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National Synchrotron Light Source II, Brookhaven National Laboratory			
Doc No. PS-C-ESH-PRC-061	Author: M. Benmerrouche	Effective Date: 27Jun2016 Review Frequency: 3 yrs	Version 4
Title: NSLS-II Insertion Devices and Front Ends Radiation Survey Plan			Administrative

Reviewed by:

6/24/2016	6/23/2016	6/23/2016
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Approved By:

6/23/2016

X 

Robert Lee
ESH Manager
Signed by: Lee, Robert J

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VERSION HISTORY LOG

VERSION	DESCRIPTION	DATE
1	First Issue.	02July2014
2	Added new steps 6.1.1, 6.2.1 and 6.2.3; general formatting; removed former 6.1.2, Note after 6.1.2, and 6.1.2, a.	06Nov2014
3	Updated personnel and procedure titles as necessary; removed references to Photon Sciences Directorate; added "Beamline Optics Retracted Farthest Away from Beam Center If Applicable" to title of 6.1; added note after 6.2.2.	10Jun2015
4	Revised to include requirements for the 3PW and Bending Magnet FEs (2.1, 2.4, 3.22 , 3.8, 4.3-4.5, added Phase 2a and 2b Surveys; removed authorization to start rad surveys (in concurrence with PS-C-ASD-PRC-166)	27Jun2016

ACRONYMS

3PW	Three Pole Wiggler	ID	Insertion Device
AD	Accelerator Division	LOTO	Lockout/Tagout
BM	Bending Magnet	NSLS-II	National Synchrotron Light Source II
BMPS	Bending Magnet Photon Shutter	QA	Quality Assurance
ARM	Area Radiation Monitor	RCD	Radiological Control Division
ESH	Environment, Safety and Health	RWP	Radiological Work Permit
FE	Front End	SR	Storage Ring
FOE	First Optical Enclosure	USI	Unreviewed Safety Issue

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1 PURPOSE AND SCOPE

The purpose of this document is to provide the activities required during commissioning of the NSLS-II IDs, 3PWs and FEs to determine if the installed radiation shielding at NSLS-II is adequate. This document also provides radiological safety guidance and establishes hold points for safety reviews prior to progression to the next commissioning step.

The scope of this procedure applies to all personnel and commissioning activities involved in commissioning of the NSLS-II IDs, 3PWs and FEs.

2 DEFINITIONS

- 2.1 Bending Magnet (BM): A single dipole magnet that serves as a source of synchrotron radiation.
- 2.2 Insertion Device (ID): Magnet array with an alternating magnetic field for controlled periodic distortion of the SR beam orbit to emit intense synchrotron radiation.
- 2.3 Front End (FE): Elements in the path of the emitted ID radiation, which collimates the beam and provides shielding against Bremsstrahlung radiation and accommodates safety shutters to isolate the beamline from synchrotron radiation. The FE is located upstream of the FOE.
- 2.4 Three Pole Wiggler (3PW): Set of permanent magnets with three poles creating a small local orbit bump for emission of synchrotron radiation.

3 RESPONSIBILITIES

- 3.1 Accelerator Coordination Group
 - 3.1.1 Determines when the SR is ready for the radiation surveys in this plan.
 - 3.1.2 Schedules radiation surveys.
 - 3.1.3 Ensures that the radiation surveys are completed.

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3.2 Lead Operator

3.2.1 Operates the SR to support beam for this plan.

3.2.2 Coordinates with Lead Beamline Scientist for control of beamline components in the FE.

3.3 RCD Staff

3.3.1 Prepare radiological survey maps.

3.3.2 Prepare the RWP.

3.3.3 Perform radiation surveys, which will include both gamma and neutron measurements.

3.3.4 Prepare the Radiation Survey Report.

3.4 ESH Staff

3.4.1 Analyze the radiation measurement data.

3.4.2 Report the radiation survey results to the ESH Manager and AD Director.

3.5 ESH Manager

3.5.1 Reviews the radiation survey results (Interim Radiation Survey Report).

3.5.2 Approves progression from each step in the commissioning sequence.

3.6 AD Director

3.6.1 In conjunction with the ESH Manager, approves commencement of the commissioning sequence.

3.7 Configuration Management Specialist

3.7.1 Posts the Radiation Survey Report on the SharePoint Document Center.

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3.8 Lead Beamline Scientist or Designee

3.8.1 Operates beamline controls for positioning of beamline components located in the FE.

3.8.2 Position optics out of the direct beam path prior to commencing radiation surveys.

4 PREREQUISITES

4.1 An RWP is prepared for the fault studies.

4.2 The blades of the X-Y slits are at normal position (open).

4.3 Beamline optics are positioned out of the direct beam path, if applicable.

4.4 LOTO has been removed from the associated ID gap and 3PW drive mechanism.

4.5 If commissioning a 3PW or BM Beamline, LOTO has been removed from the BMPS and the 3PW has been moved into nominal operating position with the BMPS closed.

5 PRECAUTIONS AND LIMITATIONS

5.1 The injected beam current shall not exceed the limits set forth in PS-C-ESH-ROASE-001, *NSLS-II Accelerator Safety Envelope (ASE)*.

5.2 RCD Staff shall perform radiological surveys in accordance with FS-SOP-1000, *Radiation Survey Techniques*, which shall include both gamma and neutron dose rate surveys.

5.3 Only RCD Staff and other authorized personnel under RCD Staff escort shall access survey areas during the survey.

5.4 Completion of the Radiation Survey Report is not a precursor to progressing to the next step of commissioning. The radiation surveys and associated data analyses (Interim Radiation Survey Report) shall be completed and presented to the ESH Manager for consideration in authorizing progression to the next phase of commissioning.

5.5 If at any point during performance of the radiation survey, radiation surveys show unexpectedly high radiation dose rates (>5 mrem/hr), the commissioning will be

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terminated, by closing the BMPS, and the cause investigated, and any hazards shall be mitigated before continuing. Any changes to shielding shall be performed in accordance with PS-C-ASD-PRC-055, *NSLS-II Radiation Safety Component Configuration Management*, and requires a Safety System Work Permit in accordance with PS-ESH-PRM-3.4.1, *Procedure for Safety System Work Permits*, and a USI screening in accordance with PS-C-ESH-PRC-002, *Unreviewed Safety Issue Determination Procedure*.

6 PROCEDURE

Note: During the commissioning process, the photon shutter and dual safety shutters shall remain closed for each FE until the survey is completed for that specific ID, BM, 3PW and FE.

Note: At a minimum, radiological surveys shall be performed at the locations specified for each condition (e.g., the areas around the specific ID, BM or 3PW during commissioning). Radiological surveys may be performed at additional locations, as necessary.

Note: Steps 6.1, 6.2, and 6.3 are performed as required in accordance with PS-C-ASD-PRC-166, *NSLS-II Insertion Devices and Front Ends Commissioning Sequence*.

6.1 Phase 1 Radiation Survey – ID Closed to Near Nominal Gap or 3PW in nominal operating position, FE X-Y slits at Normal Position (Open), BMPS Open, Beamline Optics Retracted Out of the Path of Direct Beam If Applicable

6.1.1 Complete radiation surveys at the following locations:

- Along lateral wall
- Downstream of ratchet wall (including inside FOE area)
- On top of the mezzanine floor above lateral walls/ratchet walls

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6.2 Phase 2 Radiation Survey – ID Closed to Near Nominal Gap or 3PW in nominal operating position, BMPS Open

Note: The following radiation survey is performed to evaluate extra scattering points.

Phase 2a - FE White Beam Slits (X-Y slits) Closed, Beamline Optics Retracted Out of the Path of Direct Beam, If Applicable

Note: Not all FEs have slits or optics therefore Phase 2a Radiation Surveys will not be applicable at these beamlines.

6.2.1 Complete radiation surveys at the following locations:

- Along lateral wall
- Downstream of ratchet wall (including inside FOE area)
- On top of the mezzanine floor above lateral walls/ratchet walls

Phase 2b - FE X-Y slits Open, Beamline Optics In Direct Beam Path, If Applicable

Note: Not all FEs have slits or optics therefore Phase 2a Radiation Surveys will not be applicable at these beamlines.

6.2.2 Complete radiation surveys at the following locations:

- Along lateral wall
- Downstream of ratchet wall (including inside FOE area)
- On top of the mezzanine floor above lateral walls/ratchet walls

Note: If multiple beamline optics are installed in the FE, repeat Phase 2b as necessary for each optic.

6.2.3 Document the radiation survey results from 6.1.2, 6.2.2 and 6.2.3 AND perform data analysis:

Note: Phase 1 and 2 Radiation Survey results will be included in the Radiation Survey Report prepared in accordance with section 6.5 of this procedure.

- a. Complete section 6.4 of this procedure to document the survey results AND analyze the data collected during the Phase 1 and 2 Radiation Survey.

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6.3 Phase 3 Fault Study – FE X-Y Slits Open, Electron Beam Dumped on the Outboard Side of the Applicable FE

6.3.1 Create a local orbit bump to dump beam on the outboard side of the applicable FE.

6.3.2 Complete radiation surveys at the following locations:

- Along lateral wall
- Downstream of ratchet wall (including inside FOE area)
- On top of the mezzanine floor above lateral walls/ratchet walls

6.3.3 Remove bump.

6.3.4 Document the radiation survey results AND perform data analysis.

Note: Phase 3 Fault Study Radiation Survey results will be included in the Radiation Survey Report prepared in accordance with section 6.5 of this procedure.

- a. Complete section 6.4 of this procedure to document the survey results AND analyze the data collected during the Phase 3 Fault Study.

6.4 Interim Radiation Survey Report

6.4.1 ESH Staff evaluates and analyzes the radiation survey data, AND includes the following:

- Comparison of survey results to the maximum allowable dose
- Adequacy of ARM locations

6.4.2 ESH Staff presents the radiological surveys and data analysis findings (Interim Radiation Survey Report) to the ESH Manager.

6.4.3 The Interim Radiation Survey Report is reviewed to determine the adequacy and effectiveness of the shielding.

6.4.4 HOLD POINT: Upon determination of satisfactory shielding, the ESH Manager, gives permission to proceed with commissioning.

- a. Verify changes to operating conditions are in accordance with those specified in the Interim Radiation Survey Report.

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6.5 Radiation Survey Report

6.5.1 Upon the completion of the radiation surveys, prepare a report detailing:

- Findings of the radiation surveys
- Whether the objectives were met
- Any changes deemed necessary during the performance of the radiation surveys

6.5.2 Submit the report to the ESH Manager.

6.5.3 Submit the final report to the Configuration Management Specialist for posting on the SharePoint Document Center.

6.5.4 Submit all recommended changes to QA Staff for tracking in accordance with PS-C-QAS-PRC-011, *Action Item Tracking*.

7 REFERENCES

- 7.1 FS-SOP-1000, *Radiation Survey Techniques*
- 7.2 PS-C-CMD-PRC-002, *Records Management Procedure*
- 7.3 PS-C-ASD-PRC-166, *NSLS-II Insertion Devices and Front Ends Commissioning Sequence*
- 7.4 PS-C-ASD-PRC-055, *NSLS-II Radiation Safety Component Configuration Management*
- 7.5 PS-ESH-PRM-3.4.1, *Procedure for Safety System Work Permits*
- 7.6 PS-C-ESH-PRC-002, *Unreviewed Safety Issue Determination Procedure*
- 7.7 PS-C-ESH-ROASE-001, *NSLS-II Accelerator Safety Envelope (ASE)*
- 7.8 PS-C-QAS-PRC-011, *Action Item Tracking*

8 ATTACHMENTS

Attachment A, *Example BNL Radiological Survey Form*

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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*:

- Radiological Work Permit
- Radiation Survey Report

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Attachment A Example BNL Radiological Survey Form

BNL RADIOLOGICAL SURVEY FORM					Reason for Survey	
Date: _____		Time: _____		Bldg. # _____		Location: _____
INSTRUMENTS						
MODEL	SERIAL#	Cal Due Date	Source Check (Y/N)	COMMENTS:		
DOSE RATES (HIGHEST)		AIRBORNE CONTAMINATION			LEGEND	
CONTACT	GENERAL AREA	SAMPLE #	VOLUME	uCi/cc	%DAC	<input type="checkbox"/> SMEAR SURVEY LOCATION <input type="checkbox"/> MASSLENN SURVEY LOCATION <input type="checkbox"/> AIR SAMPLE LOCATION
NA					XXX Y XXX = CONTACT READING ZZZ ZZZ = READING @ 30 Cm Y = RADIATION TYPE	
SMEAR SURVEY LOCATIONS (DPM/100 cm ²)				H R-γ α (See Attached Printout for Survey Results)		MASSLENN SURVEY RESULTS (DPM)
←----- N/A -----→						

Surveyed By: _____ Signature/Date _____ Reviewed By: _____ Signature/Date _____
 Form FS-1000.1 File Code: HP3120

-END-