1 next available number

Hazard Identification				Un-Mitigated Hazard and Risk Level					Mitigation Method / Updated Hazard and Risk Level						Verification	
#	Subsystem	Type	Title	Hazard Description	Severity	Probability	Risk Value	Risk Category	Mitigation Strategy	Mitigation Description	Severity1	Probability1	Risk Value1	Risk Category1	Verif Method	Verification Plan
Tower-1	Tower	Mech	Seimic/vibration damage	Seimic event or vibration degrades detector	2	C	6	Serious	Safety device	Address seismic motion with placement of the experiment on a seismic platform. Design to reduce local vibrational transmissivity.	3	C	11	Medium	Test	Test vibrational transmissivity of seismic platform
Cryo-1	Cryo	Cryo/ODH	ODH hazard from helium in cryo system	Injury or death from oxygen deficiency hazard due to catastrophic release of helium to drift	1	C	4	High	Control hazard	1-Limit the mass of helium stored in the C2 drift to 21kg; 2-Piping and system design and costructed to standards; 3-Develop controls to use during helium system work based on completed Hazard Report SCDMS-1. Possible controls include LOTO procedures, use of portable oxygen deficiency monitors near potential release points, deployment of rescue breathing devices, and development of emergency procedures.	1	E	12	Medium	Audit	See *Hazard Report SCDMS-1*
Cryo-2	Cryo	Press/Vac	Catastrophic failure/pressure release from shield can/E-stem	Injury from uncontrolled release/burst of shield can and/or E-Stem	2	C	6	Serious	Safety device	1-Design and build vessels to conform with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," 2015 and equivalent Canadian stds. [Safety device consists of PRV or burst disk(s)]; 2-Implement LOTO and zero pressure verification during set up and maintenance.	2	E	15	Medium	Test	Test vessels to 125% of maximum allowable working pressure. Test prototype PRVs/burst disks.
Cryo-3	Cryo	Elec	Electric shock from cryo systems	Electrical shock or startle from poor design or misuse of electrical system for cryo pumps and controllers.	2	D	10	Medium	Control hazard	1-Design cryogenic pumps and controllers according to SLAC Electrical Equipment Inspection Program (EEIP). 2-Use equipment according to manufacturer specifications or written standard operating procedures. 3-Install per electrical installation code.	4	D	19	Low	Inspection	Inspect cryo electrical equipment to assure EEIP compliance. Review and monitor electrical work and documentation. Inspect installation for code compliance.
Shield-1	Shield	Cryo/ODH	ODH hazard from N2 purge gas	Injury or death from oxygen deficiency hazard due to catstrophic release of nitrogen from gamma shielding system	1	C	4	High	Safety device	1-Fit nitrogen inlet with a critical flow orifice to limit N2 flow into drift to 900 lph. 2-Develop controls to use during helium system work based on completed Hazard Report SCDMS-1. Possible controls include LOTO procedures, use of portable oxygen deficiency monitors near potential release points, deployment of rescue breathing devices, and development of emergency procedures.	1	E	12	Medium	Test	See *Hazard Report SCDMS-1*
Shield-2	Shield	Fire	Granular activated charcoal (GAC) fire	Injury or death from fire in GAC in radon abatement system	1	D	8	Serious	Safety device	Install temperature monitoring on abatement system air outlet; overtemp will trigger pneumatic shutoff valves at inlet to and outlet from GAC canister thereby containing the condition and preventing a fire. Consider sprinkler system.	2	E	15	Medium	Test	Test thermal-monitoring interlock periodically; verify inlet and outlet valves to GAC canister close upon upon interlock tripping.
Shield-3	Shield	Fire	Polyethylene fire	Injury or death from combustible shield polyethylene fire	1	D	8	Serious	Control hazard	Water in polyethylene tanks acts as a heat sink, preventing fire. Project may replace polyethylene with metal tanks. Considering sprinkler system also.	2	E	15	Medium	Process control	Fill polyethylene tanks with water immediately upon integration to experiment
Shield-4	Shield	Elec	Electric shock from shield systems	Electrical shock or startle from poor design or misuse of electrical system for shield and radon-abatement system	2	D	10	Medium	Control hazard	1-Design shield systems according to SLAC Electrical Equipment Inspection Program (EEIP). 2-Use equipment according to manufacturer specifications or written standard operating procedures	2	E	15	Medium	Inspection	Inspect shield electrical equipment to assure EEIP compliance. Review and monitor electrical work and documentation.
Shield-5	Shield	Env	Poisoning from lead used in shielding	Illness from lead used in shielding	3	D	14	Medium	Control hazard	Procedures, JSA, PPE, monitoring while handling lead shielding	4	E	20	Low	Inspection	Inspect lead shielding to assure coating before installation on experiment
Shield-6	Shield	Matl's	Catastrophic water release from shielding	Injury from catastrophic release of water from shileding polyethyene tanks	3	D	14	Medium	Procedure, training	Put in place emergency plan for water release. Train experimenters in plan.	4	E	20	Low	Audit	Periodically review and test knowledge of emergency plan among underground workers
Shield-7	Shield	Fall	Fall from height	Serious injury caused by fall from SNOBOX, eTank or an adjacent ladder	2	D	10	Medium	Control hazard	Hazard needs to be better understood as design move forwards. To be determined what elevated items may need servicing, if any. Will aim to design to eliminate the hazard. As needed, barriers and procedures will be utlized also.	2	E	15	Medium	Review	To be determined. Not clear if the hazard will exist in the final design.

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#	Subsystem	Type	Title	Hazard Description	Severity	Probability	Risk Value	Risk Category	Mitigation Strategy	Mitigation Description	Severity1	Probability1	Risk Value1	Risk Category1	Verif Method	Verification Plan
Elec-1	Elec	Fire	Cable fire	Injury or death from fire in cable plant	1	C	4	High	Control hazard	Use only low-smoke low-halogen insulated cabling. If this cable overheats, the insulation may eventually melt and burn but it will generate less smoke than standard cables. Somke inhalation hazard reduced; improved likelihood of reaching refuge area safely. Considering sprinkler system to extinguish any fires that may occur. Fire risk to be assessed in detail during preliminary design phase.	3	D	14	Medium	Review	Complete fire risk review. Verify the correct cables were specified in the drawings and materials list. Verify the correct cables were purchased before installation.
Elec-2	Elec	Elec	Electric shock from readout electronics	Electric shock from elevated voltages of the readout electronics (±50 V DC)	2	D	10	Medium	Control hazard	1-Design readout electronics according to SLAC Electrical Equipment Inspection Program (EEIP). 2-Use equipment according to manufacturer specifications or written standard operating procedures	3	E	17	Medium	Inspection	Inspect readout electronics to assure EEIP compliance. Review and monitor electrical work and documentation.
Elec-3	Elec	Elec	Electric shock from electronics power supplies	Electrical shock or startle from poor design or misuse of electrical system power supplies	2	D	10	Medium	Control hazard	1-Use listed power supplies or design power supplies according to SLAC Electrical Equipment Inspection Program (EEIP). 2-Use equipment according to manufacturer specifications or written standard operating procedures	3	E	17	Medium	Inspection	Inspect unlisted power supplies to assure EEIP compliance. Review and monitor electrical work and documentation.
Cal-1	Cal	Env	Exposure to source radiation	Illness from exposure to radioactive calibration source material	4	D	19	Low	Procedure, training	Use and store radioactive source(s) accrding to SNOLAB Source Control rules. Post warnings and ensure personnel are trained to follow them.	4	E	20	Low	Audit	Periodically monitor complaince with SNOLAB Source Program. Audit warning signs and shifter knowledge.
UG-1	UG	Cryo/ODH	ODH hazard from gases other underground systems	Injury or death from oxygen deficiency hazard from non-life-supporting gases originating in non-SuperCDMS systems underground	1	C	4	High	Warning device	Provide continuous monitoring of drift air. Evacuate upon alarm for airborne oxygen concentrations below 19.5%. Emergency procedures, training, drills.	1	E	12	Medium	Process control	Check operation of oxygen monitors daily; audit knowledge of workers; audit drill frequency and effectiveness.
UG-2	UG	Env	Toxics from elsewhere in mine	Illness from toxic airborne contaminants originating outside experimental area	3	D	14	Medium	Procedure, training	Mine ventilation system provides fresh air. Evacuate according to SNOLAB requirements upon loss of forced-air ventialtion	3	E	17	Medium	Review	Review SNOLAB evacuation protocols
UG-3	UG	Env	Ground control	Loss of ground control can lead to serious injury or death	2	D	10	Medium	Procedure, training	Undergropund workers will inspect as required and report ground control problems to SNOLAB management immediately and avoid questionable areas.	3	E	17	Medium	Inspection	Workers will perform ground control inspections according to SNO requirements
UG-4	UG	Fire	Fire elsewhere in mine	Injury or death from the effects of a fire elsewhere in the INCO mine	1	D	8	Serious	Procedure, training	Workers underground will bide by the emergency response requirements listed in their NORCAT certification training.	2	D	10	Medium	Audit	Periodically assess UG worker knowledge of SNOLAB certification requirements. Participate in drills as required by SNOLAB.
UG-5	UG	Mech	Injury during material handling	Injury (struck-by, crushed-by, etc.) from improper use of material handling systems underground. This includes the planned SCDMS crane, SNOLAB blue boxes, and SNOLAB train cars underground.	2	C	6	Serious	Procedure, training	Workers using underground material handling equipment will receive SNOLAB certification.	3	D	14	Medium	Audit	Periodically assess UG worker compliance with SNOLAB certification requirements.
UG-6	UG	Mech	Injury not otherwise specified	Injury from hazards typically found in a lab environment: slips/trips/falls, repetitive motion, overexertion, etc.	3	C	11	Medium	Procedure, training	All work will take place according to SLAC work planning and control and SNOLAB NORCAT training requirements.	3	D	14	Medium	Audit	Periodically assess WPC used in work underground.
I&T-1	I&T	Matl's	I&T exposure to hazardous materials	Prior to CD-2 will evaluate this hazard.			#N/A	#N/A					#N/A	#N/A		
I&T-2	I&T	Fire	I&T fire	Prior to CD-2 will evaluate this hazard.			#N/A	#N/A					#N/A	#N/A		
I&T-3	I&T	Mech	I&T injury from material handling	Prior to CD-2 will evaluate this hazard.			#N/A	#N/A					#N/A	#N/A		
I&T-4	I&T	Matl's	I&T exposure to ionizing radiation	Prior to CD-2 will evaluate this hazard.			#N/A	#N/A					#N/A	#N/A		
I&T-5	I&T	Env	I&T oxygen deficiency	Prior to CD-2 will evaluate this hazard.			#N/A	#N/A					#N/A	#N/A		
I&T-6	I&T	Press/Vac	I&T injury from uncontrolled pressure release	Prior to CD-2 will evaluate this hazard.			#N/A	#N/A					#N/A	#N/A		
							#N/A	#N/A					#N/A	#N/A		

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Tables for Data Validation

Tower	Cryo/ODH
Cryo	Press/Vac
Shield	Mech
Elec	Struc
Cal	Elec
UG	Control
I&T	Env
	Fire
	Matl's
	Rad
	Fall

1	A
2	B
3	C
4	D
	E

High	Eliminate hazard	Remove the hazard altogether
Serious	Control hazard	Change design/manufacturing plans to reduce risk of mishap
Medium	Safety feature	Incorporate passive or static interveners to prevent a mishap
Low	Safety device	Add active device or monitor to interrupt mishap sequence
	Warning device	Incorporate monitors and warning of incipient mishap
	Procedure, training	Invoke special procedures, PPE, dedicated equipment

High	Test	Functional test of installed system verifies mitigation functions correctly
Serious	Inspection	Visual inspection or measurement verifies mitigation is applied as-req'd
Medium	Process control	Control parts/matl selection; qual/proof test; fab/ass'y process controls
Low	Audit	Check of in situ mitigations verifies that they are being used
	Review	Review or analysis of mitigation plans indicates that they will reduce hazard level

Statistics on Hazards

Hazard Type

	3	Cryo/ODH
	2	Press/Vac
	4	Mech
	0	Struc
	4	Elec
	0	Control
	5	Env
	5	Fire
	1	Fall
	3	Matl's
	27	**Total**
0	**Total**	Not OK Cross-check

Risk Category

	4	High
	6	Serious
	10	Medium
	1	Low
	21	**Total**
	Not OK	Cross-check

1A	1	High
2A	3	High
3A	7	Serious
4A	13	Medium
1B	2	High
2B	5	High
3B	9	Serious
4B	16	Medium
1C	4	High
2C	6	Serious
3C	11	Medium
4C	18	Low
1D	8	Serious
2D	10	Medium
3D	14	Medium
4D	19	Low
1E	12	Medium
2E	15	Medium
3E	17	Medium
4E	20	Low

Mitigation Strategy

0	Eliminate hazard
9	Control hazard
0	Safety feature
4	Safety device
1	Warning device
7	Procedure, training
21	**Total**
Not OK	Cross-check

Verification Method

4	Test
6	Inspection
2	Process control
6	Audit
3	Review
21	**Total**
Not OK	Cross-check