

Name(s) of Risk Team Members: J. Cintonino, P. Ciriigliaro, T. Dilgen, J. Durnan, C. Porretto			Point Value → Parameter ↓	1	2	3	4	5				
Area/Facility Description Title: Superconducting Magnet Division Area/Facility # (if applicable): Area-Wide FRA 28-05			Occupancy or Use	≤once/year	≤once/month	≤once/week	≤once/shift	>once/shift				
Area/Facility Description: Area-Wide Shops			Severity	First Aid Only	Medical Treatment	Lost Time	Partial Disability	Death or Permanent Disability				
			Likelihood	Highly Unlikely	Unlikely	Possible	Probable	Multiple				
Approved by: <i>E. Lessard</i> Date: 5-13-05 Rev.#: 00			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
Machining activated materials	Radiation exposure	Radiation surveys, work planning, radiation work permits, HEPA filters, PPE	1	1	1	1						
Machining hazardous materials (epoxy-coated coils)	Airborne particulates	PPE, HEPA filters, work planning	2	1	1	2						
Machining materials (not activated non-hazardous)	Becoming caught in or compressed by equipment	Equipment specific training, machine guards, PPE, postings, maintenance, Tier 1 inspections	5	4	2	40						
Machining materials (not activated non-hazardous)	Being struck by an object, such as flying debris	Equipment specific training, machine guards, PPE, postings, maintenance, Tier 1 inspections	5	4	2	40						
Machining materials (not activated non-hazardous)	Airborne particulates	PPE, ventilation, maintenance, work planning	4	1	2	8						
Working with compressed air	Pressure	PPE, pressure reducing nozzles	5	3	1	15						
Welding and brazing	UV exposure	PPE, work planning, procedures, welding permits, designated welding areas reviewed by Fire/Rescue Group	3	1	2	6						
Welding and brazing	Electric shock	Maintenance of equipment, training, UL approved equipment	3	4	2	24						
Welding and brazing	Thermal and IR burns	PPE, work planning, procedures, training, designated welding areas reviewed by Fire/Rescue Group	3	1	3	9						
Welding and brazing	Toxic fumes	PPE, work planning, ventilation, designated welding areas reviewed by Fire/Rescue Group	3	3	2	18						
Welding and brazing	Noise	Ear protection, work planning, medicals	3	4	1	12						
Welding	Compressed gas – release of kinetic energy / being struck by a flying object	Work planning, PPE, Cylinder racks, transport carts, regulators, training, Tier I inspections	3	5	1	15						
Soldering	Burns	PPE, work planning, procedures, training	5	1	3	15						

Soldering	Noxious fumes	PPE, work planning, procedures, training, portable smoke eaters, hoods	5	1	2	10							
Manual material handling	Getting struck by object such as falling load	Work planning, training, work area barricades and controls, PPE, Tier I inspections (housekeeping), postings, communication.	5	3	2	30	Material handling requirements have been clarified following Report of the Committee Investigation of the Category "R" Recurring Occurrence (CH-BH-BNL-2004-0005). Among other actions, training and certification requirements have been increased.	5	3	1	15	50%	
Mechanical material handling – overhead crane	Getting struck by dropped or moving load	Engineered lift, MAP, work planning, PPE, training, PE & SMD inspection and maintenance of equipment, Tier I inspections, route and area checked clear prior to movement, visible and audible alarms on cranes as required, directional markings on crane and pendant, availability of engineering input, use of tag lines, communication between staff.	4	5	2	40	Material handling requirements have been clarified following Report of the Committee Investigation of the Category "R" Recurring Occurrence (CH-BH-BNL-2004-0005). Among other actions, training and certification requirements have been increased.	4	5	1	20	50%	
Mechanical material handling – forklift, trucks	Getting struck by vehicle or by object such as falling load	Work planning, PPE, training, PE & SMD inspection and maintenance of equipment, Tier I inspections, route and area checked clear prior to movement, spotters, aisle markings.	4	5	2	40	Material handling requirements have been clarified following Report of the Committee Investigation of the Category "R" Recurring Occurrence (CH-BH-BNL-2004-0005). Among other actions, training and certification requirements have been increased.	4	5	1	20	50%	
Use of hand tools	Flying chips	PPE, training, maintenance, Tier I inspections, UL listed equipment, pre-use inspections	5	3	2	30							
Use of hand tools	Electrical shock	Training, GFCI, grounding cases or insulated cases	5	2	2	20							
Use of hand tools	Sharp surfaces	PPE, training, guarding	5	2	2	20							
Use of hand tools	Rotating parts	PPE, training, guarding, postings	5	2	2	20							
Magnets (test and deliverable)	Magnetic fields causing adverse mechanical force exerted on ferromagnetic objects and or to electronic/medical implants.	Training, postings, fencing, magnet design reviews, field measurements, medicals, work planning	4	4	2	16							
Magnets (test and deliverable)	Thermal exposure	Postings, PPE, training, work planning, Tier I inspections	4	3	2	24							
Shop power supplies	Shock or electrocution	Postings, labels, training, work planning, inspections	3	2	1	6							
Shop power supplies	Thermal exposure	Postings, maintenance, training, work planning, procedures, interlock systems, Tier I inspections, RF gaskets, PPE	3	1	1	3							
Magnet Tooling and Fixtures (includes winding and wrapping machines, curing and collaring presses, welding and insertion fixtures, ovens, vacuum furnace, etc.)	Pinch points, rotating parts, hydraulic pressure (being struck by object due to pressure release), vacuum, thermal exposure, and contact with electrical current.	Work planning, OPMs, MAPs, training, PPE, barricade, postings, design reviews, safety reviews, Tier I inspections	5	4	2	40							
Pressurized Magnet systems (nitrogen)	Uncontrolled release of energy/being struck by object due to pressure release	Work planning, OPMs, MAPs, training, PPE, barricade, posting, design reviews, qualification testing, ESH Coordinator witnessing, welding procedures, use of certified welders, Tier I inspections	3	5	2	30							
Vacuum leak checking (helium or HD)	Uncontrolled release of energy/being struck by object due to pressure release	Work planning, OPMs, MAPs, training, PPE, barricade, posting, design reviews, qualification testing, ESH Coordinator witnessing, welding procedures, use of certified welders, Tier I inspections	4	3	2	24							
Electrical Testing (hipot and impulse)	Shock or electrocution	Work planning, MAPs, training, PPE, barricade, posting, design reviews, Tier I inspections	3	4	3	36							
Electrical Distribution (NFPA 70E)	Shock or electrocution, arc blast	Tier I inspections, PPE, installations comply with applicable codes, training, distribution drawings, LOTO, qualified electricians and technicians, cabinet interlocks, postings, locked areas, guarding, work planning, GFCI, grounding standards, emergency procedures, implementation of NFPA 70E.	5	5	1	25	See notes 1-3 below.	5	4	1	20	20%	
Cryogenic Fluids and Systems	Contact with temperature extremes that result in frost bite or burns	Design reviews, CSC reviews, proof testing, LOTO, work planning, OPMs, PPE, training, postings, cryogenic system designs to consensus codes, Tier I inspections, relief valve testing	5	2	2	20							

Cryogenic Fluids and Systems (trenches)	Oxygen deficiency	ODH analyses, OPMs, training, ODH sensors/alarms, emergency response, work planning, LOTO, ODH area postings, Tier I inspections, relief valve testing	3	5	1	15						
Cryogenic Fluids and Systems (Room 30)	Oxygen deficiency	ODH analyses, training, ODH sensors/alarms, emergency response, work planning, LOTO, ODH area postings, Tier I inspections, relief valve testing	5	2	1	10						
Pressurized Systems (Cryogenic Test Facility)	Being struck by object due to pressure release	Postings, PPE, maintenance, training, work planning, CSC reviews, OPMs, interlock systems, certification/testing of pressure related equipment, Tier I inspections, LOTO	5	3	2	30						
Cooling water	Being struck by object due to pressure release	Design reviews, CSC reviews, proof testing, LOTO, work planning, PPE and training	3	2	1	6						
Electrical equipment & Power Supplies BNL Class A & B <250 V AC, <1000 V DC	Shock or electrocution	PPE, Tier I inspections, installations comply with applicable codes, OPMs, training, distribution drawings, LOTO, energized work permits, qualified electricians and technicians, cabinet interlocks, postings, locked areas, guarding, work planning, GFCI, grounding standards, emergency procedures	3	5	1	15						
Electrical equipment & Power Supplies BNL Class C <600 V AC <6000 V DC	Shock or electrocution, arc blast	PPE, Tier I inspections, installations comply with applicable codes, OPMs, training, distribution drawings, LOTO, energized work permits, qualified electricians and technicians, cabinet interlocks, postings, locked areas, guarding, work planning, GFCI, grounding standards, emergency procedures, two-person rule for hot work	3	5	1	15	See notes 1-3 below.	3	4	1	12	20%
Remotely And Automatically Operated Equipment	Being caught in or compressed by equipment	Guarding, training, posting, LOTO	3	2	2	12						
Working At Heights	Falls to a lower level such as from a ladder or over a railing	Postings, barriers, training, work planning, Tier I inspections, PPE, approved platforms, approved ladders, anti-slip surfaces	3	4	2	24						
Walking – Working Surfaces	Falls at the same level	PPE, Tier I inspections, work planning, posting, labeling, training, barriers, communication, lessons learned	5	3	3	45	PE instituted a program to correct deficiencies. Salt available at external doors for staff for emergency use on walkways in winter storms. Addressed at weekly safety meetings.					
Egress	Impaired egress	Tier I, work planning, posting, labeling, training, communication, emergency preparedness	4	4	2	32						
Noise Areas	Ear damage	Postings, PPE, training, work planning, noise surveys	4	4	2	32						
Chemical Use	Skin exposure	PPE, hazard communication training, MSDS, MAPs, proper containers, labeling, chemical storage cabinets, Tier I inspections	4	1	2	8						
Chemical Use	Eye exposure	PPE, hazard communication training, MSDS, MAPs, proper containers, labeling, chemical storage cabinets, Tier I inspections	4	2	2	16						
Chemical Use	Inhalation	PPE, hazard communication training, MSDS, MAPs, ventilation (hoods), annual inspection of hoods, proper containers, labeling, chemical storage cabinets, Tier I inspections	4	1	2	8						
Chemical Storage	Fire, explosion	PPE, hazard communication training, MSDS, proper container, labeling, chemical storage cabinets, CMS, Tier I inspections	3	4	2	24						
Hot Surfaces (compressors)	Contact with temperature – extremes that result burns	Posting, PPE, barriers, training, Tier I inspections	3	1	1	3						

Further Description of Controls Added to Reduce Risk:

NOTE 1: OSHA Teams visited SMD/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 BNL. 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 a classroom course on electrical safety rules and PPE.

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