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<td>B. Heneveld</td>
<td>13Nov2015</td>
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Title: Beamline Enclosures and Cryogen Fill Station ODH Monitoring and Alarm System Certification and Inspection

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<td>Christopher Porretto</td>
<td>11/9/2015</td>
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USI Screening/Resolution

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<td>Brian Heneveld</td>
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Approved by:

| Date       | |
|------------||
| 11/13/2015 | |

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National Synchrotron Light Source II, Brookhaven National Laboratory

Doc No. PS-C-XFD-PRC-005  Author: B. Heneveld  Effective Date: 13Nov2015  Review Frequency: 3 yrs  Version 3

Title: Beamline Enclosures and Cryogen Fill Station ODH Monitoring and Alarm System Certification and Inspection  Technical

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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<td>Added Cryogen Fill Stations to procedure; removed all references to Photon Science Division and replaced with NSLS-II.</td>
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ACRONYMS

BNL Brookhaven National Laboratory  O2 Oxygen
ESH Environment, Safety and Health  ODH Oxygen Deficiency Hazard
FLOCO Floor Coordinator  POM Personal Oxygen Monitor
LN2 Liquid Nitrogen
NSLS-II National Synchrotron Light Source II
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 and Cryogen Fill Stations 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 cryogen fill stations and at all exterior entrances to the beamline enclosures and cryogen fill stations
  - 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 and Cryogen Fill Station ODH Monitoring and Alarm System Inspection Data Sheet* and Attachment B, *Beamline Enclosures and Cryogen Fill Station 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 and Cryogen Fill Station ODH Monitoring and Alarm System Inspection Data Sheet* and/or Attachment B, *Beamline Enclosures and Cryogen Fill Station ODH Monitoring and Alarm System Certification* on the SharePoint Document Center.

4 PREREQUISITES

4.1 The Tester/Inspector shall be ESH Staff or personnel authorized 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:

- Staff present at the testing location
- Staff adjacent to the testing location
- Control Room
- 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 in Tedlar bag
- Tubing

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 or cryogen fill stations 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 Any replacement of components during maintenance activities in a beamline enclosure 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 and Cryogen Fill Station ODH Monitoring and Alarm System Inspection Data Sheet shall be completed for each beamline enclosure or cryogen fill station 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 O₂ 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 O₂ sensor is not within 10 years of service, **THEN** replace the Zirconium O₂ 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 and Cryogen Fill Station ODH Monitoring and Alarm System Certification* shall be completed for each beamline enclosure and cryogen fill station tested.

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

b. Using the appropriate diameter tubing, place the challenge gas in proximity 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.
c. Place tubing in position **AND** open the valve to allow gas flow.

d. Verify that both visual **AND** audible alarms have activated at the following locations:

- Within the beamline enclosure or cryogen fill station area
- At all exterior entrances to the beamline enclosure or cryogen fill station area

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

### 6.2.2 Alarm Return to Normal

a. Close the valve of the challenge gas.

b. Remove tubing.

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:
6.3 Documentation

6.3.1 Provide the completed Attachment A, *Beamline Enclosures and Cryogen Fill Station ODH Monitoring and Alarm System Inspection Data Sheet* and/or Attachment B, *Beamline Enclosures and Cryogen Fill Station 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 and Cryogen Fill Station ODH Monitoring and Alarm System Inspection Data Sheet*

Attachment B, *Beamline Enclosures and Cryogen Fill Station 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 and Cryogen Fill Station ODH Monitoring and Alarm System Inspection Data Sheets
- Completed Beamline Enclosures and Cryogen Fill Station ODH Monitoring and Alarm System Certifications
Attachment A

Beamline Enclosures and Cryogen Fill Station ODH Monitoring and Alarm System
Inspection Data Sheet

Enclosure/Cryogen Fill Station _____________

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 Yes ☐ No ☐
All conduit containing power and alarm 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 and Cryogen Fill Station ODH Monitoring and Alarm System Certification

#### Beamline Enclosure/Cryogen Fill Station _____________

**Pre-test Conditions**

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

- Staff at the testing location
- Staff in adjacent areas
- Control Room
- FLOCO

Monitor Display indicating 20.4% – 21.4% oxygen

Announcement made over PA system

All enable lights are illuminated

**Test Conditions with Challenge Gas**

- Monitor display indicating less than 18% oxygen

- Audible and visual alarm activated inside enclosure/fill station

- Audible and visual alarm activated outside enclosure/fill station at each entrance

- Communication with Control Room readily available or automated

**Return to Normal Operation**

- Monitor Display indicating 20.4% – 21.4% oxygen

- Audible and visual alarm deactivated inside enclosure/fill station

- Audible and visual alarm deactivated outside enclosure/fill station at each entrance

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

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