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Photon Sciences Directorate, Brookhaven National Laboratory

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Author: B. Heneveld
Effective Date: 21Aug2014
Review Frequency: 3 yrs
Version 2
Title: Beamline Enclosures ODH Monitoring and Alarm System Certification and Inspection
Technical

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### VERSION HISTORY LOG

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<td>Changed “hutch” to Beamline Enclosures throughout procedure; added section 6.2 and Attachment B for system inspection requirements; added Technical Authority sign-off to Attachment A. Minor edits and formatting throughout. Title changed to include Inspection.</td>
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### ACRONYMS

- **BNL** Brookhaven National Laboratory
- **ESH** Environment, Safety and Health
- **FLOCO** Floor Coordinator
- **LN₂** Liquid Nitrogen
- **NSLS-II** National Synchrotron Light Source II
- **O₂** Oxygen
- **ODH** Oxygen Deficiency Hazard
- **POM** Personal Oxygen Monitor
- **PS** Photon Sciences
1 PURPOSE AND SCOPE

The purpose of this procedure is to provide instructions for the certification and inspection of the PureAire Air Check O₂ Oxygen Deficiency Monitors and associated alarms for the NSLS-II Beamline Enclosures identified to be at risk of oxygen deficiency under specific cryogen system failure scenarios. The PureAire Air Check O₂ Oxygen Deficiency Monitors and associated alarms are required to be inspected and re-certified every 12 months; not to exceed 15 months.

The scope of this procedure includes:

- System Inspection:
  - Visual inspection of each system
  - Verifying the status of each system component
  - Determination and implementation of any required corrective actions/maintenance activities based upon the visual inspection

- System Certification:
  - Performance of functionality testing using a challenge gas to activate a system response
  - Verification of the activation of the sounder/strobes located within the beamline enclosures and at all exterior entrances to the beamline enclosures
  - Verification that a communication means (e.g., telephone) is readily available or automated to contact the Control Room

2 DEFINITIONS

2.1 Verification: A process of confirming that system testing results in the expected outcome.

2.2 Challenge Gas: The gas introduced to the monitoring sensor to ensure that the ODH monitor responds as expected under ODH conditions.

3 RESPONSIBILITIES

3.1 Testers/Inspectors

3.1.1 Coordinate and perform ODH Monitoring System inspection and certification.

3.1.2 Complete Attachment A, Beamline Enclosures ODH Monitoring and Alarm System Inspection Data Sheet and Attachment B, Beamline Enclosures ODH
 monitoring and alarm system certification, as required and forward to the configuration management specialist.

3.2 Assistants

3.2.1 Assist the Tester in performing the testing actions and observations when directed by the Tester.

3.2.2 Report all test observations to the Tester.

3.3 Configuration Management Specialist

3.3.1 Posts the completed Attachment A, Beamline Enclosures ODH Monitoring and Alarm System Inspection Data Sheet and/or Attachment B, Beamline Enclosures ODH Monitoring and Alarm System Certification on the SharePoint Document Center.

4 PREREQUISITES

4.1 The Tester/Inspector shall be PS ESH Staff or personnel designated by ESH Staff.

4.2 Assistants shall be designated by the Testers.

4.3 All Testers and Assistants shall be current in Oxygen Deficiency Hazard - Class 0 (TQ-ODH) training.

4.4 The following have been notified that the test will be performed:

- Beamline Staff at the testing location
- Beamline Staff at the two adjacent beamlines
- Control Room
- Appropriate FLOCO

4.5 An announcement has been made on the Building 740 public address system notifying personnel of the testing.

4.6 The appropriate functionality testing materials are available:

- Challenge gas
- Tubing
- A flow regulator
- Painter’s tape (or equivalent) for diffusion ports
4.7 The Monitor Display indicates an oxygen concentration at or between 20.4% and 21.4%.

**Note:** The Enable Lights are located adjacent to the sounder/strobe and indicate that the alarm is powered and connected to the monitoring device.

4.8 All Enable Lights are illuminated (Figure 4-1).

![Figure 4-1: ODH Monitor with Blue Sounder/Strobe and Green Enable Light](image)

### 5 PRECAUTIONS AND LIMITATIONS

5.1 Entering the beamline enclosures to perform ODH functionality testing or inspection requires coordination with beamline scientists to minimize disruption and ensure that safe entry procedures are followed.

5.2 No beamline enclosures shall be entered if the alarm system is activated under a potential LN₂ System failure condition prior to evaluation and authorization by BNL Fire/Rescue.

5.3 Enclosure access doors shall be placed in an open position during personnel occupancy, including implementation of functionality testing, due to a potential for oxygen deficiency.
5.4 Any replacement of components during maintenance activities requires a Safety System Work Permit in accordance with PS-ESH-PRM-3.4.1, *Procedure for Safety System Work Permits* and re-certification of the system in accordance with PS-C-XFD-PRC-035, *NSLS-II Beamline Enclosures ODH Monitoring and Alarm System Configuration Management*.

6 PROCEDURE

**Note:** System inspection and certification is required every 12 months; not to exceed 15 months.

6.1 System Inspection

**Note:** Attachment A, *Beamline Enclosures ODH Monitoring and Alarm System Inspection Data Sheet* shall be completed for each beamline enclosure inspected.

6.1.1 Visual Inspection

**Note:** Maintenance is performed in accordance with the PureAire Air Check O₂ Deficiency 0-25% Monitor Instruction Manual if any of the conditions below are not met.

a. Perform a visual inspection of the entire monitoring system including:
   - Sensor
   - Cable conduit
   - Alarm units

a.1 Upon inspection, verify the following:
   - The monitor display is indicating 20.4% – 21.4% oxygen
   - The monitor is securely mounted
   - No dust or other material has accumulated in and around the sensor diffusion port
   - All green enable lights are illuminated
   - All conduit containing power and alarm cables are intact and in good condition

b. Verify that the Zirconium O₂ sensor is within 10 years of service by inspecting the calibration sticker located on the upper left corner of the display face of the PureAire Air Check O₂ Oxygen Deficiency Monitor.
**Note:** Replacement of the Zirconium O$_2$ sensor requires the use of a Safety System Work Permit in accordance with PS-ESH-PM-3.4.1, *Procedure for Safety System Work Permits*.

c. **IF** the Zirconium O$_2$ sensor is not within 10 years of service, **THEN** replace the Zirconium O$_2$ sensor.

d. **IF** any inspection results deviate from the expected configuration, **THEN** contact the Technical Authority.

### 6.2 System Certification

#### 6.2.1 Alarm Activation

**Note:** Attachment B, *Beamline Enclosures ODH Monitoring and Alarm System Certification* shall be completed for each beamline enclosure tested.

a. Verify that the monitor display indicates 20.4% - 21.4% oxygen.

b. Seal diffusion ports with painter’s tape (or equivalent) as indicted in Figure 6-1 below.

c. Using the correct diameter tubing, connect the challenge gas to the monitor in a manner that will ensure that the gas will adequately impact the diffusion sensor as indicated in Figure 6-1 below.

![Figure 6-1: Correct configuration of tape and tubing for testing](image)

   d. Place Tester in position **AND** open the valve to initiate gas flow.
e. Verify that both visual **AND** audible alarms have activated at the following locations:
   - Within the beamline enclosure
   - At all exterior entrances to the beamline enclosure

f. Verify that communication with the Control Room is readily available or an automated communication has occurred.

6.2.2 Alarm Return to Normal

a. Turn off the challenge gas.

b. Remove tubing and diffusion port tape.

c. **WHEN** the monitor indicates an oxygen concentration of greater than 19.5%, **THEN** verify that both visual **AND** audible alarms have returned to normal (non-activated) at the following locations:
   - Within the beamline enclosure
   - At all exterior entrances to the beamline enclosure

d. **IF** the test was unsuccessful, **THEN** post the beamline enclosure indicating that “Calibrated POMs are Required for Entry” **AND** notify the Technical Authority.

6.3 Documentation

6.3.1 Provide the completed Attachment A, *Beamline Enclosures ODH Monitoring and Alarm System Inspection Data Sheet* and/or Attachment B, *Beamline Enclosures ODH Monitoring and Alarm System Certification* to the Configuration Management Specialist for posting on the SharePoint Document Center.

7 REFERENCES

7.1 PS-C-XFD-PRC-035, *NSLS-II Beamline Enclosures ODH Monitoring and Alarm System Configuration Management*

7.2 PS-C-CMD-PRC-002, *Records Management Procedure*

7.3 PS-ESH-PM-3.4.1, *Procedure for Safety System Work Permits*

7.4 PureAire Air Check O₂ Deficiency 0-25% Monitor Instruction Manual
8 ATTACHMENTS

Attachment A, *Beamline Enclosures ODH Monitoring and Alarm System Inspection Data Sheet*
Attachment B, *Beamline Enclosures ODH Monitoring and Alarm System Certification*

9 DOCUMENTATION

The following documents are generated as a result of this procedure and shall be maintained in accordance with PS-C-CMD-PRC-002, *Records Management Procedure*:

- Completed Beamline Enclosures ODH Monitoring and Alarm System Inspection Data Sheets
- Completed Beamline Enclosures ODH Monitoring and Alarm System Certifications
Attachment A

Beamline Enclosures ODH Monitoring and Alarm System Inspection Data Sheet

Enclosure _____________

Monitor Display indicating 20.4% – 21.4% oxygen  Yes □ No □
Monitor is securely mounted  Yes □ No □
Diffusion port is free of dust or other material accumulation  Yes □ No □
All enable lights are illuminated inside and outside enclosure at each entrance  Yes □ No □
All conduit containing power and signal cables are intact and secure  Yes □ No □
Zirconium O₂ sensor is within 10 years of service  Yes □ No □

Maintenance activities to be performed (if required):

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Note: Signatures below indicate that the inspection has been completed.

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Attachment B

Beamline Enclosures ODH Monitoring and Alarm System Certification

Enclosure _____________

Pre-test Conditions

The following have been notified that the test will be performed:

- Beamline Staff at the testing location
- Beamline Staff at the adjacent beamlines
- Control Room
- Appropriate FLOCO

Monitor Display indicating 20.4% – 21.4% oxygen

Yes ☐ No ☐

Test Conditions with Challenge Gas

Monitor display indicating less than 18% oxygen

Yes ☐ No ☐

Audible and visual alarm activated inside enclosure

Yes ☐ No ☐

Audible and visual alarm activated outside enclosure at each entrance

Yes ☐ No ☐

Communication with Control Room readily available or automated

Yes ☐ No ☐

Return to Normal Operation

Monitor Display indicating 20.4% – 21.4% oxygen

Yes ☐ No ☐

Audible and visual alarm deactivated inside enclosure

Yes ☐ No ☐

Audible and visual alarm deactivated outside enclosure at each entrance

Yes ☐ No ☐

Painter’s tape (or equivalent) removed from the diffusion ports

Yes ☐ No ☐

Note: Signatures below indicate that the test has been completed.

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B1