.2 Assessment of the renovation and construction plans**

Assessment of the renovation and construction plans for the presence of these potential hazards. In Section 3, Table 1 lists the potential hazards for this project based on the construction plans and the activities to be performed during renovation. Section 3 also includes a narrative description of each hazard category.

### **3.3 Assessment of the probability of a mishap or equipment failure**

Assessment of the probability of a mishap or equipment failure and the severity of the consequences.

The final step in the analysis was a ranking of the hazards according to the various risks related to the environment or safety and health activities. Classification of the identified hazards was documented using a Hazard Analysis worksheet. Each identified hazard was characterized according to hazard type, potential consequences, and initiating event. In consultation with the SLAC ES&H Division staff, risk rankings were assigned. Also included are descriptions of the installed hazard mitigation measures, both passive and active. The hazard analysis worksheet is included as Attachment B.

The RSB Project will remove or mitigate as many of the identified hazards as can be achieved prior to the beginning of the projects' demolition phase. Surveys of the buildings will be conducted by SLAC National Accelerator Laboratory. The results of the radiation and hazardous materials identification surveys will be presented to the projects management. The project management will establish a budget for removal and relocation of these materials to designated location at SLAC National Accelerator Laboratory. This budget will also include, where possible, removal of these materials from the site for proper disposal.

## 4.0 Results and Assessments

The results of the second step in the Hazard Analysis methodology, hazard identification, are presented in Table 1 using a matrix of hazard type versus work breakdown structure (WBS) activity. As indicated in the table, the RSB project would involve relocation, demolition, construction, mechanical, electrical, fire, hazardous materials, radiation, and environmental hazards.

Construction safety, including demolition, has been identified as the one of the highest hazard activities during the project. A medium ranked hazard will be the relocation of personnel before the demolition/construction phase begins and a the end of the project. The lowest ranked hazards have been identified as existing hazardous materials, radiation, etc.

**Table 1: Hazard Identification for RSB Project**

	Reference Section	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8
WBS Number	WBS Description	Construction Hazards	Mechanical Hazards	Electrical Hazards	Fire Hazards	Haz Mat Hazards	Spill Hazards	Radiation Hazards	Environmental Hazards
	Relocation					X			X
	Demolition	X	X	X	X	X	X	X	X
	Construction	X	X	X	X	X	X	X	X
	Demolition	X	X	X	X	X	X	X	X
	Structural	X	X	X	X	X	X		
	Mechanical	X	X		X		X		
	Electrical	X		X	X				
	Architectural	X				X	X		X

## 4.1 Relocation Hazards

The scope of relocation for the project includes personnel, material, and equipment in all of the locations contained within the boundaries of the project. For example: the footprint of the RSB will require the demolition of the existing office and experimental space (trailers). All personnel and equipment will be relocated to other areas and buildings at the SLAC National Accelerator Laboratory. The Project will make every effort to reduce the number of moves in the relocation effort. Some relocation will have to occur twice due to the needs to of the Laboratory.

The assumptions for the relocation hazards relating to environmental safety and health have been determined by comparing this projects scope to historical personnel and laboratory moves at SLAC. Those comparisons included several projects involving relocations of personnel, material, and equipment; LCLS and PULSE.

The hazards associated with relocation (medium probability) include:

- Material handling
- Slip/trips/falls
- Unidentified materials

- Lacerations
- Electrical
- Hazardous energy
- Falls from height

To remove or mitigate these hazards the control hierarchy will be followed.

- Eliminate or substitute the hazard where feasible
- Engineering controls
- Administrative controls
- Personal Protective Equipment (PPE)

A graded approach will be used for each location. Grouping the hazards and environmental concerns based on condition and like activities will be performed where feasible.

## 4.2 Demolition Hazards

The potential demolition hazards related to environmental, safety, and health have been addressed by comparing the tasks and activities to a renovation project and a “ground up” construction project. Demolition has been identified as a high hazard activity (Attachment B). The hazards include many of the concerns that occur with a construction project:

- Material handling
- Slip/trips/falls
- Vibrating equipment
- Scaffolding
- Excavation
- Electrical
- Hazardous energy (latent or potential)
- Stationary combustion engine
- Dust
- Impacts on adjacent operations
- Falls from height (as opposed to trip/falls over surfaces)

- Hot work
- Lacerations
- Overhead hazards (falling objects)
- Powered industrial vehicles (e.g., scissor lifts)
- Chemical hazards (paints, solvents, adhesives, etc.)
- Hoisting and rigging
- Oxygen deficiency
- Vehicular hazards
- Radiation/emitting sources

To mitigate these hazards, the subcontractor is required to submit their company safety programs, which must include the California Injury & Illness Prevention Program (IIPP) along with company's Code of Safe Work Practices. The subcontractor will have to submit and have accepted a California Heat Illness Prevention Program (HIPP). A completed Safety Qualification Form will be required with evidence of the subcontractor performing demolition work successfully at three previous locations. Their proposed site superintendent will have to submit evidence of experience with demolition work and creating a safety plan for the activities. A single Site-Specific Safety Plan (SSSP) for this project is also prepared by the general or prime subcontractor and the lower-tier sub-contractors. The SSSP is a project-specific plan addressing anticipated/potential hazards that will be encountered while performing the contracted work. In addition, the SSSP has identified the SLAC specific conditions, policies, and procedures for controlling the project-specific safety and environmental hazards. The plan includes, but is not limited to, information about emergency contacts, emergency response, emergency care providers (non-life or life threatening) required permits, staging areas, delivery areas, area, building, and work hazards, subcontractor training, equipment to be used during site work, and personal protective equipment (PPE) requirements for the entire scope of the project. The plan is reviewed by the ES&H Division and must be accepted before work commences.

Job Safety Analysis (JSA) documents will address the mitigations and controls for the hazards identified by this document, the SSSP, and field findings. This series of documents are site/area and task specific. They are created prior to the start of work or activities and are maintained/updated daily. The JSA will be communicated to all participants in the work area that day along with any visitors to the site/area controlled by the project.

## 4.3 Construction Hazards

Construction and its associated activities are among the highest safety hazards in any workplace. The Research Support Building and Infrastructure Modernization Project management and integrated support team understands these hazards and has emphasized the ISEMS approach to hazard identification and mitigation. Using past construction projects at SLAC National Accelerator Laboratory as guidelines to determine the hazards, identify the controls used to remove or mitigate those hazards, and examine the lessons learned from those projects provided a listing of the potential construction safety hazards for this project. Those hazards, moderate in probability, relevant to the project include:

- Material handling
- Slip/trips/falls
- Vibrating equipment
- Scaffolding
- Demolition
- Excavation
- Electrical
- Hazardous energy
- Stationary combustion engine
- Dust
- Impacts on adjacent operations
- Falls from height (as opposed to trip/falls over surfaces)
- Hot work
- Lacerations
- Overhead hazards (falling objects), failure to use hardhats
- Powered industrial vehicles (e.g., scissor lifts)
- Chemical hazards (paints, solvents, adhesives, etc.)
- Hoisting and rigging
- Oxygen deficiency
- Vehicles (e.g. work , delivery)

To mitigate these hazards, the subcontractor is required to submit their company safety programs as outlined in the demolition hazards section; 4.2 All the subcontractors involved in the project will submit a Safety Qualification Form which will capture the subcontractors qualifications to work on this project.

Each subcontractor working in the construction phase will be required to fill out Job Safety Analysis (JSA) document. This process was described in the demolition hazards section; 4.2.

## **4.4 Mechanical Hazards**

The scope of the mechanical hazards that may be encountered during relocation, demolition, and construction include; transporting, lifting, moving, positioning, and assembly of large, heavy, and awkward components. Additional mechanical hazards include the use of portable hand and powered tools. The applicable SLAC ES&H Chapters policies and procedures will be applied to these hazards. Mitigating mechanical hazards will be identified in the job safety analysis (JSA) that will be updated and communicated daily during the projects duration. The JSA lists hazards already identified for a given project in the statement of work, contractor site visit, SSSP, and related documents, and provides details of how to control them for specific tasks. The analysis and results are documented using JSA forms, and are discussed with workers before beginning the task. As the project progresses feedback from project managers, subcontractor management and employees, etc. will be used to adjust the JSA to correct and improve the communication of the hazards to all the affected personnel. Visitors to the project areas will be briefed on the JSAs and will be required to sign their acknowledgement of having read the JSAs. Any hazard that is identified during work activities that is not covered in the JSA will have a “stop activity” issued by the person who identified the hazard. The subcontractor’s site management, the SLAC project manager, UTR, and other safety personnel will evaluate the hazard, consider the removal of the hazard or its mitigation based on the control hierarchy described previously.

## **4.5 Electrical Hazards**

Electrical hazards will exist during the demolition, remodeling, and construction phases of the project. The resulting hazards analysis has determined that these hazards are of moderate probability. The relocation portion of the project may encounter these hazards as well. Hazards include unknown energized sources/circuits, exposed wires, and stored energy (capacitors & inductors). An incident could result in electrical shock, burns, or injuries from an arc-flash. Chapter 8 of the ESHM identifies the requirements for working on electrical systems. A Utility Isolation Plan (UIP) will be prepared to actively

mitigate accidents and injuries related to electrical hazards; subcontractors and their lower-tier subcontractors will follow the procedures outlined in the UIP. The UIP will be communicated to the subcontractors involved in the work prior to its start. Any questions or concerns raised by the subcontractors will be resolved prior to the start of the work. The UIP will also include other utilities such as water and natural gas. An electrical work plan will be required, and authorization must be obtained through SLAC Authority Having Jurisdiction (AHJ), with assistance from the Electrical Safety Officer, to perform any work that is energized. All electrical work shall be controlled through the Control of Hazardous Energy (CoHE), also known as Lockout/Tagout (LOTO). CoHE is a set of practices and procedures to safeguard personnel against the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during relocation, demolition, construction, commissioning, service, or maintenance activities. Additionally, no panel shall be opened or breaker activated unless an ARC flash calculation has been completed by SLAC and the panel is labeled with appropriate PPE warning labels to match existing labels in use at SLAC. Workers must comply with warning labels on the panels. Lists of the labels in use at SLAC are provided the subcontractors and their employees when they complete ES&H Course 375 prior to their start of work at SLAC. In addition, all subcontractors who will be working on or around the electrical portions of the project will have to complete ES&H Course 239.

## **4.6 Fire Hazards**

Construction and demolition activities elevate the risk of fire to a level determined to be high for this project. This level was determined due to the passive mitigations being turned off or removed during demolition and those mitigations not being installed or activated during construction. Active mitigations such as fire watches and housekeeping must be substituted. Some of the identified fire hazards include electrical work, welding or cutting, construction debris, and flammable material use. The subcontractor's SSSP identifies measures to mitigate fire hazards. Those mitigations will address the particular hot work being performed. A SLAC Hot Work Permit will be used for all of the potential fire generating hazards and is issued by on-site SLAC fire department. The Hot Work Permit will identify ingress pathways, egress routes, fire extinguisher locations, and fire safety watch requirements. The Fire Marshal, Assistant Fire Marshal, and other safety professionals will review the fire permits and make spot checks during the project to verify the project's compliance with the SLAC fire permit program. The SSSP will identify the need for Hot Work Permits and the JSA will identify the tasks that require the Permit, the person responsible for providing the permit, who completes the permit, and the duration of the permit.

## **4.7 Hazards associated with Hazardous Materials**

At all phases of the project hazardous materials are present either in the existing buildings or are brought in by the subcontractors. Those hazardous materials issues to

be addressed during demolition and construction include; asbestos removal and handling, handling of toxic or allergenic materials, handling of compressed gas cylinders, and exposure to chemicals; cutting fluids, solvents, etc. The probability for these hazards has been determined to be low based on the surveys of the buildings prior to the start of the project. Also, all subcontractors must submit a recent MSDS sheet with the SSSP and have the material accepted by SLAC ES&H.

During demolition and construction, asbestos and small amounts of lead, PCBs, and other contaminants may be encountered in the project area. SLAC ES&H staff will evaluate exposures and advise project management on additional personal protective equipment (PPE), procedures, or training that may be required.

The control of hazards in the above categories is addressed through the application of Occupational Safety and Health Administration (OSHA) regulations and other relevant standards, such as American National Standards Institute (ANSI) and American Conference of Governmental Industrial Hygienists (ACGIH), as well as the ESHM. Hazards identified in the SSSP will be mitigated by the methods outlined in the JSA ensuring that every subcontractor follows those mitigations and that proper safety training has been completed by the workers for their assignments. An asbestos-qualified subcontractor will be used to remove all the asbestos-containing materials (ACM) that have been identified by the surveys conducted prior to the start of work.

## **4.8 Spill Hazards**

A spill or release of material can impact the environment and personnel safety. During demolition and construction spill or release hazards can include liquids from cutting pressurized piping or from entrainment in secured piping, tipping paint and solvent containers, fuel and material deliveries, and leaks from equipment malfunctions. The probability for these hazards has been determined by the project to be low.

Spill prevention measures will be implemented and mitigations will be in place prior to the start of work. Spill prevention measures include closing containers when not in use, proper storage including secondary containment, spill cleanup supplies and equipment at the worksite, protecting drains and softscape in staging areas, and immediately reporting all spills. All piping to be cut will be drained and depressurized prior to being cut as determined by the utility isolation plan. The location of the cuts will be clearly marked as described in the demolition plan. The SSSP for the Project contains spaces for environmental and hazardous materials release information and the measures to be taken to prevent a release or spill. The JSA's will address those specific activities with the potential for spills or releases and their mitigations and communicate the information to the affected personnel.

## 4.9 Radiation Hazards

The buildings and areas encompassed by the RSB&IM have used various radiological materials and sources as part of lab's operations. The controls for the associated radiological hazards include examination of the historical activities in the building and areas, survey all the buildings and areas, removal of all sources and surveying all material removed for disposal. Surveys of the Project's areas and buildings have been completed before the demolition and construction areas are released to the subcontractor. Also, any potential radiological material that is discovered during demolition, renovation or construction will be surveyed by SLAC's RP group and removed to a designated location for storage.

## 4.10 Environmental Hazards

Hazardous waste will be generated during the project from the demolition of the existing buildings, the construction of the RSB, and the renovations in the identified three buildings. Waste handling, storage and disposal will be coordinated according to the ESHM. SLAC has comprehensive programs for the handling, storage, and disposal of hazardous material and chemical wastes. The project has determined the probability of these hazards to be low.

Some of the potential hazards are associated with natural phenomena; earthquakes, flooding, landslides, and high winds. SLAC has an Emergency Preparedness Plan in place to address these issues for all people who may be onsite at SLAC. The SSSP for the project will include these hazards and identify the contents of the Emergency Preparedness Plan to the subcontractors and their personnel. The JSA will include mitigations and controls that apply to those activities that have the potential for generating environmental hazards.

## 5.0 Conclusions

It is the intent of the Project's management team that the technical and scientific goals of the project be achieved in a safe and environmentally sound manner. This document summarizes a variety of potential ES&H hazards that might be encountered prior to and during the RSB Project. The conclusion of the RSB Project Management Team is that all major hazards have been identified and can be addressed by the means discussed here and in the attachments. Through the use of historical documents on experiments or work activities at the project sites and surveys conducted of those areas, the project will remove as many of the hazards as possible to remove the risks associated with those

hazards. A “stop activity” order will be issued if any previously unidentified hazards are discovered during relocation, demolition, renovation or construction. The new hazards will be evaluated using the control hierarchy and a plan will be prepared to mitigate the hazard(s). This document will serve as a guide in developing the actual hazard analysis and job planning that will be used during construction.

All subcontractors, prime and sub-tier, will be required to submit a Safety Qualification Form to demonstrate their ability to perform the work safely. In addition each subcontractors comprehensive safety program will be evaluated and accepted prior to the start of work. These steps along with safety oversight by SLAC SME’s and Safety Coordinators will assist in the projects execution of its work in a safe manner.

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# APPENDIX A

## Hazard List

The following list is a synopsis of potential hazards that may be associated with a project similar in scope to the RSB Project at SLAC. This list was assembled by consulting SLAC's Work Smart Standards document and by using generic potential hazard groupings. The intent is to provide a checklist that identifies potential hazards that might be encountered during the RSB Project. The list is in no way intended to substitute for a thorough on-site facility inspection. Instead, it serves as a catalogue of watchful experience and reminder alerts.

### Construction Hazards

- Material handling
- Hoisting and rigging
- Slip/Trips/Falls
- Vibrating equipment
- Excavation
- Demolition
- Stationary combustion engines
- Falls from height (as opposed to trip/falls over surfaces)
- Hot work
- Lacerations
- Overhead and falling objects hazards
- Powered industrial vehicles; e.g. scissor lifts, etc.
- Chemical hazards
- Oxygen deficiency
- Hoisting and rigging
- Construction debris
- Subcontractor vehicles

### Mechanical Hazards

- Material shipment and receiving
- Moving large awkward heavy equipment
- Handling awkward and/or heavy components.

### Kinetic Energy

- Power tools and equipment
- Movement of large objects
- Overhead structures and equipment
- Motor generator equipment and flywheels

### Hazardous Energy

- Compressed gases
- Vacuum/pressure vessels

### Hazardous Atmosphere

- Confined space(s)
- Oxygen deficiency

### Environmental Hazards

- Earthquakes
- Hazardous waste
- Air emissions
- Hazardous energy

### Toxic Materials

- Chemical agents
- Lead and other heavy metals
- Polychlorinated biphenyls (PCB's)

### Fire Hazards

- Combustible Liquids
- Combustible Materials
- Flammable Liquids
- Flammable Materials
- Cable insulation

### Electrical Hazards

- Unknown wiring
- Shorts in power tools
- Stored energy in capacitors

### Radiation Hazards

- Use of small radioactive sources

### Toxic Material Hazards

- Materials listed on the TSCA inventory.

### Spill Hazards

- Solvents
- Paints
- Fuel for generators
- Adhesives, solvents, paint
- Releases to the air

# APPENDIX B

## Hazard Analysis Worksheet

This attachment presents the results of the Hazard Analysis process in the form of a spreadsheet summary. The data are organized according to hazard type and project WBS number. Presented are the initiating event, the consequences, and the risk classification. Comments and a listing of the hazard mitigation measures in place are provided for each entry.

Ref section	WBS	Hazard Type	Consequence	Initiating Event	Severity/Probability	Comments and Hazard Mitigation Measures
	?	Relocation Hazards	Personal Injury, Equipment Damage, Facility/Structure Damage	Unknown factors and /or unsafe practice	Medium	<b>Comments:</b> Multiple hazards exist in moving existing equipment, furniture, and personal effects. <b>Passive Mitigation:</b> SLAC specific and employer specific training. <b>Active Mitigation:</b> Personnel training, review of the area/building hazards (JSA) for each stage of relocation, and staging plan incorporated into the JSA.
		Demolition	Personal Injury, Equipment Damage, Facility/Structure Damage, Environmental Damage	Unsafe practices, Plan Misstep, Missing/Poor Communication	Medium	<b>Comments:</b> Multiple hazards exist in demolition of existing structures and building interiors. <b>Passive Mitigation:</b> SLAC ESHM, SLAC specific training. <b>Active Mitigation:</b> Personnel training, subcontractor qualifications, SLAC SME review, comments, and observations.
		Construction Hazards	Personal Injury or Equipment Damage	Unsafe practices	Medium	<b>Comments:</b> Multiple hazards exist in construction. The majority of the injuries are extremities caught between, cuts, lacerations, and stains due to lifting <b>Passive Mitigation:</b> Use equipment properly with safety guards. <b>Active Mitigation:</b> All personnel need proper training and a daily review of the hazards (JSA) for each assignment. Reiteration of the proper use of PPE to prevent cuts and lacerations, keeping hands and feet clear of pinch zones and correct lifting techniques will be emphasized.
		Mechanical Hazards	Personnel Injury	Unsafe Practices	Medium	<b>Comments:</b> Operation of hand held power tools and manual tools as well as rotating machinery operations and pressurized systems. Also possible injury to personnel if proper procedures are not followed when lifting and moving heavy objects <b>Passive Mitigation:</b> Equipment safety guards. <b>Active Mitigation:</b> All personnel need proper training and a daily review of the hazards (JSA) for each assignment

Ref section	WBS	Hazard Type	Consequence	Initiating Event	Severity/ Probability	Comments and Hazard Mitigation Measures
		Electrical Hazards	Personnel Injury or property damage	Contact with Energized Equipment	High	<p><b>Comments:</b> Unknown wiring and unguarded wiring or shorts in power tools can present an electrical hazard.</p> <p><b>Passive Mitigation:</b> All equipment meets applicable NEC and NEMA codes and SLAC Safety requirements. All electrical equipment and tools used by contractors shall be UL- or NRTL listed. No daisy-chaining of electrical extension cords. GFCIs shall be used and checked daily with all electric (non-battery operated) tools and equipment. LO/TO (and verify zero energy) rules shall be used for all work on electrical equipment. All un-terminated wires should be covered (i.e.: wire nuts).</p> <p><b>Active Mitigation:</b> Strict adherence to the procedures identified in the Utility Isolation Plan. EWP procedures are in effect for all work on electrical equipment and systems. Also, Lockout/Tag out rules is in effect for all work on this equipment per OSHA requirements. Tools and equipment will be regularly inspected and faulty equipment will be removed from service.</p>
		Fire Hazards	Personnel Injury or Equipment Damage	Unsafe Practices	High	<p><b>Comments:</b> The demolition and remodeling could present a fire hazard.</p> <p><b>Passive Mitigation:</b> Fire response equipment is located near work area(s).</p> <p><b>Active Mitigation:</b> The subcontractor SSSP and JSA must be reviewed daily and be followed. No hot work will be allowed without a specific permit</p>
		Hazardous Materials Hazards	Personnel injury/ Accidental Exposure	Unsafe Practices	Low	<p><b>Comments:</b> The removal of the asbestos, etc. and the application of the chemicals used in the floor bonding operations may have associated health hazards.</p> <p><b>Passive Mitigation:</b> Choose chemicals with the lowest toxicity possible, consistent with the ESHM and best environmental practices. Comply with all applicable regulations for handling and storing chemicals.</p> <p><b>Active Mitigation:</b> Only certified asbestos abatement contractors and trained personnel, wearing proper PPE, may engage in asbestos removal activities. The subcontractor will properly notify the Bay Area Air Quality Management District prior to asbestos removal. All personnel working with chemicals need to wear proper PPE, have completed the proper training and review the hazards (JSA) daily.</p>

Ref section	WBS	Hazard Type	Consequence	Initiating Event	Severity/ Probability	Comments and Hazard Mitigation Measures
		Spill Hazards	Personnel injury/ Environ-mental exposure	Unsafe practices or equipment failure	Low	<p><b>Comments:</b> Spills of any material may present a hazard to personnel and/or the environment.</p> <p><b>Passive Mitigation:</b> Maintain spill kits at the work area(s).</p> <p><b>Active Mitigation:</b> Respond to spills immediately. Report spills immediately to the UTR. The UTR will contact ESH for assistance. Spills will be prevented by maintaining tools and equipment in proper working condition.</p>
		Radiation Hazards	Personnel injury	Unsafe Practices	Low	<p><b>Comments:</b> Radioactive sources have been present in the laboratories.</p> <p><b>Passive Mitigation:</b> All radioactive sources will be removed by the RP Dept.</p> <p><b>Active Mitigation:</b> Radiological surveys of equipment being removed shall be performed. Also, any potential radiological material that is discovered during demolition or construction will be surveyed and removed.</p>
		Environment al Hazards	Environmental damage/ Personnel Injury	Unsafe Practices	Low	<p><b>Comments:</b> Earthquakes and other natural disasters present a hazard to the personnel and the environment. Hazardous waste, incorrectly handled, could impact the environment.</p> <p><b>Passive Mitigation:</b> All personnel should know the emergency exit routes. All hazardous waste should be handled and disposed of properly. The building is structurally retrofitted to resist earthquakes.</p> <p><b>Active Mitigation:</b> The subcontractor SSSP will include actions to be taken by workers in an emergency. SLAC Waste Management Group will coordinate the disposal of all hazardous waste.</p>