

Name(s) of Risk Team Members: A. Etkin, J. White	Point Value → Parameter ↓	1	2	3	4	5
Area/Facility Description Title: Collider-Accelerator Department Area/Facility # (if applicable): Area-Wide FRA17-05	Occupancy or Use	≤once/year	≤once/month	≤once/week	≤once/shift	>once/shift
Area/Facility Description: Area Wide Building 912/U-Line/g-2	Severity	First Aid Only	Medical Treatment	Lost Time	Partial Disability	Death or Permanent Disability
	Likelihood	Extremely Unlikely	Unlikely	Possible	Probable	Multiple
Approved by: <i>E. Lessard</i> Date: 4/27/05 Rev.#: 0						

Reason for Revision (if applicable):	Comments:
--------------------------------------	-----------

Physical Item or Activity	Hazard(s)	Control(s)	Before Additional Controls				Control(s) Added to Reduce Risk	After Additional Controls				% Risk Reduction
			Occupancy A	Severity B	Likelihood C	Risk* AxBxC		Occupancy A	Severity B	Likelihood C	Risk* AxBxC	
Hydraulics	Being struck by an object due to a pressure release	Design reviews, ESRC/ASSRC reviews, pressure testing, LOTO, work planning, PPE, training, procedures, posting labeling	3	4	2	24						
Hydraulics	Falls/slips on same level	Design reviews, ESRC/ASSRC reviews, pressure testing, LOTO, work planning, Tier 1 inspections	3	4	3	36						
Hydraulics	Fire	Design reviews, ESRC/ASSRC reviews, proof testing, LOTO, work planning, PPE, training, Fire/Rescue Group response	3	4	2	24						
Water	Being struck by an object due to a pressure release	Design reviews, ASSRC reviews, proof testing, LOTO, work planning, PPE and training	4	3	2	24						
Water	Contact with temperature – extremes that result in such injuries as heat exhaustion, frost bite or burns	Postings, maintenance, PPE, training, work planning, ASSRC review, procedures, Tier 1 inspections	4	3	2	24						
Moving Items with Cranes	Being struck by an object, such as falling objects	Training, daily crane inspections prior to use, PE crane maintenance, PPE, certified rigging equipment, Tier 1 inspections, yearly rigging inspections, load weights and center of gravity known prior to lift, procedures, qualified crane operators, critical lift and engineered lift requirements and reviews, warning alarms, postings, work planning, load testing, barriers	3	5	2	30						
Fork truck use	Being struck by an object, such as dropped loads	Training, daily fork truck inspections, PPE, seat belts tier 1, PE inspections and maintenance, required items strapped to mast, load weight and center of gravity known, work planning, postings, alarms, qualified fork lift operators, escort for transport if required, road surface maintenance	3	4	3	36						

Fork truck use	Traffic accidents, tip-over	Training, daily fork truck inspections, PPE, seat belts tier 1, PE inspections and maintenance, required items strapped to mast, load weight and center of gravity known, work planning, postings, alarms, qualified fork lift operators, escort for transport if required, road surface maintenance, spotter , back up alarms	3	4	2	24					
Manual material handling (pallet jacks, barrel and equipment carts, etc.)	Being struck by an object, such as falling objects	Training ,certified equipment, PPE as required, limited to load carrying limit of equipment, postings, tier 1,procedures, specific back injury prevention training, work planning , certified riggers if required, manual lift weight limit	4	3	3	36					
Manual material handling(pallet jacks, barrel and equipment carts, etc.)	Overexertion – injuries caused by excessive lifting, pushing, pulling, holding, carrying or throwing of an object	Training, certified equipment, PPE as required, limited to load carrying limit of equipment, postings, Tier 1 inspections, procedures, specific back injury prevention training, work planning, certified riggers if required, manual lift weight limit	4	3	4	48					
Gasses	Fire and heat	Interlocked emergency exhaust fans, remote/local audible/visible alarms, emergency response, EMTs, work planning, MSDS, LOTO, postings, system designs to consensus codes, flammable gas alarms, cylinder storage controls, cylinder labels, gas volume limits, inspections, cylinder hydrostatic testing	3	2	2	12					
Confined spaces	Exposure to a hazardous atmosphere	Gas sampling probe inserted prior to entry, appropriate atmosphere testing performed by a trained tester with functionally-tested monitor with a valid calibration date, procedures, confined space certification prepared by a trained person, confined space entry trained personnel	2	5	2	20					
Confined spaces	Increased chance of shock because of close proximity to conducting surfaces	Administrative controls, GFCI protection required	2	5	2	20					
Pressurized Systems	Being struck by an object, such as flying debris, due to a pressure release	Postings, PPE, maintenance, training, work planning, Cryogenic Safety Committee /ASSRC/ESRC reviews, procedures, interlock systems, certification/testing of pressure related equipment, Tier 1 inspections, LOTO, C-AD Chief ME reviews, codes and standards usage	4	4	2	32					
Pressurized Systems	Being struck by an object due to a pressure release	Postings, PPE, maintenance, training, work planning, Cryogenic Safety Committee /ASSRC/ESRC reviews, procedures, interlock systems, Certification/testing of pressure related equipment, Tier 1 inspections, LOTO, C-AD Chief ME reviews, codes and standards usage	3	3	2	18					
Vacuum	Ear damage	Postings, PPE, maintenance, training, work planning, ASSRC reviews, procedures, Tier 1 inspections, Chief ME reviews, vacuum windows covered during handling, use of industry standards, design reviews	2	4	2	16					
Vacuum	Being struck by an object, such as flying debris, due to a vacuum failure	Postings, PPE, maintenance, training, work planning, ASSRC reviews, procedures, Tier 1 inspections, Chief ME reviews, vacuum windows covered during handling, , use of industry standards, design reviews	2	4	2	16					
Working at heights	Falls to lower level, such as falling from a ladder or over a railing	Postings, barriers, fall protection, maintenance, training, work planning, procedures, Tier 1 inspections, PPE, approved scaffolding and platforms, approved ladders, anti-slip surfaces	4	5	3	60	An ad hoc committee has been appointed to address the issue of fall protection during shield block work. The principal difficulties concern the infeasibility of conventional fall protection methods in certain situations and the possibility of creating a greater hazard when using certain fall protection methods.				

Magnetic Field	Adverse mechanical force exerted on ferromagnetic objects and or to electronic/medical implants	Barriers, warning systems, postings, training, ASSRC review, work planning, procedures, Tier 1 inspections, magnetic safety reviews, medical exams, training	3	3	2	18							
Remotely Operated Equipment	Becoming caught in or compressed by equipment	Postings, barriers, guards, maintenance, training, work planning, procedures, Tier 1 inspections, ASSRC reviews	2	3	2	12							
Electrical Caged Area/ Rooms	Electrical shock	Locked areas, procedures, electrical safety training, control zones (e.g. signs and barriers), work permits, job safety analysis, LOTO, safety watch, energized electrical work permits, equipment design review, scheduled maintenance of equipment, fire rescue response, EMTs, work planning, PPE	2	5	2	20	See notes 1 through 4	2	4	2	16	20%	
Machining Activated Materials	Radiation exposure	Radiation surveys, facility specific training, work planning, radiation work permits, ALARA Committee review, shielding as needed, HEPA filters, PPE	3	1	2	6							
Machining Materials	Becoming caught in or compressed by equipment	Equipment specific training, machine guards, PPE, postings, maintenance, Tier 1 inspections	3	3	3	27							
Machining Materials	Being struck by an object, such as flying chips	Equipment specific training, machine guards, PPE, postings, maintenance, Tier 1 inspections	3	3	3	27							
Machining Materials	Airborne particulates	PPE, ventilation, maintenance, work planning	3	1	2	6							
Working With Compressed Air	Being struck by an object due to a pressure release	PPE, pressure reducing nozzles	3	3	3	27							
Working With Compressed Air	Injecting air through skin	PPE, pressure reducing nozzles	3	3	2	18							
Welding And Brazing	UV exposure	PPE, work planning, welding screens, procedures, welding permits, designated welding areas reviewed by Fire/Rescue Group	2	3	3	18							
Welding And Brazing	Electric shock	Maintenance of equipment, training, UL approved equipment	2	5	2	20							
Welding And Brazing	Contact with temperature – extremes that result in such injuries thermal burns and infrared burns	PPE, work planning, procedures, training, designated welding areas reviewed by F/R Group	2	3	3	18							
Welding And Brazing	Toxic fumes	PPE, work planning, ventilation, designated welding areas reviewed by F/R Group	2	2	2	8							
Welding And Brazing	Noise	Ear protection, work planning, medicals	2	1	2	4							
Soldering	Contact with temperature – extremes that result in such injuries as burns	PPE, work planning, procedures, training	5	2	3	30							
Soldering	Toxic fumes	PPE, work planning, procedures, training, ventilation, medicals	5	1	2	10							
Use Of Hand Tools	Being struck by an object such as flying chips	PPE, training, maintenance, Tier 1 inspections, UL listed equipment, pre-inspections	4	2	2	16							
Use Of Hand Tools	Electrical shock	GFCI, grounding cases or double insulated tools	4	3	2	24	See notes 1 through 4	4	2	2	16	33%	

Use Of Hand Tools	Being struck by an object such as sharp surfaces	PPE, training, guards	4	2	2	16						
Use Of Hand Tools	Becoming caught in or compressed by equipment	Equipment specific training, guarding, PPE, postings	4	2	2	16						
Chemical Handling	Burns	Procedures, compliance with regulations, training, CMS inventory, MSDS, volume controls, Fire/Rescue group response, PPE as required, locked or controlled areas, postings, labeling, proper containers, segregation, spill cleanup equipment available, Tier 1 inspections	3	2	3	18						
Chemical Handling	Inhalation	Procedures, compliance with regulations, training, CMS inventory, MSDS, volume controls, Fire/Rescue group response, PPE as required, locked or controlled areas, postings, labeling, segregation, Tier 1 inspections	3	2	2	12						
Chemical Handling	Eye exposure	Procedures, compliance with regulations, training, CMS inventory, MSDS, volume controls, PPE as required, eyewash and showers, locked or controlled areas, postings, labeling, proper containers, segregation, Tier 1 inspections	3	2	2	12						
Shop Power Supplies	PCB exposure	Postings, labels, training, work planning, inventory, inspections	3	1	2	6						
Water From Leaking Roofs	Falls on same level	Tier 1 inspections, maintenance, work planning, postings, temporary roof, janitors; safety checklist for Walking and Working Surfaces	5	4	2	40						
Water From Leaking Roofs	Mold, mildew	Tier 1 inspections, maintenance	5	2	2	20						
Lighting	Poor visibility	Tier 1 inspections, maintenance, emergency lighting, temporary lighting	3	2	3	18						
Lighting	Falls on same level	Tier 1 inspections, maintenance, emergency lighting, temporary lighting	3	3	3	27						
Lighting	Being struck by an object due material handling mishaps	Tier 1 inspections, maintenance, emergency lighting, temporary lighting	2	3	3	18						
Uneven Floor Surfaces	Falls on same level	Tier 1 inspections, maintenance, work planning, postings, ramps, floor markings	4	4	3	48						
Electrical Equipment & Power Supplies BNL Class A & B <250 V AC, <1000 V DC	Shock or electrocution	All equipment is listed or reviewed by CEE, Tier 1 inspections, disconnected cable policy, installations comply with applicable codes, procedures, training, distribution drawings, LOTO, Kirk keys, energized electrical work permits, ASSRC/ESRC reviews, qualified electricians and technicians, cabinet interlocks, postings, locked areas, guarding, work planning, GFCI, grounding standards, emergency procedures	5	4	2	40	See notes 1 through 4	5	3	2	30	25%
Electrical Equipment & Power Supplies BNL Class C <600 V AC, <6000 V DC	Arc blast, burn	All equipment is listed or reviewed by CEE, Tier 1 inspections, disconnected cable policy, installations comply with applicable codes, procedures, training, distribution drawings, LOTO, Kirk keys, energized electrical work permits, ASSRC/ESRC reviews, qualified electricians and technicians, cabinet interlocks, postings, locked areas, guarding, work planning, GFCI, grounding standards, emergency procedures, two-person rule for energized electrical work	3	5	2	30	See notes 1 through 4	3	4	2	24	20%

Electrical Equipment & Power Supplies BNL Class D >600 V AC, >6000 V DC	Arc blast, burn	All equipment is listed or reviewed by CEE, Tier 1 inspections, disconnected cable policy, installations comply with applicable codes, procedures, training, distribution drawings, LOTO, Kirk keys, energized electrical work permits, ASSRC/ESRC reviews, qualified electricians and technicians, cabinet interlocks, postings, locked areas, guarding, work planning, GFCI, grounding standards, emergency procedures, safety watch for energized electrical work	2	5	2	20	See notes 1 through 4	2	4	2	16	20%
Extension Chords, Temporary Wiring And Power Strips	Shock or electrocution	All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; qualified electricians and technicians; GFCI; grounding standards	4	3	3	36	See notes 1 through 4	4	3	2	24	33%
Transformer And Switch Yards	Shock or electrocution	All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; qualified electricians and technicians; GFCI; grounding standards, grounding before work start	2	5	2	20	See notes 1 through 4	2	4	2	16	20%
Transformer And Switch Yards	Arc blast	PPE; procedures; training; qualified electricians	2	5	2	20	See notes 1 through 4	2	4	2	16	20%
Underground/Overhead Cables/Wiring	Shock or electrocution	All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; qualified electricians and technicians; GFCI; grounding standards, digging permit	3	5	3	45	See notes 1 through 4	3	4	3	36	20%
Batteries/UPS	Molten spray	PPE; procedures; training	4	2	2	16	See notes 1 through 4	4	2	1	8	50%
Batteries/UPS	Hydrogen gas explosion	PPE; procedures; training, ventilation	4	3	2	24						
Standby Generators	Shock or electrocution	All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; LOTO; Kirk keys; energized electrical work permits; ASSRC/ESRC reviews; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; grounding standards; emergency procedures	4	5	2	40	See notes 1 through 4	4	4	2	32	20%
Standby Generators	Noise	Hearing protection	4	4	2	32						
Electrical Disconnects And Switches	Arc blast; burn	Procedures, training, PPE	2	4	3	24	See notes 1 through 4	2	4	2	16	33%
Electrical Disconnects And Switches	Shock or electrocution	All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; LOTO; Kirk keys; energized electrical work permits; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; GFCI; grounding standards; emergency procedures; two-person rule for energized electrical work.	2	5	2	20	See notes 1 through 4	2	4	2	16	20%
Motor Control Centers; Panels And Wall Sockets	Shock or electrocution	All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; LOTO; Kirk keys; energized electrical work permits; ASSRC/ESRC reviews; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; grounding standards	4	5	2	40	See notes 1 through 4	4	4	2	32	20%

Motor Control Centers; Panels And Wall Sockets	Arc blast; burn	PPE; training; procedures	4	5	2	40	See notes 1 through 4	4	4	2	32	20%
Capacitors/Inductors	Electrocution from stored energy	Administrative controls , shorting procedures	2	5	2	20	See notes 1 through 4	2	4	2	16	20%
Walking – Working Surfaces	Falls on same level	Tier 1; work planning; skill of craft; P.E. scheduled maintenance; internal and external audits; posting; labeling; training; barriers; communication; internal processes; lessons learned; safety checklist for Walking and Working Surfaces	5	4	2	40						
Storage	Being struck by an object due to improperly secured material	Tier 1; inventory control; work planning; postings; labels; barriers; PPE; internal and external audits; training; communication; internal procedures; lessons learned	4	3	2	24						
Egress	Impaired egress	Tier 1; work planning; skill of craft; P.E. scheduled maintenance; internal and external audits; posting; labeling; training; barriers; communication; internal processes; lessons learned; life safety codes; emergency preparedness	5	3	3	45						
Primary Beam	Unshielded proton, electron or ion beam, external radiation	ACS, PASS, postings, crash buttons and chords, C-AD area classification, shielding, dosimeter, training, RSC reviews	1	5	2	10						
Secondary Beam	Unshielded beams, external radiation	ACS, PASS, postings, crash buttons and chords, C-AD area classification, shielding, dosimeter, training, locked gates, fenced in areas, RCD surveys, RWPs, work planning, RSC reviews, RCD oversight	2	4	2	16						
Target Areas	Unshielded beam, residual radiation, external radiation	ACS, PASS, postings, crash buttons and chords, C-AD area classification, shielding, dosimeter, training, locked gates, fenced in areas, RCD surveys, RWPs, work planning, RSC reviews, RCD oversight, extra shielding around targets, special keys to target areas	2	2	2	8						
General Area Radiation	Residual radiation, external radiation	Postings, training, shielding, RCD surveys, RCD oversight, RWP, work planning	5	1	2	10						
Contamination	Residual radiation, activated fluids, external or internal radiation	Postings, training, RCD surveys, RCD oversight, RWP, work planning, PPE, friskers, keeping contamination areas minimized, response to spills	3	1	2	6						
Internal Radiation	Internal radiation	RWP, work planning, PPE, WB counting, sealed tunnel/cave gates to reduce exposure to activated air, delay before entering primary areas to allow decay of isotopes, HEPA vacuums, air sampling, RCD oversight	1	1	2	2						
Storage Of Radioactive Materials	Residual radiation, external radiation	Fenced and posted areas, dosimeter, RWPs, work planning, RCD oversight, inspections, RMA inventories, some areas locked, shielding	5	1	2	10						
Radioactive Sources	Internal or external radiation	Training, BNL and C-AD source custodians, source inventory, shielding, locked boxes, leak checks, posting, dosimeter, Chipmunk calibration procedures, locked cage for Chipmunk source	3	1	2	6						
Tours	Internal or external radiation	Postings, trained escorts, RCD concurrence to enter radiation areas, RWP, work planning, training waiver, red TLD, BNL minors policy	3	1	2	6						

Further Description of Controls Added to Reduce Risk:

NOTE 1: OSHA Teams visited C-AD during the period October 20 through October 31, 2003 and recorded electrical non-compliances. All OSHA findings will be closed by 2006 by full compliance or with an equivalent level of safety.. The status of the OSHA items are maintained in BNL's Compliance suite, and closed on a schedule commensurate with funding.

NOTE 2: A compliance plan to have all electrical installations accepted by an Authority Having Jurisdiction (AHJ), as per 29CFR1910 Subpart S, has been implemented by BNL. UL, CSA, LLC or other NRTL accepted equipment will be acquired at BNL for all future installations. Prior installations shall be reviewed and accepted by qualified AHJs. The plan must be completed by 2009.

NOTE 3: Full compliance with NFPA 70E was adopted by the C-AD in December 2005. NFPA 70E prescribes protective clothing to protect against shock and arc blast; thus reducing the severity and likelihood of an injury. It also prescribes training, which is currently fulfilled by taking the 2005 version of Electrical Safety 1 and by attending the C-AD 3-hour classroom course on electrical safety rules and PPE.

NOTE 4: Contractor and vendor training in work planning and electrical safety has been improved. Plans to reach all contractors and vendors with regard to NFPA 70E requirements prior to performing work at BNL have been implemented. C-AD has obtained lists of all its vendors and suppliers and is ensuring that they take Electrical Safety 1 or have equivalent training if needed.

*Risk:	0 to 20	21 to 40	41-60	61 to 80	81 or greater
	Negligible	Acceptable	Moderate	Substantial	Intolerable