

Name(s) of Risk Team Members: D. Mc Cafferty, D. Passarello	Point Value → Parameter ↓	1	2	3	4	5
Area/Facility Description Title: Collider-Accelerator Department Area/Facility # (if applicable): EBIS in Building 930 FRA 20-06	Occupancy or Use	≤once/year	≤once/month	≤once/week	≤once/shift	>once/shift
Area/Facility Description: EBIS 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: 5-23-2006 Rev.#: 0						

Reason for Revision (if applicable):	Comments:
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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	
General area radiation	Residual radiation, external radiation	Postings, training, shielding, RCD surveys, TLD area monitoring program, RCD oversight, RWP, work planning	5	1	4	20						
Electrical Equipment & Power Supplies BNL Class A & B <250 VAC; <1000Vdc	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, temporary wiring installations are now tracked and when due they are removed or converted to permanent wiring. An ECN is required prior to issuing a work order for all work on the power distribution system. A drawing or a sketch and a printed label or panel directory is now issued with the work order. Electricians have been assigned to label existing disconnects.	5	3	2	30	Risk reduction is the result of implementing controls identified in FRA 20-05. See "Further Description of Controls Added to Reduce Risk" below.					
Electrical Equipment & Power Supplies BNL Class C <600 VAC; <6000 VDC	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.	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Electrical Equipment & Power Supplies BNL Class C <600 VAC; <6000 VDC	Arc blast; burn	Procedures, training, PPE as per NFPA 70E.	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Electrical Equipment & Power Supplies BNL Class D >600 VAC; >6000 VDC	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	4	2	16	Risk reduction is the result of implementing controls identified in FRA 20-05.					

Electrical Equipment & Power Supplies BNL Class D >600 VAC; >6000 VDC	Arc blast; burn	Procedures, training, PPE as per NFPA 70E.	2	4	2	16	Risk reduction is the result of implementing controls identified in FRA 20-05.					
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	5	4	2	40	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Underground/Overhead Cables/Wiring	Shock or electrocution	All equipment is listed or reviewed by CEE; installations comply with applicable codes; procedures; training; distribution drawings; LOTO; Kirk keys; qualified electricians; postings; work planning; digging permit.	2	4	2	16	Risk reduction is the result of implementing controls identified in FRA 20-05.					
General Wiring; Cable Trays; Buss Work	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.	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05.					
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.	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Motor Control Centers; Panels And Wall Sockets	Arc blast; burn	Procedures; training; PPE as per NFPA 70E	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Electrical Disconnects And Switches	Arc blast; burn	Procedures, training, PPE as per NFPA 70E	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05					
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.	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05					
Circuit Breakers	Arc blast; flash	All equipment is listed or reviewed by CEE; procedures; training, PPE as per NFPA 70E.	4	3	2	24	Risk reduction is the result of implementing controls identified in FRA 20-05					
Appliances And Computers	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.	5	3	2	30	Risk reduction is the result of implementing controls identified in FRA 20-05					
Vacuum Pumps	Shock or electrocution	All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; LOTO; Kirk keys; working hot permits; ASSRC/ESRC reviews; qualified electricians and technicians; postings; work planning; grounding standards.	3	4	2	24	Risk reduction is the result of implementing controls identified in FRA 20-05					
Magnets	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; postings; locked areas; guarding; work planning; grounding standards.	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05					
Magnets	Magnetic fields	Posting; fencing; warnings; magnet design reviews; field measurements; medicals; work planning; ASSRC reviews; work planning.	2	3	3	18						
Capacitors/inductors	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; postings; locked areas; guarding; work planning; grounding standards.	3	4	2	24	Risk reduction is the result of implementing controls identified in FRA 20-05.					

Beam Components and Instrumentation	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; postings; locked areas; guarding; work planning; grounding standards.	3	4	2	24	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Beam Components and Instrumentation	Being struck by an object, due to moving parts remotely operated	Guards for moving parts.	2	3	3	18						
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.	5	3	2	30	Risk reduction is the result of implementing controls identified in FRA 20-05.					
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. C-A staff identified outside walking/working surfaces that are in need of repair. In 2005 PE instituted a program to correct deficiencies. Snow shovels and salt were distributed to staff for emergency use on walkways in winter storms. A safety checklist: Walking and Working Surfaces was distributed to staff. C-A O.P.M. 2.28.d specifies that work performed with risk factors of slipping and falling shall be classified at a minimum as a moderate hazard job and will require additional review and an Enhanced Work Permit. C-AD Housekeeping Policy and OPM 1.7, Supervisory Practice for Working with Hazards documents C-AD commitment to housekeeping practices.	5	3	3	45						
Storage	Being struck by an object, such as a tool falling on a worker from above	Tier 1; inventory control; work planning; postings; labels; barriers; internal and external audits; training; communication; internal procedures; lessons learned, no storage on top of lockers or around electrical panels or disconnects.	4	5	2	40						
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	4	4	2	32						
Air	Poor indoor air quality	Tier 1; work planning; skill of craft; P.E. scheduled maintenance; internal and external audits; posting; labeling; training; barriers; HVAC maintenance, ventilation, IH monitoring as required.	4	3	3	36						
Electrical Fire	Smoke And Heat	Fire detection & suppression systems; equipment protective systems; ASSRC/ESRC reviews; Fire Hazards Analysis; Fire stops; all equipment is listed or reviewed by CEE; Tier 1 inspections; maintenance; electrical & life safety code compliance; emergency procedures; EMTs & BNL fire rescue; removal of unused cable; ASE requirements; audible alarms; evacuation procedures and training; upgrading fire alarm panels	5	2	3	30	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Flammable Liquid Fire	Smoke And Heat	Fire detection & suppression systems; procedures; training; chemical segregation; volume controls; fire cabinets; MSDS; Tier 1 inspections; storage controls; ventilation; labeling; ignition source control	5	2	2	20						
Combustible Material Fire	Smoke And Heat	Fire detection & suppression systems; procedures; training; equipment protective systems; all equipment is listed or reviewed by CEE; Tier 1 inspections Reducing combustibles in the workplace in compliance with OSHA requirements. New enhanced housekeeping policy in place.	5	2	2	20	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Cryogenic fluids and systems	Oxygen deficiency	ODH analyses, ODH controls, ASSRC reviews, ESRC reviews, training, postings, interlocked emergency exhaust fans, PPE, remote/local audible/visible alarms, emergency response, EMTs, work planning, procedures, POMs, medical clearance, escape pack, MSDS, LOTO, postings, Cryo-system designs to consensus codes, inspections, relief valve testing	2	5	2	20						
Gasses	Oxygen deficiency, toxic/flammable gas	ODH analyses, ODH controls, training, ASSRC reviews, ESRC reviews, interlocked emergency exhaust fans, remote/local audible/visible alarms, emergency response, EMTs, work planning, POMs, medical clearance, escape pack, MSDS, LOTO, postings, designs to consensus codes, flammable gas alarms, cylinder storage controls, cylinder labels, gas volume limits, inspections, cylinder hydrostatic testing	4	5	2	40						

Moving Items with Cranes	Being struck by an object, such as a tool falling on a worker from above	Training, daily crane inspections prior to use, PE crane maintenance, PPE, certified rigging equipment, Tier 1, yearly rigging inspections, load weights and center of gravity known prior to lift, procedures, qualified riggers if required, critical lift and engineered lift requirements and reviews, warning alarms, postings, work planning, load testing, barriers	4	5	2	40						
Mobile crane use	Being struck by an object, such as a tool falling on a worker from above	Training, daily crane inspections prior to use, PE crane maintenance, PPE, certified rigging equipment, Tier 1, yearly rigging inspections, load weights and center of gravity known prior to lift, procedures, critical lift and engineered lift requirements and reviews, warning alarms, postings, work planning, load testing, barriers, certified HEMO operators and riggers only, seat belts, PE Rigging Supervisor review	4	5	2	40						
Mobile crane use	Highway accidents, such as tip-over or traffic accident	Training, daily crane inspections prior to use, PE crane maintenance, PPE, certified rigging equipment, Tier 1, yearly rigging inspections, load weights and center of gravity known prior to lift, procedures, critical lift and engineered lift requirements and reviews, warning alarms, postings, work planning, load testing, barriers, certified HEMO operators and riggers only, PE Rigging Supervisor review, outriggers on crane, alarms and indications in cab, escort for movement, seat belts	4	4	2	32						
Miscellaneous rigging equipment use (come-alongs, lifting fixtures, a-frames, Johnson bars, skates, etc.)	Being struck by an object, such as a falling load or tool	Certified inspected equipment, training, work planning, engineering review and witnessed load tests, PPE as required, certified riggers as required, load weights and center of gravity known, postings labeling Rigging equipment inspections performed and failed equipment is removed. Purchase of new equipment requires all equipment to meet OSHA standards. Improved training and rigorous qualification requirements have been implemented for personnel involved in hoisting and rigging.	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Miscellaneous rigging equipment use (come-alongs, lifting fixtures, a-frames, Johnson bars, skates, etc.)	Overexertion – injuries caused by excessive lifting, pushing, pulling, holding, carrying or throwing of an object	Certified inspected equipment, training, e.g. Ergonomics in Mechanical and Industrial Work, work planning, engineering review and witnessed load tests, PPE as required, certified riggers as required, load weights and center of gravity known, postings labeling	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Manual material handling (pallet jacks, barrel and equipment carts, etc.)	Being struck by an object, such as a falling load or tool	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	5	3	3	45						
Manual material handling (manual lift or pallet jacks, barrel and equipment carts, etc.)	Overexertion – injuries caused by excessive lifting, pushing, pulling, holding, carrying or throwing of an object	Training, e.g. Ergonomics in Mechanical and Industrial Work, certified equipment, PPE as required, limited to manual lift weight limit or load carrying limit of equipment, postings, Tier 1 inspections, procedures, specific back-injury prevention training, work planning, certified riggers if required. OSHAS 18001 raises awareness with regards to sprains, and strains. WOSH committee involvement in first aid events, department group 5-minute group safety meetings	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Transportation of small equipment in lab vehicles	Being struck by an object, such as a falling load or tool	Training, lab vehicles rated for load, procedures, loads secured in trucks, certified riggers if required, work planning, chemicals and radioactive materials in proper containers and labeled, vehicle maintenance, speed limits, traffic rules, snow removal, vehicle inspections	4	3	3	36						
Transportation of small equipment in lab vehicles	Highway accidents, such as traffic accident	Training, lab vehicles rated for load, procedures, loads secured in trucks, certified riggers if required, work planning, chemicals and radioactive materials in proper containers and labeled, vehicle maintenance, speed limits, traffic rules, snow removal, vehicle inspections	4	4	2	32	Risk reduction is the result of implementing controls identified in FRA 20-05.					
Water	Being struck by an object due to a pressure release	Postings, maintenance, PPE, training, work planning, ASSRC review, procedures, Tier 1 inspections	4	3	2	24						
Cryogenic	Being struck by an object due to a pressure release	Postings, maintenance, training, work planning, LOTO, Cryogenic Safety Committee /ASSRC/ESRC reviews, procedures, PPE, interlock systems, Tier one inspection, pressure testing	4	3	2	24						
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/ESRC reviews, procedures, PPE, interlock systems, Tier 1 inspection	4	3	2	24						

Pressurized Gas Systems	Being struck by an object due to a pressure release	Postings, PPE, maintenance, training, work planning, Cryogenic Safety Committee /ASSRC reviews, procedures, interlock systems, Certification/testing of pressure related equipment, Tier 1 inspections, LOTO, C-AD Chief ME reviews, codes and standards usage	5	3	2	30					
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	4	4	2	32					
Vacuum	Being struck by an object 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	4	4	2	32					
Work at heights	Falls to lower level, such as falling from a ladder or over a railing	Postings, barriers, maintenance, training, work planning, procedures, Tier 1 inspections, approved ladders, anti-slip surfaces	3	4	3	36					
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	5	4	2	40					
Chemicals	Exposure	Postings, barriers, PPE, maintenance, training, work planning, procedures, Tier 1 inspections, CMS, MSDS	3	2	2	12					
Chemicals	Fire/explosion	Postings, barriers, PPE, maintenance, training, work planning, procedures, Tier 1 inspections, CMS, MSDS	3	2	2	12					
Chemicals	Reactive metals	Postings, barriers, PPE, maintenance, training, work planning, procedures, Tier 1 inspections, CMS, MSDS	2	2	2	8					

Further Description of Controls Added to Reduce Risk:
Reference Temporary Procedure “Temporary Procedure to Open or Close Breakers and Switches” to enhance NFPA 70 E PPE requirements, enhanced awareness, PPE labels on breakers, panels or switches

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