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Brookhaven National Laboratory/ Photon Sciences Directorate

<b>Subject:</b>	NSLS-II USI #1 – Use of Radiation Work Permit for Commissioning NSLS-II Linac RF System				
<b>Number:</b>	LT-ESH-USI-001	<b>Version:</b>	1	<b>Effective:</b> 05Dec2011	<b>Pages</b> 1 - 6
<b>Prepared By:</b>	Nicholas Gmür	<b>Approved By:</b>		<b>Approved By:</b> Steve Hoey	

\*Approval signatures on file with master copy.

VERSION	DESCRIPTION OF ANY CHANGES	DATE	PREPARER	APPROVED BY
1	Original document	05Dec2011	Nicholas Gmür	See signatures above

## NSLS-II Unreviewed Safety Issue #1

### Use of Radiation Work Permit for Commissioning NSLS-II Linac RF System

**EMS, FUA and SAD/ASE Checklist for Photon Sources Directorate Reviews**

(Photon Sources Directorate ES&H personnel and the Environmental Compliance Representative can assist in completing this form)

**Review Committee:** Laboratory ESH Committee

**Date:** 05Dec2011

**Project Name (and # if any):** NSLS-II USI #1

This checklist identifies issues associated with this project that may impact the Directorate Environmental Management System, Occupational Health & Safety Management System, Facility Use Agreements, Safety Assessment Documents & Accelerator Safety Envelopes, and NEPA documents. This checklist will be completed during a review process, if needed, and form part of the documentation of that review.

**SIGNIFICANT ENVIRONMENTAL ASPECTS ASSOCIATED WITH THIS PROJECT:**

Check off any environmental aspects that are associated with this project ([NSLS](#) and [NSLS-II Environmental Management System aspects matrices](#) show the significant aspects).

For criteria, go to the SBMS Subject Area titled [Identification of Environmental Aspects and Impacts](#)

<input type="checkbox"/>	Industrial Waste Generation	<input type="checkbox"/>	Work with Engineered Nanomaterials	<input type="checkbox"/>	Power Consumption	<input type="checkbox"/>	Historical Contamination (groundwater, soil)
<input type="checkbox"/>	Hazardous Waste Generation	<input type="checkbox"/>	Atmospheric Emissions	<input type="checkbox"/>	Engineered Nanomaterials	<input type="checkbox"/>	Soil Activation
<input type="checkbox"/>	Radioactive Waste Generation	<input type="checkbox"/>	Liquid Effluents	<input type="checkbox"/>	Historical Monuments/Cultural Resources	<input type="checkbox"/>	Transuranic Waste Generation
<input type="checkbox"/>	Mixed Waste Generation	<input type="checkbox"/>	Storage or Use of Chemicals or Radioactive Materials*	<input type="checkbox"/>	Sensitive/Endangered Species and Sensitive Habitats (including Pine Barrens)	<input type="checkbox"/>	Other Regulatory Requirements - recycling
<input type="checkbox"/>	Medical Waste Generation	<input type="checkbox"/>	Water Consumption	<input type="checkbox"/>	Environmental Noise	<input type="checkbox"/>	NONE

\*Art 12 registered area, spill potential, transportation of hazmat or rad, backflow devices, PCBs.

Any environmental aspects new to the Directorate: Y or N? Any aspects associated with new activities: Y or N? If yes, describe below and issue a memo to the appropriate Photon Sciences Directorate ESH Manager:

**APPLICABLE REGULATORY REQUIREMENTS:**

Check off any BNL [Subject Areas](#) that are applicable to this process:

Note: PI's should consider subscribing to the Subject Area Subscription Service as a means of staying informed of changes to the Subject Area requirements.

<input type="checkbox"/>	Drinking Water	<input type="checkbox"/>	Radioactive Waste Management
<input type="checkbox"/>	Environmental Monitoring	<input type="checkbox"/>	Regulated Medical Waste Management
<input type="checkbox"/>	Hazardous Waste Management	<input type="checkbox"/>	Spill Response
<input type="checkbox"/>	Liquid Effluents	<input type="checkbox"/>	Storage and Transfer of Hazardous & Non-hazardous Materials
<input type="checkbox"/>	Mixed Waste Management	<input type="checkbox"/>	Transfer of Hazardous or Radioactive Materials On-Site
<input type="checkbox"/>	National Environmental Policy Act (NEPA) and Cultural Resource Evaluation	<input type="checkbox"/>	Transport of Hazardous or Radioactive Materials Off-Site
<input type="checkbox"/>	Non-Radioactive Airborne Emissions	<input type="checkbox"/>	Underground Injection Control
<input type="checkbox"/>	PCB Management	<input type="checkbox"/>	Regulated Industrial Waste Management
<input type="checkbox"/>	Pollution Prevention and Waste Minimization	<input type="checkbox"/>	Working with Nanomaterials ES&H
<input type="checkbox"/>	Radioactive Airborne Emissions	<input type="checkbox"/>	None

**Facility Use Agreement (FUA)**

Answer “Yes” or “No” for each category below.

Category	Applicable		Elements and Details
	Yes	No	
Radiological Source Terms	<input checked="" type="checkbox"/>	<input type="checkbox"/>	See FUA Table 4.1.1 for details.
Chemical, Toxic, Biological & Hazardous Source Terms	<input type="checkbox"/>	<input checked="" type="checkbox"/>	See FUA Table 4.1.2 for details.
Physical Source Terms	<input type="checkbox"/>	<input checked="" type="checkbox"/>	See FUA Table 4.1.3 for details.

If yes, do any terms require an update to the FUA: Y or N? If yes, describe below and issue a memo to the appropriate Photon Sciences Directorate ESH Manager: **Note: The FUA for building 740 will be written once construction has been completed. Radiological information would be included at that time.**

**Safety Assessment Document (SAD)/Accelerator Safety Envelope (ASE)**

Does this project include components that exceed or are not included in the safety boundaries described in the SAD or the ASE: Y or N? If yes, describe below and issue a memo to the appropriate Photon Sciences Directorate ESH Manager: **Activities that may increase the level of a known hazard or may introduce a new type of hazard not examined in a Safety Assessment Document, and therefore may impact the items below must be evaluated through the PSD USI determination process:**

- **Radiation monitoring for personnel protection**

**Job/Facility Risk Assessments (JRA/FRA)**

Does this project include components that exceed or are not included in the jobs, hazards, controls or risks described in the JRA/FRAs: Y or N? If yes, describe below and issue a memo to the appropriate Photon Sciences Directorate ESH Manager:

## **NSLS-II Unreviewed Safety Issue #1**

### **Use of Radiation Work Permit for Commissioning NSLS-II Linac RF System**

#### **Introduction**

This document is prepared as an addendum to the existing National Synchrotron Light Source II (NSLS-II) Linac Commissioning Safety Assessment Document (LCSAD); dated May 11, 2011. It is intended to provide a risk analysis for the use of a Radiation Work Permit (RWP) for commissioning the NSLS-II Linear Accelerator (Linac) radiofrequency (RF) system. The use of the RWP is analyzed as an Un-reviewed Safety Issue (USI) as defined in DOE Order 420.2C, *Accelerator Safety*.

#### **Executive Summary**

A NSLS-II Linac is being constructed as part of the injection system for the new NSLS-II Storage Ring. The LCSAD discusses treating the Linac RF system as a Radiation Generating Device during the RF commissioning period. Brookhaven National Laboratory (BNL) Radiological Control Division (RCD) personnel have agreed that commissioning the Linac could be conducted using instead a Radiation Work Permit (RWP). This would maintain the necessary controls required during Linac commissioning and would be simpler to manage administratively.

The safety impact of using the RWP for Linac RF commissioning is outlined below. It is concluded that the RWP can be used without impacting the safety basis of commissioning the Linac RF system and that no change to the NSLS-II Linac Commissioning Accelerator Safety Envelope (LCASE) will result.

## **Risk Analysis**

A Linac is being constructed for NSLS-II. It will form the first part of a two-part injection system (includes a Booster) for the new NSLS-II electron Storage Ring. NSLS-II LCSAD and LCASE (dated May 11, 2011) documents have been prepared and they have been approved by the Department of Energy Brookhaven Office.

Once the Linac has been constructed, it must undergo a period of commissioning to assure that it meets its technical specifications and is ready to inject bunches of electrons into the NSLS-II Booster whose own commissioning will follow that of the Linac.

Linac commissioning will take place in two phases. The first phase will involve the commissioning of the Linac RF system, consisting of the klystrons, modulators, RF cavities, and associated power, control and diagnostic equipment. The second phase will involve commissioning the Linac itself. Both commissioning efforts require that the Personal Protection System (radiation safety interlocks) be fully tested and functional.

Section 3.3.2.3 of the LCSAD states:

*“Five Linac traveling wave-accelerating structures may be powered by up to three high-power klystrons; the third klystron may act as a hot spare or may be in use. The klystrons are supported by solid state switched pulsed modulators. The Klystrons will be tested prior to Linac commissioning and will be subject to the requirements established in SBMS Subject Area for Radiation Generating Devices [RGD]. The Klystrons generate x-ray fields during operation and will be shielded with lead sheets to reduce radiation levels to < 0.5 mR/h at contact.”*

And, Section 4.15 of the LCSAD states:

*“Significant x-ray fields within the Linac enclosure can also be created by electrons released by high electric field gradients within the Linac tanks (dark current) when the tanks are powered by the RF cavities. Commissioning of the RF cavities and tanks will take place prior to the Linac commissioning with beam. These devices will be subject to the requirements of the SBMS Radiation Generating Devices subject area. The Klystron tubes located within the Linac Klystron Gallery will also generate x-ray fields requiring shielding. The technical specifications for the Klystrons required that lead shielding be provided to reduce radiation levels to < 0.5 mR/h at contact. These radiation levels will be checked when the Klystrons are commissioned to confirm the adequacy of the shielding.”*

Subsequent to the approval of the LCSAD and LCASE, members of the BNL Radiological Control Division reviewed the above for controlling the Linac RF system commissioning using RGD requirements (based on the SBMS *Radiation Generating Device* subject area) and concluded that this commissioning could be controlled equally well using requirements outlined in a Radiation Work Permit (BNL *Radiological Control Manual*, Section 3.2.1); salient features of a RWP are:

## A. Program Requirements

1. The Radiological Work Permit (RWP) is an administrative mechanism and shall be used to establish radiological controls for intended work activities. The degree of control shall be commensurate with the existing and potential radiological hazards associated with the work. [10CFR835.501(b)]
2. The RWP is a written authorization to perform work within radiological areas and shall inform workers of area radiological conditions, work control requirements and entry and egress requirements. [10CFR 835.501(d)]
3. The RWP provides a mechanism to relate worker exposure to specific work activities.

Below is email confirmation that RCD agrees with this change:

From: Ryan, Dennis J  
Sent: Wednesday, August 03, 2011 4:47 PM  
To: Casey, William (Bob); Zafonte, Frank J; Kahnhauser, Henry F  
Cc: Gmur, Nicholas  
Subject: RE: Booster RGDs

Bob,  
I concur that this is what we discussed earlier and it is the appropriate way to handle Linac Klystron conditioning and testing.

Dennis

From: Casey, William (Bob)  
Sent: Wednesday, August 03, 2011 3:10 PM  
To: Ryan, Dennis J; Zafonte, Frank J; Kahnhauser, Henry F  
Cc: Gmur, Nicholas  
Subject: FW: Booster RGDs

In the discussion that we had last month, we said that we would handle the linac klystron tests through a RWP rather than registering the device as an RGD. I just want to confirm that with you again since we had stated RGD in the Linac SAD. We would prefer to treat it through the RWP, and write a USI to cover the deviation from the approved SAD. Please confirm with us that a RWP to cover the testing of the linac klystrons is acceptable with you.

Bob

## Conclusion

Use of an RWP for NSLS-II Linac RF system commissioning presents no impact to the Linac facility safety basis (LCSAD) and requires no changes to the LCASE.

