

Name(s) of Risk Team Members: Ed Lessard, Ralph Brown and Bill Christi			Point Value → Parameter ↓		1	2	3	4	5			
Area/Facility Description Title: Collider-Accelerator Area/Facility # (if applicable): Area-Wide FRA 12-05			Occupancy or Use		≤once/year	≤once/month	≤once/week	≤once/shift	>once/shift			
Area/Facility Description: STAR Area-Wide			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:					
			Before Additional Controls				After Additional Controls					
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	
Primary Beam	High hazard ionizing radiation	ACS; PASS; postings; crash buttons and chords; C-AD area classification; shielding; dosimeters; training; RSC reviews	1	5	2	10						
General Area Radiation Residual Radiation, External Radiation	Ionizing radiation	Postings, training, shielding, RCD surveys, RCD oversight, RWP, work planning	4	1	2	8						
Hydraulics	Being struck by an object, due to a pressure release	Design reviews, ESRC/ASSRC reviews, pressure testing, work planning, PPE, training, procedures, posting labeling, LOTO to move detector	3	4	2	24						
Hydraulics	Falls on same level	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, oil temperature interlock	3	4	2	24						
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; working hot 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	Procedures, training, PPE	3	5	2	30	See Notes 1 through 4.	3	4	2	24	20%

Electrical Equipment & Power Supplies BNL Class C <600 V AC; <6000 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; working hot 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 hot work	2	5	2	20	See Notes 1 through 4.	2	4	2	16	20%
Electrical Equipment & Power Supplies BNL Class D >600 V AC; >6000 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; working hot permits; ASSRC/ESRC reviews; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; GFCI; grounding standards; emergency procedures; safety watch for hot work	2	5	2	20	See Notes 1 through 4.	2	4	2	16	20%
Electrical Equipment & Power Supplies BNL Class D >600 V AC; >6000 V DC	Arc blast; burn	Procedures, training, PPE as per NFPA 70E	2	5	2	20	See Notes 1 through 4.	2	4	2	16	20%
Electrical Disconnects And Switches	Arc blast; burn	Procedures, training, PPE as per NFPA 70E	2	4	3	24	See Notes 1 through 4.	2	3	3	18	25%
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; working hot permits; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; GFCI; grounding standards; emergency procedures; two-person rule for hot work; PPE as per NFPA 70E	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; working hot permits; ASSRC/ESRC reviews; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; grounding standards; PPE as per NFPA 70E	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 as per NFPA 70E; training; procedures	4	4	2	32	See Notes 1 through 4.	4	3	2	24	25%
Electrical Powered Hand Tools	Shock or electrocution	All equipment is listed or reviewed by CEE; Tier 1 inspections; procedures; training; labeling; work planning; GFCI; grounding standards; double insulation; PPE as per NFPA 70E	4	3	3	36	See Notes 1 through 4.	4	3	2	24	33%
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; PPE as per NFPA 70E	4	3	3	36	See Notes 1 through 4.	4	3	2	24	33%
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	3	4	2	24						

Vacuum	Being struck by an object such as flying debris	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	3	4	2	24					
Magnetic Field	Adverse mechanical force exerted on ferromagnetic objects and or to electronic/medical implants.	Barriers; warning systems; postings; training; ESRC review; work planning; procedures; Tier 1 inspections; magnetic safety reviews; medical exams; inspection of magnet prior to startup	1	4	2	8					
Flammable /Explosive Gases	Fire, smoke and heat	Fire detection & suppression systems; procedures; training; equipment protective systems; ASSRC/ESRC reviews; Fire Hazards Analysis; Tier 1 inspections; maintenance; emergency procedures; BNL Fire Rescue; ASE requirements; volume controls; segregation controls; labeling; area posting; gas detection interlock systems; annual certification of fire alarm system	4	4	2	32					
Gasses	Oxygen deficiency	ODH analyses; ODH controls; training; remote/local audible/visible alarms; emergency response; work planning; MSDS; postings; flammable gas alarms; cylinder storage controls; cylinder labels; gas volume limits; inspections; cylinder hydrostatic testing; flow limiting devices; semi-annual calibration of ODH sensors	4	5	2	40					
Lighting	Being struck against an object, such as a carpenter walking into a door frame due to poor lighting	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 to a material handling mishaps	Tier 1 inspections; maintenance; emergency lighting; temporary lighting	2	3	3	18					
Material Handling Equipment	Falls to lower level, such as falling from a ladder or over a railing	Training, work planning, inspections, independent PE inspections and approval of equipment, fall protection training, approved scaffolding and platforms, approved fall protection harnesses, Tier 1 inspections, PPE, PE maintenance	3	4	3	36					
Material Handling	Being struck by an object due to improperly secured material or loss of control	Work planning; equipment specific training; work area barricades and controls; PPE; clamps; straps; vices; fixtures	3	3	3	27					
Chemical Handling	Eye exposure	Procedures; compliance with regulations; training; CMS inventory; MSDS; volume controls; PPE as required; locked or controlled areas; postings; labeling; proper containers; segregation; proper spill cleanup equipment available; Tier 1 inspections; fire-proof locker for storage	3	4	2	24					
Chemicals	Inhalation exposure	Procedures; compliance with regulations; training; CMS inventory; MSDS; volume controls; PPE as required; locked or controlled areas; postings; labeling; proper containers; segregation; proper spill cleanup equipment available; Tier 1 inspections	3	3	2	18					

Chemicals	Fire; explosions	Procedures; compliance with regulations; training; CMS inventory; MSDS; volume controls; PPE as required; locked or controlled areas; postings; labeling; proper containers; segregation; proper spill cleanup equipment available; Tier 1 inspections	3	2	2	12							
Manual Material Handling	Bodily reaction – injuries resulting from bending, climbing, loss of balance and slipping without falling	Gloves; hardhat; use of handcarts and dollies; training; non-slip safety shoes	4	3	3	36							
Remotely Operated Equipment	Personnel entanglement in mechanisms.	Postings; barriers; guards; maintenance; training; work planning; procedures; Tier 1 inspections	2	4	2	16							
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	3	24							
Use Of Hand Tools	Being struck against an object, such as a sharp surface	PPE; training; guarding	4	2	3	24							
Use Of Hand Tools	Becoming caught in or compressed by equipment	Equipment specific training; guarding; PPE; postings	4	2	3	24							
Machining Materials	Becoming caught in or compressed by equipment	Equipment specific training; machine guards; PPE; postings; maintenance; Tier 1 inspections	2	3	3	18							
Machining Materials	Being struck by an object, such as flying chips or debris	Equipment specific training; machine guards; PPE; postings; maintenance; Tier 1 inspections	2	3	3	18							
Machining Materials	Non-rad airborne particulates	PPE; maintenance; work planning	2	1	2	4							
Walking – Working Surfaces	Falls on same level	PPE; Tier 1; work planning; P.E. scheduled maintenance; internal and external inspections; posting; labeling; training; barriers; communication; lessons learned; safety checklist: Walking and Working Surfaces	5	4	2	40							
Work 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	3	5	3	45	Replaced ladders with fixed stairs	3	5	2	30	33%	
Working Environment	Poor air quality; mold	HVAC; facility maintenance; Tier 1 inspections	5	2	2	20							
Water	Being struck by an object due to a pressure release	Postings; maintenance; PPE; training; work planning; ASSRC and ESRC reviews; procedures; Tier 1 inspections; PLC monitoring and interlocks; leak detection systems	4	1	3	12							
Tours	Internal or external radiation	Postings; trained escorts; training waiver; BNL minors policy	3	1	2	6							
Transformer And Switch Yards	Shock or electrocution	All equipment is listed or reviewed by CEE; Tier 1 inspections; installations comply with applicable codes; procedures; training; LOTO; qualified electricians; postings; locked areas; work planning; grounding standards; emergency procedures; grounding before work start	2	5	2	20							
Transformer And Switch Yards	Arc blast	PPE; procedures; training; qualified electricians	2	4	3	24	See Notes 1 through 4.	2	4	2	16	33%	

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; working hot permits; ASSRC/ESRC reviews; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; grounding standards; emergency procedures	2	5	3	30	See Notes 1 through 4.	2	5	2	20	33%
Standby Generators	Noise	Hearing protection	2	4	2	16						
Radioactive Sources	Internal or external radiation	Training; BNL and C-AD source custodians; source inventory; shielding; locked boxes; leak checks; posting; dosimeters	2	1	2	4						
Pressurized Systems Compressed Air	Being struck by an object due to a pressure release	Postings; PPE; preventive maintenance; training; work planning; ESRC reviews; procedures; interlock systems; certification/testing of pressure related equipment; Tier 1 inspections; LOTO; C-AD Chief ME reviews; codes and standards usage	2	2	2	8						
Noise	Hearing loss	Training; hearing protection; noise surveys; procedures; postings; medicals; engineered noise reduction; work planning	2	4	2	16						
Egress	Impaired egress	Tier 1; work planning; skill of craft; P.E. scheduled maintenance; internal and external inspections; posting; labeling; training; barriers; communication; life safety codes; emergency preparedness	5	3	3	45						
Cryogenic	Being struck by an object due to a pressure release	Postings; maintenance; training; work planning; Cryogenic Safety Committee /ASSRC reviews; procedures; PPE; Tier one inspection; pressure testing	4	2	2	16						
Cryogenic	Contact with temperature – extremes that result in such injuries frost bite or burns	Postings; maintenance; training; work planning; Cryogenic Safety Committee /ASSRC reviews; procedures; PPE; Tier 1 inspection	4	3	2	24						
Confined Spaces	Entrapment	Barriers; postings; training; Confined Spaces Permits; work planning; procedures; Tier 1 inspections	1	3	2	6						
Computer And Office Machine Usage	Repetitive motion resulting in muscular-skeletal injury	BNL SHSD ergonomic reviews; training; use of ergonomically designed equipment	5	3	3	45						
Batteries/UPS	Molten spray	PPE as per NFPA 70E; procedures; training	4	2	2	16						
Limited Access Areas	Impaired egress	Tier 1; work planning; skill of craft; training; barriers	2	1	3	6						
Lasers	Eye damage	Barriers; interlock systems; postings; training; LSO review; work planning; PPE; procedures; Tier 1 inspections; warning systems; medical eye exams	2	4	3	24						

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