Jefferson Lab
Thomas Jefferson National Accelerator Facility

Task Hazard Analysis (THA) Worksheet

(See ES&H Manual Chapter 3210 Appendix T1
Work Planning, Control, and Authorization Procedure)

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Author:	M. Poelker	Date:	February 24, 2017	Task #: If applicable	

Complete all information. Use as many sheets as necessary

Task Title:	keV operations of the Upgraded Injector Test Facility (UITF)	Task Location:	UITF, High Bay Area of Test Lab
Division:	Accelerator	Department: Center for Injectors and Sources	Frequency of use:
Lead Worker:	M. Poelker		

Mitigation already in place:
Standard Protecting Measures
Work Control Documents

Ionizing Radiation Engineered Controls

- Below 7' height inside Cave 1, the walls provide concrete shielding of at least 55". Above 7', the East wall thickness is 27"
- The ceiling in the keV section of UITF is made of concrete at least 30" thick. Iron plate 3.5" thick is placed below cable penetrations.
- The ceiling of MeV section of UITF is made of 22" concrete.
- The main entrance to UITF is a labyrinth with walls 36" concrete and ceiling 22" concrete.
- In the keV regions, the beam termination points (dumps and Faraday Cups) are shielded to handle up to 32 mA beam current.
- The gun HV Power Supply can only be turned ON when UITF is swept and armed with Personnel Safety System (all doors are locked)
- The RF system can only be turned ON when UITF is swept and armed with Personnel Safety System (all doors are locked)

Exposure to Laser non-ionizing Radiation
Drive Laser hazards are mitigated through use of Class 1 laser enclosures (hutch and laser beam line transport) and via redundant laser shutters interlocked to the Laser Personnel Safety System (LPSS). For laser alignment mode when a person needs to be in the enclosure with the laser turned ON, administrative procedures require use of laser goggles, training and closing of doors interlocked to the LPSS. Laser hazards and procedures are fully covered under a separate document ACC-17-64784-LOSP.

Oxygen Deficiency Hazard
A preliminary ODH assessment was performed that considers cryogenic nitrogen and helium, and gaseous nitrogen for the entire UITF enclosure and considering MeV beam production using the SRF ¼ cryomodule, and installation of the HDIce target. The assessment is deemed "preliminary" until all ODH-related precautions and requirements have been implemented and verified adequate. In this assessment, the UITF enclosure was assigned a rating of ODH0 for areas below 9'. Above 9' the enclosure is considered ODH1. Signage will clearly indicate these conditions. Fixed oxygen and nitrogen monitoring systems will be used to detect and alert for OHD conditions. Sensors are located in appropriate areas. The preliminary assessment can be found at:
https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-135009/UITF%20prelim_%20ODH%20assessment.pdf

In this THA, the focus is on keV beam operations, which does not require cryogenic nitrogen or helium. The analysis in this THA describes gaseous nitrogen used for venting the gun and beamline.

	The quantity of SF6 gas stored inside the gun high voltage power supply pressure vessel is relatively small and does not pose an ODH hazard. **SF6 Exposure** A complete release of the SF6 from the gun high voltage power supply pressure vessel would create a layer of SF6 gas less than 1" thick on the bottom of the Cave1 floor. However, if the gas were to mix with air in the Cave, it would take approximately 45 minutes to remove the SF6 from the UITF enclosure, when considering the 4400 cfm exhaust fan that vents to the outside of Building 58. This time interval does not allow enough time for personnel to exceed the 8-hour exposure limit of 1000ppm. The estimated 8-hour average exposure concentration would be ~ 572ppm.

Sequence of Task Steps	Task Steps/Potential Hazards	Consequence Level	Probability Level	Risk Code (before mitigation)	Proposed Mitigation (Required for Risk Code >2)	Safety Procedures/ Practices/Controls/Training	Risk Code (after mitigation

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1	Gun operation / Exposure to Ionizing Radiation	M	M	3	See Mitigations already in place	A Personnel Safety System (PSS) has been designed and implemented to protect individuals from ionizing radiation during high voltage and electron beam operations. In the keV region, Radcon approved shielding is in place at beam termination points. A sweep will be done prior to closing the UITF entrance door using the procedure referenced in the UITF OSP. Magenta beacons are activated prior to arming high voltage interlocks, indicating potential for ionizing radiation inside the UITF enclosure. The top of the UITF Cave1 roof is considered a Radiologically Controlled Area. A personal dosimeter is required when accessing the Cave1 roof during keV operations. Radcon will evaluate radiation levels atop Cave1 during keV operation whenever a new photogun is high voltage conditioned and when new (higher) beam currents are produced.	1
2	Laser operation / Exposure to non-ionizing laser radiation	M	L	2	See Mitigations already in place	Use of Class 1 laser enclosures (hutch) interlocked to the LPSS, use of laser goggles, training and LPSS laser shutters interlocked secured access during alignment	1

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3	RF non-ionizing radiation	L	L	1	See Mitigations already in place	A Personnel Safety System (PSS) has been designed and implemented to protect individuals from non- ionizing radiation during operation of the buncher and the ¼ cryomodule. A sweep will be done prior to closing the UITF entrance door using the procedure referenced in the UITF OSP.	1
4	ODH (GN2)	M	L	3	Restricted flow orifices and automatic valve closure at power outage	Personnel will exit UITF when ODH alarms sound. All personnel entering the area must have ODH1 training and follow procedures based on EH&S signage.	1
5	Electrical and High Voltage	M	M	3	Terminals insulated or guarded to prevent inadvertent contact. Approved LTT procedure followed when attaching the electron gun to the HV power supply.	LTT training for and application by workers during maintenance PSS monitors power supply "off state" during access	1
6	Pressure / Vacuum	L	M	2	Category 0 vacuum system The SF6 tank was approved	Review by Design Authority	1
7	Magnetic Fields	L	L	1	Magnet fields fall to acceptable levels very near the magnet.	Signage posted as required on the basis of measurements by IH for energized magnets.	1

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8	SF6	L	EL	1	Contents of gun HV power supply SF6 tank does not constitute ODH hazard. Pressure gauge on SF6 tank provides visible alarm when pressure falls to specified level Commercial SF6 transfer/recovery system	Equipment specific training when transferring SF6 from the High Voltage tank to the Dilo recovery system Access to the floor is restricted when ventilation fan inoperative, or when there is a known leak on the SF6 tank	1
9	Lead shielding	L	EL	1	Wear approved gloves when moving lead. Lead will be painted whenever possible.	Lead Worker training required SAF-136	1

Highest Risk Code before Mitigation:	3	**Highest Risk Code after Mitigation:**	1

When completed, if the analysis indicates that the Risk Code before mitigation for any steps is "medium" or higher (RC≥3), then a formal Work Control Document (WCD) is developed for the task. Attach this completed Task Hazard Analysis Worksheet. Have the package reviewed and approved prior to beginning work. (See ES&H Manual Chapter 3310 Operational Safety Procedure Program.)

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Form Revision Summary

Periodic Review –

ISSUING AUTHORITY	TECHNICAL POINT-OF-CONTACT	APPROVAL DATE	REVIEW DATE	REV.
ESH&Q Division	Harry Fanning			

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