C-AD Risk Assessment Screening

Table A2-1 Risk Assessment for Vacuum Hazards

FACILITY NAME: C-AD
SYSTEM: Vacuum Beam Line
SUB-SYSTEM: Vacuum System, Beam Window
HAZARD: Vacuum

Event	Structural failure of vacuum boundary
Possible Consequences, Hazards	Implosion of any vacuum component could pose a potential health risk from flying objects.
Potential Initiators	Failure caused by worker mistake or inadvertent striking contact with vacuum boundary.

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	() High	() Medium	(X) Low	() Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Hazard Mitigation	1. Beam line vacuum components designed to meet C-A/industry standards 2. Vacuum and pressure systems reviewed by the C-A Chief Mechanical Engineer or his designate 3. Vacuum components, except for windows, are constructed of heavy-walled material, per ASME Boiler and Pressure Vessel Code, Section VIII to minimize the threat of implosion when evacuated 4. Training of Users and Staff

Risk Assessment Following Mitigation

Consequence	() High	() Medium	(X) Low	() Extremely Low
Frequency	() Anticipated High	() Anticipated Medium	(X) Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	() Low Risk	(X) Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N No If Yes, need ASE requirement.

Table A2-2 Risk Assessment for External Events

FACILITY NAME: C-AD
SYSTEM: Entire Facility
SUB-SYSTEM: N/A
HAZARD: External Event (Earthquake, Tornado, Hurricane, Flood, Aircraft Impact, Forest Fire)

Event	External event impacts C-AD
Possible Consequences, Hazards	Personnel injuries, equipment/building damage or programmatic impact
Potential Initiators	Earthquake, severe weather, flooding, forest fire, aircraft impact

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	(X) High	() Medium	() Low	() Extremely Low
Frequency	() Anticipated High	() Anticipated Medium	() Unlikely	(X) Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Hazard Mitigation	1. Building designed to Uniform Building Code 2. Relatively small radioactive inventory cannot cause offsite health effects 3. BNL Fire Department can respond quickly to forest fire. BNL has firebreaks 4. No active systems needed to protect personnel from adverse health effects after accelerator off 5. Severe weather and flooding potential is extremely low; warning of these impending hazards will allow for accelerator shutdown and for personnel safety 6. BNL Wildfire Prevention Program

Risk Assessment Following Mitigation

Consequence	() High	() Medium	(X) Low	() Extremely Low
Frequency	() Anticipated High	() Anticipated Medium	() Unlikely	(X) Extremely Unlikely
Risk Category	() High Risk	() Medium	() Low Risk	(X) Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N No If Yes, need ASE requirement.

Table A2-3 Risk Assessment for Electric Shock

FACILITY NAME: C-AD
SYSTEM: Facility
SUB-SYSTEM: Magnets, Power Supplies, Instrumentation
HAZARD: Electric Shock from Exposed Conductors

Event	Worker contacts energized conductor
Possible Consequences, Hazards	Shock, impact injury, burns
Potential Initiators	Worker falls, fails to control position of limbs or tools, equipment failure, improper work controls

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	(X) High	() Medium	() Low	() Extremely Low
Frequency	(X) Anticipated High	() Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	(X) High Risk	() Medium	() Low Risk	() Extremely Low

Hazard Mitigation	1. Exposed conductors and terminals are covered for protection of personnel as per BNL and C-AD Electrical Safety requirements 2. Training for workers / experimenters 3. Use of work planning, LOTO and Working Hot Permits 4. Magnets de-energized when routine access allowed into tunnels/rings or are completely protected from personal contact 5. Review is performed for electrical safety on all non-commercial 'in-house' built equipment. Review is by the Chief Electrical Engineer or his designate

Risk Assessment Following Mitigation

Consequence	() High	() Medium	() Low	(X) Extremely Low
Frequency	() Anticipated High	() Anticipated Medium	(X) Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	() Low Risk	(X) Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N Yes If Yes, need ASE requirement.

Table A2-4 Risk Assessment Radiation Exposure Outside Enclosures

Facility Name: C-AD
System: Areas Outside Beam Enclosures
Sub-System: Accelerator Berm Shields, Beam-line Shields, Entrances to Accelerators , Target Areas and Experimental Areas, Penetrations to Beam Enclosures
Hazard: Prompt Beam Radiation Outside Beam Enclosures

Event	Credible beam control fault
Possible Consequences, Hazards	Unwarranted radiation exposure due to abnormal radiation levels outside concrete and earth berm shielding, fenced areas, penetrations and chicanes
Potential Initiators	Failure of magnet or magnet power supply, inefficient beam tuning

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency, and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	() High	() Medium	() Low	(X) Extremely Low
Frequency	(X) Anticipated High	() Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Hazard Mitigation	1. Beam information display and operating procedures. Beam tuned at low intensity 2. Operator / Physicist / User training 3. Review of radiation safety design of shields and penetrations by C-A RSC 4. Radiological area postings, fenced gates interlocked with beam, locked gates 5. Area radiation monitors alarm locally and in MCR during periods of abnormal radiation levels 6. Area radiation monitors interlock beam off during periods of abnormal radiation levels 7. Sweep procedures prior to beam initiation 8. Beam intensity limits 9. Periodic inspection of earthen berm to verify integrity

Risk Assessment Following Mitigation

Consequence	() High	() Medium	() Low	(X) Extremely Low
Frequency	() Anticipated High	() Anticipated Medium	(X) Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	() Low Risk	(X) Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N No If Yes, need ASE requirement.

Table A2-5 Risk Assessment for Radiation Exposure Inside Enclosures

FACILITY NAME: C-AD
SYSTEM: Beam Enclosures
SUB-SYSTEM: C-AD Beam Line Tunnel, Target Room
HAZARD: Prompt Beam Radiation inside Beam Enclosures

Event	Person inside enclosure during beam operation
Possible Consequences, Hazards	Personal injury or death due to external prompt radiation associated with beam
Potential Initiators	Person inadvertently enters enclosure; person fails to leave before beam initiated

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	(X) High	() Medium	() Low	() Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	(X) Medium	() Low Risk	() Extremely Low

Hazard Mitigation	1. Operating procedures 2. Worker / User training 3. Review of facility design for radiation safety by C-A RSC 4. Tunnel/target room sweep procedures 5. ACS and PASS door locks and other access controls 6. Audible/visual alarms initiated by ACS and PASSinside enclosures before beam initiation, allowing sufficient time for un-swept individuals to manually stop beam initiation or exit enclosure to stop beam initiation 7. ACS and PASS automatic interlock to stop beam given access violation 8. ACS and PASS controls critical devices to automatically confine beam to enclosure, thus keeping beam out of downstream section with personnel inside

Risk Assessment Following Mitigation

Consequence	() High	() Medium	(X) Low	() Extremely Low
Frequency	() Anticipated High	() Anticipated Medium	() Unlikely	(X) Extremely Unlikely
Risk Category	() High Risk	() Medium	() Low Risk	(X) Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N Yes If Yes, need ASE requirement.

Table A2-6 Risk Assessment for Radiation Exposure from Activated Components

FACILITY NAME: C-AD
SYSTEM: Beam Dump, Other Activated Components
SUB-SYSTEM: N/A
HAZARD: External Radiation from Activated Beam Dump, Activated Magnets and Other Components

Event	Worker / User inside target room or tunnel during beam off periods
Possible Consequences, Hazards	Excessive external dose
Potential Initiators	Improper work planning, procedure violation

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	() High	() Medium	() Low	(X) Extremely Low
Frequency	(X) Anticipated High	() Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Hazard Mitigation	1. Beam tuning keeps activation of magnets and beam–line components to a minimum 2. Integrated Safety Management program assures proper work planning prior to authorizing start of work 3. Radiological surveys of work areas performed and RWP issued prior to start of work 4. ALARA design and administrative controls assure doses are well below regulatory limits 5. C-A ALARA Committee reviews jobs and facility designs. 6. Worker / User training 7. Radiological postings warn personnel of high dose rates 8. Personnel entering High Radiation Areas must wear alarming self-reading dosimeters

Risk Assessment Following Mitigation

Consequence	() High	() Medium	() Low	(X) Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	() Low Risk	(X) Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N No If Yes, need ASE requirement.

Table A2-7 Risk Assessment for Conventional/Industrial Hazards

FACILITY NAME: C-AD
SYSTEM: Entire Facility
SUB-SYSTEM: N/A
HAZARD: Noise, Heat, Confined Spaces, Lasers, Rotating Equipment, Pressurized Systems, Hazardous Atmospheres, Magnetic and RF Fields, Hoisting, Rigging, Heights, Cryogenic Fluids, Chemicals, Flammable / Explosive Gases, Falling Objects, Hot Surfaces, Trip Hazards, Welding/Cutting, Excavation, etc.

Event	Injury resulting from industrial hazard
Possible Consequences, Hazards	Worker/experimenter injury or death
Potential Initiators	Improper work planning, procedure violation

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	(X) High	() Medium	() Low	() Extremely Low
Frequency	(X) Anticipated High	() Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	(X) High Risk	() Medium	() Low Risk	() Extremely Low

Hazard Mitigation	1. Integrated Safety Management program assures proper work planning prior to authorizing start of work 2. Worker / User training 3. Review and audit of conventional safety issues by C-A staff and ESH experts during Tier 1, work planning and/or ESH appraisals as required by the BNL Integrated Assessment Program 4. Review of experimental safety by C-A ESRC 5. Review of accelerator system safety by ASSRC 6. Uniform laboratory safety requirements defined by BNL SBMS 7. Environmental review of experiments 8. Industrial hygiene review of experiments 9. New designs incorporate requirements of BNL SBMS and industrial standards for conventional and industrial safety 10. Formal C-AD Worker, Safety and Health Program

Risk Assessment Following Mitigation

Consequence	() High	() Medium	(X) Low	() Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N No If Yes, need ASE requirement.

Table A2-8 Risk Assessment for Airborne Radioactive Releases

FACILITY NAME: C-AD
SYSTEM: Ventilation
SUB-SYSTEM: Exhaust Systems
HAZARD: Radioactive or Hazardous Materials

Event	Uncontrolled release of airborne radioactive or hazardous materials
Possible Consequences, Hazards	Adverse health effects to workers (public health effects not possible)
Potential Initiators	Improper work planning, violation of procedures, human error

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	() High	() Medium	(X) Low	() Extremely Low
Frequency	(X) Anticipated High	() Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Hazard Mitigation	1. Integrated Safety Management program assures proper work planning prior to authorizing start of work 2. Worker / User training 3. Review of conventional safety by C-A ASSRC 4. Review of experimental safety by C-A ESRC 5. Safety standards defined by BNL SBMS 6. BNL Environmental Management System 7. BNL Chemical Management System 8. Testing of HEPA filters and periodic replacement as required by BNL SBMS 9. Design incorporates requirements of BNL SBMS and standards for radiation safety

Risk Assessment Following Mitigation

Consequence	() High	() Medium	() Low	(X) Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	() Low Risk	(X) Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N No If Yes, need ASE requirement.

Table A2-9 Risk Assessment for Liquid Radioactive Releases

FACILITY NAME: C-AD
SYSTEM: Cooling Water System
SUB-SYSTEM: Radioactive Water
HAZARD: Soil and Groundwater Contamination

Event	Spill of activated cooling water to soil
Possible Consequences, Hazards	Groundwater contamination, internal dose to BNL personnel or public
Potential Initiators	Water pressure boundary failure, procedure violation, improper work planning

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	() High	() Medium	(X) Low	() Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Hazard Mitigation	1. Integrated Safety Management program assures proper work planning prior to authorizing start of work 2. Worker / User training 3. Review of conventional and experimentsl safety by C-A ASSRC and ESRC 4. Safety requirements defined by BNL SBMS 5. BNL Environmental Management System 6. BNL Chemical Management System 7. Extensive groundwater monitoring well system and groundwater-sampling program 8. Site suited for easy groundwater plume characterization 9. It would take decades for an un-remediated plume to migrate offsite to contaminate a drinking water well; this assures that even if un-remediated, no one would drink contaminated water 10. Periodic replacement of activated cooling water with fresh water to reduce activity levels in water systems 11. Suffolk County Article 12 Code is followed in the design of cooling water systems and piping that contain significant amounts of tritium 12. The laboratory maintains contingency storage facilities should water tankers with tritiated water develop leaks 13. Tankers stored in Suffolk County registered secondary containments

Risk Assessment Following Mitigation

Consequence	() High	() Medium	() Low	(X) Extremely Low
Frequency	() Anticipated High	() Anticipated Medium	(X) Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	() Low Risk	(X) Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N No If Yes, need ASE requirement.

Table A2-10 Risk Assessment for Loss of Electrical Power

FACILITY NAME: C-AD
SYSTEM: Entire Facility
SUB-SYSTEM: N/A
HAZARD: Hazards Produced As Power Is Lost To Equipment

Event	Loss of offsite power, local loss of power to C-AD facility
Possible Consequences, Hazards	Personal safety hazards, programmatic loss
Potential Initiators	Loss of electrical power to BNL site or local power loss to C-AD caused by equipment failure or operator error

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	() High	() Medium	() Low	(X) Extremely Low
Frequency	(X) Anticipated High	() Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Hazard Mitigation	1. Integrated Safety Management program assures proper work planning prior to authorizing start of work 2. Worker / User training 3. Review of conventional safety by C-A ASSRC and BNL ESH Committees 4. Review of experimental safety by C-A ESRC 5. Backup power supplied to required systems to reduce programmatic impact 6. Accelerator automatically shuts down upon loss of electrical power 7. ACS and PASS fail-safe design 8. Emergency lighting 9. BNL and C-AD emergency procedures

Risk Assessment Following Mitigation

Consequence	() High	() Medium	() Low	(X) Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	() Low Risk	(X) Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N No If Yes, need ASE requirement.

Table A2-11 Risk Assessment for Fire

FACILITY NAME: C-AD
SYSTEM: Entire Facility
SUB-SYSTEM: N/A
HAZARD: Personal Injury or Equipment Damage

Event	Magnets, power and control cables, laboratory equipment combustion
Possible Consequences, Hazards	Personal injury/death, programmatic impact
Potential Initiators	Loss of cooling to magnets or power supplies, transient combustibles start fire which spreads, electrical component overheating, flammable/combustible gas ignition, human error

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	(X) High	() Medium	() Low	() Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	(X) Medium	() Low Risk	() Extremely Low

Hazard Mitigation	1. Combustible loading is minimized at facilities 2. Periodic safety inspections 3. Safety training for Users and staff 4. Fire protection/suppression system is designated safety significant 5. Design reviewed by BNL Fire Protection Engineer 6. Design meets NFPA requirements 7. Emergency ventilation in accelerators 8. Experiments reviewed by C-A ESRC 9. Conventional safety reviewed by C-A ESRC 10. Fire Hazards Analysis completed for C-AD and written/reviewed by a FP Engineer

Risk Assessment Following Mitigation

Consequence	() High	() Medium	(X) Low	() Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N Yes If Yes, need ASE requirement.

Table A2-12 Risk Assessment for Groundwater Contamination

FACILITY NAME: C-AD
SYSTEM: Soil Shielding
SUB-SYSTEM: N/A
HAZARD: Groundwater Contamination

Event	Groundwater contamination from activated soil
Possible Consequences, Hazards	Internal radiation dose, loss of regulator/public confidence
Potential Initiators	Soil cap failure, excessive beam loss in unexpected locations, cap design/installation errors

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	() High	(X) Medium	() Low	() Extremely Low
Frequency	(X) Anticipated High	() Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	(X) Medium	() Low Risk	() Extremely Low

Hazard Mitigation	1. Beam tunnel and target room impermeable soil caps at known/anticipated beam loss locations 2. Periodic cap inspections 3. Beam tuning procedures to reduce soil activation 4. Operator / Physicist training 5. C-AD Environmental Management System 6. Extensive groundwater monitoring well system and sampling program in place 7. Long travel time for plume to reach BNL site boundary

Risk Assessment Following Mitigation

Consequence	() High	() Medium	(X) Low	() Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N Yes If Yes, need ASE requirement.

Table A2-13 Risk Assessment for Biological/Medical Hazards

FACILITY NAME: C-AD
SYSTEM: NASA Experimental Facilities
SUB-SYSTEM: NSRL or Beam Line in Building 912
HAZARD: Biological or Medical

Event	Release or contamination by biological or medical hazards
Possible Consequences, Hazards	Illness, programmatic impact
Potential Initiators	Failure to follow procedures, improper review of experiment, equipment failure

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	() High	(X) Medium	() Low	() Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	(X) Medium	() Low Risk	() Extremely Low

Hazard Mitigation	1. NSRL facility designed for Biosafety Level 2, which can safely handle blood, body fluids and tissues infected with unknown agents 2. General public excluded from NASA facility 3. Cell Facility separated from Animal Facility in building 4. Animal Facility HEPA filtered 5. Regulated Medical Wastes handled by properly trained BNL Medical Department Personnel 6. Biological Safety cabinets used to protect workers and users 7. Training of the user in safe laboratory practices, including engineered systems and PPE, is given by the BNL Medical Department, commensurate with risk to worker 8. Experiments with human cells and tissues reviewed by BNL Institutional Review Board 9. Transportation of cells, animals, etc., to and from the facility, will be in accordance with BNL requirements 10. Review of experiments by appropriate BNL committees, and by C-A ESRC 11. Review of experiment by industrial hygienist and ECR

Risk Assessment Following Mitigation

Consequence	() High	() Medium	() Low	(X) Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N No If Yes, need ASE requirement.

Table A2-14 Risk Assessment for Oxygen Deficiency Hazards

FACILITY NAME: C-AD
SYSTEM: Accelerator and Experimental Facilities
SUB-SYSTEM: Cryogenic liquids, inert gas use/storage, Air Conditioning Systems
HAZARD: Oxygen Deficiency

Event	Breathing air displaced causing reduced oxygen concentration
Possible Consequences, Hazards	Illness, asphyxiation
Potential Initiators	Significant release of gases to area or room

Risk Assessment Prior to Mitigation
Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	(X) High	() Medium	() Low	() Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	(X) Medium	() Low Risk	() Extremely Low

Hazard Mitigation	1. ODH hazards analyzed and controls in place as per BNL SBMS requirements 2. Use of portable or fixed alarming oxygen concentration monitors 3. Training of Users and Staff 4. Work planning and LOTO 5. Review of ODH hazards and controls by C-AD ASSRC and ESRC 6. Review of ODH hazards and controls by BNL LESHC Cryogenic Subcommittee 7. Cryogenic designs meet ASME Code and appropriate consensus stands designs and testing requirements 8. Confined Space Entry Permitting Program 9. BNL and C-AD emergency procedures 10. Active exhaust ventilation systems supplied by normal and standby power if needed to minimize ODH risk

Risk Assessment Following Mitigation

Consequence	() High	(X) Medium	() Low	(X) Extremely Low
Frequency	() Anticipated High	() Anticipated Medium	(X) Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N Yes If Yes, need ASE requirement

Table A2-15 Risk Assessment for Hazardous Material Handling

FACILITY NAME: C-AD
SYSTEM: Accelerator and Experimental Facilities
SUB-SYSTEM: Beryllium Vacuum Pipes, Lead Bricks, Asbestos Building Materials
HAZARD: Inhalation of Hazardous Materials

Event	Working with or handling Be, Pb or asbestos items creates airborne concentrations of hazardous materials
Possible Consequences, Hazards	Illness, toxic reactions
Potential Initiators	Improper work planning, violation of procedures, human error

Risk Assessment Prior to Mitigation

Note: Refer to Chapter 4 for an explanation of consequence, frequency and risk levels. "Low" and "Extremely Low" risk levels are considered acceptable.

Consequence	() High	(X) Medium	() Low	() Extremely Low
Frequency	() Anticipated High	(X) Anticipated Medium	() Unlikely	() Extremely Unlikely
Risk Category	() High Risk	(X) Medium	() Low Risk	() Extremely Low

Hazard Mitigation	1. Airborne hazards are analyzed and controls in place as per BNL SBMS requirements 2. Integrated Safety Management program assures proper work planning prior to authorizing start of work 3. Worker / User training 4. Review of conventional safety by C-A ASSRC 5. Review of experimental safety by C-A ESRC 6. Safety standards defined by BNL SBMS 7. BNL Environmental Management System 8. BNL Chemical Management System 9. Testing of HEPA filters and periodic replacement as required by BNL SBMS 10. Work plan incorporates requirements of BNL SBMS and standards for Be, Pb or asbestos safety 11. Active exhaust ventilation systems supplied by normal and standby power if needed to minimize risk

Risk Assessment Following Mitigation

Consequence	() High	(X) Medium	() Low	(X) Extremely Low
Frequency	() Anticipated High	() Anticipated Medium	(X) Unlikely	() Extremely Unlikely
Risk Category	() High Risk	() Medium	(X) Low Risk	() Extremely Low

Is the mitigated hazard adequately controlled by existing BNL policies? Y/N Yes If No, roll up into ASE.
Is the hazard mitigation system needed for hazard control? Y/N Yes If Yes, need ASE requirement

Examples of OHSAS 18001 Facility, Area and Job Risk Assessments

This following risk tables were developed using a standard method for developing, using and maintaining risk assessments that meets the requirements of OHSAS 18001 Clause 4.3.1. The procedures can be found in BNL's SBMS.

A "rough draft" estimate of hazards and risks for each area or activity was prepared and is shown in Table A2-16. The list was developed based on previous experience and information on known physical items or jobs in the work areas.

The assessments in the subsequent tables were developed by:

- describing the physical items or activities or jobs present in the area or facility
- identifying the hazards associated with each physical item or job step
- identifying controls in place for each hazard
- determining the Occupancy or Use of the area or Frequency of the job
- estimating the potential Severity of an accident associated with each hazard
- estimating the Likelihood or chances of an injury for each hazard given existing controls
- identifying possible additional controls needed for these hazards
- re-estimating the risk and the % risk reduction if controls were added

An assessment was performed for all areas and jobs listed in Table A2-16. Only a few example assessments are shown here.

The complete listing of Facility Risk Assessments (FRAs) is at http://www.rhichome.bnl.gov/AGS/Accel/SND/facility_and_area_risk_assessments.htm.

The complete listing of Job Risk Assessments (JRAs) is located at http://www.rhichome.bnl.gov/AGS/Accel/SND/job_risk_assessments.htm

These assessments are updated each year or when modifications to facilities, areas or jobs occur. As necessary, the Department management schedules and assigns appropriate personnel to conduct or update an FRA or JRA in conjunction with a Critique, Occurrence, near miss or non-conformance associated with a job or a facility.

Table A2-16 Risk Assessment Strategy for Jobs and Work Areas

Area or Activity	**Description**	**Priority**	**Reason**
General Electrical Issues	Standard electrical installations and activities throughout the facility	Medium	Minor shocks have occurred the last few years from legacy wiring. Overheating occurs occasionally due to the inventory of components. Some open ATS items related to improving electrical safety. Many OSHA violations found by OSHA Team.
General Fire Issues	General fire protection throughout the facility; cover special areas separately	Medium	Fire protection systems are old but operable. Upgrades are needed and ADS forms are outstanding and awaiting funding. Fires are possible significant programmatic problems. Minor fires have occurred in the last few years. FHAs are currently being revised for C-AD facilities. BNL only had a single FP Engineer for many years until end of 2004.
General Radiation Issues	General radiation protection issues throughout the facility	Low	In general, radiation is not a significant health risk but is a compliance issue. Access controls provide protection against high hazard radiation.
General ODH Issues	General oxygen deficiency issues throughout the facility	Low	ODH analyses have provided a good approach to worker safety in the newer facilities.
General Housekeeping Issues	General housekeeping issues throughout the facility	Medium	Work is sometimes finished without area cleanup completed. Causes restricted walkways, slip hazards, increased fire loading. Tier 1 inspections cite this numerous times. Many OSHA findings related to housekeeping.
Cryogenic Refrigerator Room	1005R for RHIC He expansion as part of the refrigeration process	Medium	ODH 1 area. A lot of equipment under pressure. Cryogenic fluids. High ambient temperature in building in warm weather.
Cryogenic Compressor Room	1005H for RHIC He compression as part of the refrigeration process	Medium	High pressure helium. Highest noise levels of all C-AD facilities.
He Reliquifier	1005E for conversion of He gas to liquid for storage	Low	Recently reviewed by ASSRC.
Shops	Mechanical and electrical maintenance	Medium	Recent injuries. Improved training on machine operations is needed.
Offices	General offices with computer usage	Medium	Ergonomic injuries have been experienced.
STAR	RHIC experiment	Low	Reviewed by ESRC annually. User injury rates are extremely small.

Area or Activity	Description	Priority	Reason
PHENIX	RHIC experiment	Low	Reviewed by ESRC annually. User injury rates are extremely small.
PHOBOS	RHIC experiment	Low	Reviewed by ESRC annually. User injury rates are extremely small.
BRAHMS	RHIC experiment	Low	Reviewed by ESRC annually. User injury rates are extremely small.
NSRL	NASA Experimental Building	Low	Reviewed by ESRC annually. User injury rates are extremely small.
Building 912/U-Line/ g-2	AGS experiments	Medium	Roof leaks causing walking/working surface issues. A lot of work is taking place such as decommissioning of old beam lines in preparation for future experiments.
Warehouses/storage facilities	Storage of materials and movement of materials	Low	Not a lot of material movement.
Equipment Testing Areas	Permanent testing locations for C-AD equipment	Medium	Test areas have not been specifically reviewed in the recent past.
EBIS	Building 930A	Medium	Not reviewed in detail for a few years.
eCooler	Building 939	Low	Recent reviews by ASSRC and RSC.
Waste Yard	Building 960 area	Low	No injuries in recent past.
90 Day Area/Satellite Areas	Various locations	Low	No injuries in recent past.
Accelerators	Booster, AGS	Low	No injuries in recent past.
Preinjectors	Linac. Tandem	Low	No injuries in recent past.
Collider	RHIC tunnel and service/support buildings	Low	No injuries in recent past.
Locked Electrical rooms/Locked Electrical Caged Areas	930B, 1005E, 1007W, 928 basement, 919B, 911B relay room	Low	No injuries in recent past.
Transportation	Vehicle use for moving materials within and interfacing with C-AD property	High	Recent dropped load from flatbed truck.
Material handling-machinery	Cranes, forklifts, etc.	High	Recent forklift dropped load.
Material handling-manual	Human lifting	Medium	Back injuries have occurred.
Electrical work- routine	<600 V	Medium	Hazard is experienced daily by many workers. Controls have been effective.

Area or Activity	**Description**	**Priority**	**Reason**
Electrical work-high energy	>600 V	Medium	Hazard is experienced daily by many workers. Controls have been effective.
Electrical working hot	Working on energized equipment	Medium	High consequences. Controls have been effective.
Radiation/contamination work	Work in posted areas	Low	Compliance issue. Very detailed controls in place and significant oversight.
Work with lasers	Lasers at C-AD facilities	Medium	Recent injury at Chemistry but external review of BNL laser safety recently completed.
Pressurized system work	Liquid and gas systems	Medium	Hazard is experienced daily by many workers. Controls have been effective. Cryogenic personnel responded to a few pressure boundary leaks in the last few years.
Vacuum system work	Beam lines and vacuum system equipment	Low	No recent injuries.
Biological/animal work	NSRL or Building 912	Low	In one facility and good controls in place.
Cable pulling	Various locations	High	Done a few times per year by many workers with varying experience. Injuries have occurred in the past.
Operations	MCR, CAS, Siemens, Cryogenics, Tandem	Low	No recent injuries.
Emergency response	LEC, DEC and emergency forces	Low	No recent injuries.
Waste handling	Radioactive, hazardous, industrial wastes	Low	No recent injuries.
Work with hazardous materials	Be, lead, chemicals, etc.	Low	No recent injuries.
Adding cooling tower chemicals	Adding water treatment chemicals	Medium	A Water Group technician inhaled water chemical vapors in the last year that caused concern. No recent injuries. CMS in place.
Hi-pot testing	Various locations	Medium	High consequences and done frequently.
Crane use by C-AD staff	Use by non-riggers	Medium	Recent rigging occurrences require a closer look here.
Forklift use by C-AD staff	Use by non-riggers	Medium	Recent forklift occurrences require a closer look here.
Welding/Welding Helper	Various locations	Medium	Recent issue with welder's helper getting arc-eye.
Tours	Various locations	Low	No injuries or perceived health issues. Good escort program in place.

Table A2-17 Area/Facility Risk Assessment – Facility Wide Electrical

Name(s) of Risk Team Members: P. Cirnigliaro, A. Etkin, R. Karol, E. Lessard, J. Maraviglia, D. Passarello, A. Piper, R. Savage, J. Scott, M. Van Essendelft	Point Value → Parameter ↓	1	2	3	4	5
Area/Facility Description Title: Collider-Accelerator Department Area/Facility # (if applicable): Facility Wide – FRA 1	Occupancy or Use	≤once/year	≤once/month	≤once/week	≤once/shift	≥once/shift
Area/Facility Description: Facility Wide Electrical	Severity	First Aid Only	Medical Treatment	Lost Time	Partial Disability	Death or Permanent Disability
Approved by:*E. Lessard* Date:6-30-04 Rev.#: 2	Likelihood	Impossible	Unlikely	Possible	Probable	Multiple
Reason for Revision (if applicable): FRA number added. Standard hazard nomenclature added.		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
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	5	4	2	40	A new computer based LOTO program was introduced to better track LOTOs. C-AD supervisors removed temporarily stored items away from disconnects and breaker panels. Technicians, engineers and electricians were trained regarding the proper use of temporary wiring. Temporary wiring installations are now tracked and when due they are removed or converted to permanent wiring. OPM 13.6.2 was modified to state that 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. Supervisors now indicate that all labeling was completed. Electricians have been assigned to label existing disconnects for a few hours each week.	5	4	2	40	The likelihood of an injury was reduced but it is not impossible. Occupancy and severity do not change.

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	5	2	40						
Electrical Equipment & Power Supplies BNL Class C <600 VAC; <6000 VDC	Arc blast; burn	Procedures, training, PPE	4	5	2	40						
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	5	2	20						
Electrical Equipment & Power Supplies BNL Class D >600 VAC; >6000 VDC	Arc blast; burn	Procedures, training, PPE	2	5	2	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	5	4	2	40						
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	5	2	20						
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	4	32						

Batteries/UPS	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	3	4	3	36						
Batteries/UPS	Molten spray	PPE; procedures; training	3	3	2	18						
Batteries/UPS	Being struck by an object, such as due to hydrogen gas explosion	PPE; procedures; training	3	3	2	18						
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	2	20						
Standby Generators	Noise	Hearing protection	5	4	2	40						
Standby Generators	Entanglement	Guards for rotating parts	5	5	2	50						
Siemens And Westinghouse MG Sets	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	5	5	2	50						
Siemens And Westinghouse MG Sets	Noise	Hearing protection	5	4	2	40						
Siemens And Westinghouse MG Sets	Becoming caught in or compressed by equipment	Crash button for shut down; guards for rotating parts	5	5	2	50	It is planned that postings be upgraded to enter Siemens MG Room or to lock the MG Room					
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	5	5	2	50						

Buss or electrical equipment cooling water	Being struck by an object from water jet or pressure	Tier 1 inspections; installations comply with applicable codes; procedures; training; distribution drawings; LOTO; work planning	4	2	3	24						
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	5	3	60						
Motor Control Centers; Panels And Wall Sockets	Arc blast; burn	PPE; training; procedures	4	5	3	60						
Electrical Disconnects And Switches	Arc blast; burn	Procedures, training, PPE	4	4	3	48						
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	3	48						
Circuit Breakers	Arc blast; flash	All equipment is listed or reviewed by CEE; PPE; procedures; training	4	3	3	36						
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						
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	5	3	45						
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	5	4	2	40						

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	5	2	30						
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	3	36						
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	3	45						
RF Cavities	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; locked areas; guarding; work planning; grounding standards; emergency procedures	3	5	3	45						
RF Cavities	Rf field	RF gaskets; interlocked areas	3	2	2	12						
RF Cavities	Noise	Hearing protection	3	2	2	12						
RF Cavities	Radiation exposure from X-rays	Access controls; shielding; training; RCD surveys; postings; locked areas; procedures for test areas; RWP; work planning	5	4	2	40						
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	2	4	2	16						

Further Description of Controls Added to Reduce Risk: OSHA Teams visited C-AD during the period October 20 through October 31, 2003. Many electrical OSHA non-compliances were recorded. Many disconnects were found to be obstructed by large transformers, stairs, sinks, water heaters, walls, pumps, uninterruptible power supplies, fixed fire-protection equipment or building girders. Many were obstructed by temporarily stored items. Many disconnects such as circuit breakers were not labeled in English, spares were not marked, or the labels were faded. The C-AD system of labeling with numbers is not accepted by OSHA. Temporary wiring was being used where permanent wiring should have been installed. Flexible cord was being used to power fixed equipment such as work benches or ventilation systems and was being strung through walls, ceilings and doors or to power distribution boxes. Long 20-foot flexible cord was used on vibrating equipment. Flexible cord was used to feed metal outlet boxes that lay on the floor. All the OSHA items are being tracked and closed on a schedule commensurate with funding.

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

Table A2-18 Job Risk Assessment – Cable Pulling

Name(s) of Risk Team Members: E. Lessard and D. Passarello	Point Value → Parameter ↓	1	2	3	4	5
Job Title: Cable Pulling Job Number or Job Identifier: JRA 12	Frequency (B)	≤once/year	≤once/month	≤once/week	≤once/shift	>once/shift
Job Description: Removing cable from cable tray or adding new cable to tray in various locations throughout the complex.	Severity (C)	First Aid Only	Medical Treatment	Lost Time	Partial Disability	Death or Permanent Disability
Training and Procedures List (optional): Approved by:*E. Lessard* Date: 6-30-04 Rev. #: 0	Likelihood (D)	Impossible	Unlikely	Possible	Probable	Multiple

Stressors (if applicable, please list all): Unwilling helpers, heat	Reason for Revision (if applicable):	Comments:

				Before Additional Controls							After Additional Controls					
Job Step / Task	Hazard	Control(s)	Stressors Y/N	# of People A	Frequency B	Severity C	Likelihood D	Risk* AxBxCxD	Control(s) Added to Reduce Risk	Stressors Y/N	# of People A	Frequency B	Severity C	Likelihood D	Risk* AxBxCxD	% Risk Reduction
LOTO Power to Cables in Tray	Electrocution	Work planning, LOTO training	N	2	1	5	2	20								
Pull In or Remove AC or DC Cables	Being struck against an object - cuts and skin abrasions from working in tight spaces	Knee and elbow pads, steel-toe shoes, gloves	Y	5	1	3	4	60	Purchase gloves that allow one to feel cable ties, thus no need to keep removing gloves	Y	5	1	3	3	45	25%
Pull In or Remove AC or DC Cables	Overexertion – injuries caused by excessive lifting, pushing, pulling, holding, carrying or throwing of an object	Team coordination to share the pulling forces equally, more guys working together leads to less strain	Y	5	1	3	4	60	Recommend to management that a regular team be used for cable pulls. See Further Description below.	Y	5	1	3	3	45	25%
Pull In or Remove AC or DC Cables	Being struck by an object, such as a tool falling on a worker from above	Safety glasses, hard hats	Y	5	1	3	3	45								

Pull In or Remove AC or DC Cables	Falls to lower level, such as falling from a ladder or over a railing	Fall protection (railings or scaffolding or tie-offs or man-lifts), OSHA compliant ladders, barricade around work area	Y	5	1	3	4	60	On rare occasions, men have to stand on cable tray. This type of work should be considered high hazard and not be done	Y	5	1	3	3	45	25%
Pull In or Remove AC or DC Cables	Contact with temperature – extremes that result in such injuries as heat exhaustion, frost bite or burns	Fans indoors, water outdoors	Y	5	1	3	3	45	Supply water to cable pull team	Y	5	1	3	2	30	33%
Pull In or Remove AC or DC Cables	Bodily reaction – injuries resulting from bending, climbing, loss of balance and slipping without falling	Team coordination to share the pulling forces equally	Y	5	1	3	4	60	Recommend to management that a regular team be used for cable pulls. See Further Description below.	Y	5	1	3	3	45	25%
Pull In or Remove AC or DC Cables	Falls on same level	Shoes with slip resistant soles	Y	5	1	3	4	60	Purchase shoes with slip resistance soles, current oil resistant soles become hardened and get slippery	Y	5	1	3	3	45	25%
Pull In or Remove AC or DC Cables	Tics	White suits, tic spray	Y	5	1	3	3	45								
Moving Cable Spools and Pulling Cable Off Spools	Bodily reaction – injuries resulting from bending, climbing, loss of balance and slipping without falling	Use experienced personnel who know how to move a spool with little manual force, bring cable close to work area using lifting equipment, use jacks to hold cable off ground during long pull	Y	5	1	3	4	60	Investigate the use of a cable spool trailer that can be towed by a vehicle	Y	5	1	3	3	45	25%
Connect AC or DC Cables	Becoming caught in or compressed by equipment	Following manufacturer's instructions for safe use of hydraulic crimper, PPE.	N	2	1	5	2	20								

Further Description of Controls Added to Reduce Risk:

The current practice of supplementing the regular 2-man cable-pull team with local help often leads to unwilling workers who don't share the weight, which leads to back injuries and strains to other people on the pull to react to the extra forces. Unwilling workers feel this job is beneath their status. Inexperienced people are not aware of the best way to position their bodies for this job. Experienced people know how to lift cables, work as a team and move cable rolls with relative ease.

Man lifts should be bettor maintained. Recent experience shows that man lifts are being brought in by crane when needed but when they are used to help reach a cable tray, the man-lifts do not work. This slows a job down for days and creates job stressors such as time pressure and reduced number of breaks. Breaks are important for the crew since they must often take a few minutes to gather their strength after a difficult pull. Man-lifts should be checked and be fully operational before being lifted into cable-pull work areas.

Radio communications between team members inside and outside shielded areas is difficult using the F2 frequency. This is due to a lot of traffic on that frequency when a fire/rescue call goes out. Investigate alternate communications. Good communications are needed to share the pulling equally and avoid strains and back injuries.

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