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Jefferson Lab
Thomas Jefferson National Accelerator Facility

Operational Safety Procedure Form

(See ES&H Manual Chapter 3310 Appendix T1 Operational Safety Procedure (OSP) and Temporary OSP Procedure for instructions.)

DEFINE THE SCOPE OF WORK

Title:	Test of ANL Bubble Chamber Detector		
Location:	CEBAF Injector 5D Beamline	**Type:**	☐ **OSP** ☒ **TOSP**
Risk Classification (per Task Hazard Analysis attached) (See *ESH&Q Manual Chapter 3210 Appendix T3 Risk Code Assignment*.)		**Highest Risk Code Before Mitigation (3 or 4):**	4
		Highest Risk Code after Mitigation (N, 1, or 2):	1
Owning Organization:	ACCCIS	**Date:**	8/4/15
Document Owner(s):	Riad Suleiman, Dave Meekins		

Document History (Optional)

Revision:	Reason for revision or update:	Serial number of superseded document

ANALYZE THE HAZARDS

1. Purpose of the Procedure – Describe in detail the reason for the procedure (what is being done and why).

The intent is to use the CEBAF Injector test area with a maximum beam energy of 9.5 MeV (kinetic) to test the operational characteristics of the Argonne Bubble Chamber. The electron beam will be fully stopped (with the exception of knock on electrons) by a water cooled copper dump/radiator. The chamber was tested at Duke where a high neutron background adversely affected the results (slight modifications have been made since this test). The detector is not capable of distinguishing events (bubbles) from photons and neutrons. The purpose of the test at JLAB is to determine the photon detection effectiveness in a low neutron background environment. Operating parameters (e.g. pressure, temperature, fluid, event rate, buffer fluid level) shall be adjusted within a safety envelope to improve photon detection and chamber recovery times. The active fluids for the test are N2O and C2F6. Note that 150 ml of mercury is required as a buffer fluid in the detector. See the detailed procedure TGT-PROC-15-001 Argonne Bubble Chamber Test filed in the JLAB Document Repository and pressure system folder PS-TGT-14-002.

2. Scope – include all operations, people, and/or areas that the procedure will affect.

The test will take place in the CEBAF Injector area where the chamber is installed. The DAQ and remote controls system shall be placed in the Injector Service Building.

3. Description of the Facility – include floor plans and layout of a typical experiment or operation.

Test shall be performed in the CEBAF Injector area at the end of the 5D beamline. The formal songsheet for the beamline is given in ACC2008000-1100.

4. Authority and Responsibility:

4.1 Who has authority to implement/terminate

Riad Suleiman, Brad DiGiovine

4.2 Who is responsible for key tasks

1) Brad DiGiovine: Reassembly, installation, leak testing, alignment, filling, operation, disassembly, removal.
2) Riad Suleiman: Beam operation, beam current and energy changes.

Communication between Brad, Riad and MCC shall be accomplished verbally. Daily planning will be performed at the MCC 0800 meeting.

4.3 Who analyzes the special or unusual hazards (See ES&H Manual Chapter 3210 Appendix T1 Work Planning, Control, and Authorization Procedure)

Todd Kujawa: Inspect electrical components as required by JLAB (ANL has also performed inspections)
Jennifer Williams: Analyze and inspect the HazMat systems (ANL has also performed inspections and monitored air quality while filling and other operations were performed)
Pressure systems DA is Dave Meekins. The reviewer for pressure systems is Ed Daly.

4.4 What are the Training Requirements (See http://www.jlab.org/div_dept/train/poc.pdf)

SAF 801 Rad worker I
SAF 103 ODH
SAF 130 Oil Spill Training (not required for all personnel)
SAF 132 Tunnel worker safety
SAF 801kd RWP for tunnel access
SAF 100 General safety

5. Personal and Environmental Hazard Controls Including:

5.1 Shielding

The copper beam dump, which has already been commissioned, shall require the shielding package 14-INJ-02. The photon dump shall require same shielding package.

5.2 Interlocks

The standard interlocks for the PSS system etc. shall be in place in the injector area.

5.3 Monitoring systems

Standard monitoring systems shall be in place in the injector area.

5.4 Ventilation

Standard ventilation of the injector area is required.

5.5 Other (Electrical, ODH, Trip, Ladder) (Attach related Temporary Work Permits or Safety Reviews as appropriate.)

The system has been reviewed and inspected by Todd Kujawa.

6. List of Safety Equipment:

6.1 List of Safety Equipment:

SKC Elemental Mercury Passive sampler
Assay Technology 575 Nitrous Oxide sampler

6.2 Special Tools:

There are no special tools required

DEVELOP THE PROCEDURE

1. Associated Administrative Controls

In August 2015, one of the rapid access probes in the Injector was relocated above the copper radiator/dump in the bubble chamber beamline. This ensures that rapid access will function as intended in this configuration and operation of the bubble chamber will not require RadCon surveys as the electron beam energy is gradually raised. If the radiator/dump gets activated, the probe will alarm at 1.4 mrem/h at 1 foot, i.e. a safety factor of ~3.5 below the radiation area limit. Therefore, as long as the Rapid Access beacon activates when the button is depressed, no survey is required for Controlled Accesses or prior to going to Restricted Access. See procedure TGT-PROC-15-001 for other administrative controls.
A walkthrough of the Injector and ISB, and short presentation on the bubble chamber will be led by Riad Suleiman on Sept 9, 2015.

2. Operating Guidelines

See procedure TGT-PROC-15-001 with detailed description.

3. Notification of Affected Personnel (who, how, and when)

1) Use of the ATLis work planning tool.
2) Briefings at the MCC 0800 meeting

4. List the Steps Required to Execute the Procedure: from start to finish.

1) Reassemble, install and align the bubble chamber
2) Leak test the bubble chamber and record results
3) Install operating cables and test
4) Inspect electrical systems (Todd Kujawa)
5) Fill detector and startup refrigeration
6) Place detector in standby mode
7) Take test DAQ measurements
8) Perform measurements with the beam on the 5D beam dump
9) Access as need to make adjustments to and to perform detector calibrations
10) Deenergize system
11) Remove detector from Injector area

Detailed procedures can be found in TGT-PROC-15-001 and in the pressure system folder PS-TGT-14-002.

5. Back Out Procedure(s) i.e. steps necessary to restore the equipment/area to a safe level.

The system may be deenergized by the system expert Brad DiGiovine if required. During emergencies, the system may be deenergized by following the Emergency Deenergizing Procedure. This second procedure is likely to break the inner glass vessel which will not result in hazard to personnel and will remove the stored energy from the system.

6. Special environmental control requirements:

6.1 Environmental impacts (See EMP-04 Project/Activity/Experiment Environmental Review)

Under normal operating conditions, release of < 20 STP liters N2O or C2F6. For complete cell failure, the air concentration is less than 25 ppm for N2O and 20 ppm for C2F6. See table below. Should leaks develop it is possible to release 150 ml of mercury. A secondary containment pan is installed under the chamber to contain the mercury.

GAS	Concentration after full vent	Exposure limit
N2O	25 ppm	50
C2F6	20 ppm	1000

6.2 Abatement steps (secondary containment or special packaging requirements)

The system has been designed and fabricated to National Consensus Codes and Argonne National Lab standards. This makes leaks due to mechanical failure extremely unlikely. There are operating procedures in place for operation of the detector and there is no intent to "handle" mercury at JLAB. The detector was preloaded with mercury in a clean room at ANL.

7. Unusual/Emergency Procedures (e.g., loss of power, spills, fire, etc.)

During a power loss the mechanical protection on the detector will prevent overpressure. See the procedure TGT-PROC-15-001. Detailed procedures can be found in the attached reference document and the pressure system folder PS-TGT-14-002.

8. Instrument Calibration Requirements (e.g., safety system/device recertification, RF probe calibration)

There are no instrument calibrations required for this test.

9. Inspection Schedules

Because of the short duration of the test only initial inspections are required. Air monitoring shall be performed during the filling and venting/relief operations using the equipment listed in 6.1. The electrical components shall be inspected by Todd Kujawa.

10. References/Associated Documentation

1) Please reference PS folder PS-TGT-14-002
2) System P&ID TGT-502-1000-0000
3) Detailed procedures and description in TGT-PROC-15-001 and the pressure systems folder PS-TGT-14-002.

11. List of Records Generated (Include Location / Review and Approved procedure)

1) This procedure.
2) The THA associated with this procedure.
3) Procedure TGT-PROC-15-001 which includes a conduct of operations.
4) All pressure systems documentation is stored in the PS folder PS-TGT-14-002.
5) Attached reference document.

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To Submit OSP
for Electronic Signatures

Distribution: Copies to: affected area, authors, Division Safety Officer
Expiration: Forward to ESH&Q Document Control

Form Revision Summary

Qualifying Periodic Review – 02/19/14 – No substantive changes required.
Revision 1.3 – 11/27/13 – Added "Owning Organization" to more accurately reflect laboratory operations.
Revision 1.2 – 09/15/12 – Update form to conform to electronic review.
Revision 1.1 – 04/03/12 – Risk Code 0 switched to N to be consistent with 3210 T3 Risk Code Assignment.
Revision 1.0 – 12/01/11 – Added reasoning for OSP to aid in appropriate review determination.
Revision 0 – 10/05/09 – Updated to reflect current laboratory operations

ISSUING AUTHORITY	FORM TECHNICAL POINT-OF-CONTACT	APPROVAL DATE	REVIEW REQUIRED DATE	REV.
ESH&Q Division	Harry Fanning	02/19/14	02/19/17	1.3

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