

Name(s) of Risk Team Members: A. Etkin, Y. Makdisi			Point Value → Parameter ↓	1	2	3	4	5				
Area/Facility Description Title: Collider-Accelerator Area/Facility # (if applicable): Area-Wide FRA 13-05			Occupancy or Use	≤once/year	≤once/month	≤once/week	≤once/shift	>once/shift				
Area/Facility Description: PHENIX 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)	Occupancy A	Severity B	Likelihood C	Risk* AxBxC	Control(s) Added to Reduce Risk	Occupancy A	Severity B	Likelihood C	Risk* AxBxC	% Risk Reduction
Primary Beam	High hazard ionizing radiation	ACS; PASS; postings; crash buttons and chords; C-AD area classification; shielding; dosimeter; training; RSC reviews	1	5	2	10						
General Area Radiation Residual Radiation, External Radiation	Ionizing radiation	Postings, PASS, 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, 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						
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	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 on or near energized conductors 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 C <600 V AC; <6000 V DC	Arc blast; burn	Procedures, training, PPE	2	5	2	20	See Notes 1 through 4	2	4	2	16	20%
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%
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	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	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	Being struck by an object due to 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	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	4	4	2	32					
Gasses	Oxygen deficiency	ODH analyses; ODH controls; training; remote/local audible/visible alarms; emergency response; work planning; MSDS; LOTO; postings; flammable gas alarms; cylinder storage controls; cylinder labels; gas volume limits; inspections; cylinder hydrostatic testing	4	5	2	40					
Lighting	Being struck against an object, such as a carpenter walking into a door frame, due to 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 to a material handling mishap	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 Equipment	Becoming caught in or compressed by equipment	Training, work planning, inspections, Tier 1 inspections, PPE	3	4	3	36					
Material Handling	Being struck by an object due to improperly secured material; 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	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	Overexertion – injuries caused by excessive lifting, pushing, pulling, holding, carrying or throwing of an object	Gloves; hardhat; handcarts; dollies; training; safety shoes	4	3	3	36					
Remotely Operated Equipment	Becoming caught in or compressed by equipment	Postings; barriers; guards; maintenance; training; work planning; procedures; Tier 1 inspections; ASSRC reviews	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 sharp surfaces	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	Equipment specific training; machine guards; PPE; postings; maintenance; Tier 1 inspections	2	3	3	18						
Machining Materials	Non-rad airborne particulates	PPE; ventilation; 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 audits; posting; labeling; training; barriers; communication; lessons learned; safety checklist for 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; safety checklist for Walking and Working Surfaces	4	5	2	40						
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 review; procedures; Tier 1 inspections; PLC monitoring and interlocks	4	1	3	12						
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	1	2	8						
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						
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	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%
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, two-person rule for energized electrical work	2	5	2	20	See Notes 1 through 4	2	4	2	16	20%
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; dosimetry; Chipmunk calibration procedures; locked cage for Chipmunk source	2	1	2	4							
Pressurized Systems	Being struck by an object due to a pressure release	Postings; PPE; 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; locked areas with limited access to authorized personnel only	2	4	2	16							
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							
Cryogenic	Being struck by an object due to a pressure release	Postings; maintenance; training; work planning; LOTO; Cryogenic Safety Committee /ASSRC reviews; procedures; PPE; interlock systems; Tier one inspection; pressure testing	4	2	2	16							
Cryogenic	Contact with temperature – extremes that result in such injuries as frost bite or burns	Postings; maintenance; training; work planning; LOTO; Cryogenic Safety Committee /ASSRC reviews; procedures; PPE; interlock systems; Tier 1 inspection	4	3	2	24							
Confined Spaces	Becoming caught in or compressed by equipment	Barriers; postings; training; Confined Spaces Permits; work planning; procedures; Tier 1 inspections	2	2	3	12							
Computer And Office Machine Usage	Repetitive motion	BNL SHSD ergonomic reviews; training; use of ergonomically designed equipment	5	3	3	45							
Batteries/UPS	Molten spray	PPE; procedures; training	4	2	2	16	See Notes 1 through 4	4	2	1	8	50%	
Batteries/UPS	Chemical burn	PPE; procedures; training	3	2	2	12							
Batteries/UPS	Shock or electrocution	All equipment is listed or reviewed by CEE; Tier 1 inspections; 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; guarding; work planning; grounding standards; emergency procedures	5	4	2	40	See Notes 1 through 4	5	3	2	30	25%	
Limited Access Areas	Impaired egress	Tier 1; work planning; skill of craft; training; barriers;	3	3	1	9							
Lasers	Eye damage	Barriers; interlock systems; postings; training; LSO review; work planning; PPE; procedures; Tier 1 inspections; warning systems	2	4	3	24							
Confined Spaces	Oxygen deficiency	Training; atmospheric testing before entry and periodically; entry procedures; Permits; work planning; LOTO; respirators; forced ventilation; personnel rescue equipment; emergency planning	1	5	2	10							
Confined Spaces - Metal	Increased chance of shock due of proximity to conducting surfaces	All equipment is listed or reviewed by CEE; work planning; grounding standards; GFCI	1	3	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