April 4, 2016 – Revision 4 Dean Wyncott

ICMS APS\_

**Guidelines for Scheduling and Performing the**

**Annual Routine Radiation Survey of the Experiment Enclosures**

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This guideline outlines the responsibility of the Floor Coordinator clarifying the technical aspects for performing an Annual Routine Radiation Survey. This will also define the essential interaction between the Floor Coordinator, the beam line personnel and the Health Physics group.

The Safety Assessment Document of the APS defines the operating and safety envelope for the APS x-ray beam lines. The SAD requires an Annual Routine Radiation Survey of the complete beam line, beginning one year from the Shielding Verification date of the station(s). It is a matter of compliance with the Safety Assessment Document that beam lines do not exceed 30 days beyond their annual due date.

**The ANL Radiation Safety Officer may allow a beam line to exceed 30 days beyond the annual due date.** Construction, upgrades or technical problems that prevent a beam line from bringing beam into an experiment station are the situations for this exception.

The survey can be performed with mono beam for a white or pink beam enclosure, in order to keep in compliance with the annual due date. If there is an inability to bring white or pink beam into that station due to the beam line configuration, the beam line personnel shall be informed that the survey(s) are to be rescheduled at the first opportunity to bring white or pink beam into the enclosure(s).

When a white or pink beam station has been surveyed in mono beam, an Administrative Restriction is to be posted that will only allow mono beam in the station, until a Routine Radiation Survey of the station is performed in white or pink beam. A laminated copy of the Administrative Restriction should be attached to a beam line component or the station panel in a position that will prevent the beam line personnel from changing into white beam mode. If possible, the white beam mode key can be placed in the beam line end cabinet.

It is the responsibility of the Floor Coordinator to be the principal contact between the beam line personnel and the Health Physics group.

An Excel file (Annual Routine Radiation Survey Record) has been created to provide information on the beam lines: station type (white, pink, mono), survey points and survey history. This file is in the ICMS #APS\_1695044. All pertinent data from the Health Physics Experiment Enclosure Survey form is entered into this record. From this record, a determination is made of the beam lines that will be due for a survey during the next run.

It is advantageous to provide the Health Physics group with a Routine Radiation Survey Schedule one week prior to an APS run. The Health Physics group will provide technicians based upon this schedule. The new schedule will also be posted to the Floor Coordinator Home Page.

**Scheduling**

* Determine the beam lines that will be due for their Annual Routine Radiation Survey during the next run period, including those that will be due during the following maintenance period. Surveys cannot be scheduled to take place on Machine Intervention days. Routine Radiation Surveys will require dedicated User beam time.
* Send an email to the beam line custodian and appropriate beam line personnel, informing them of the month when their beam line will be due for the Annual Routine Radiation Survey. (See example below)
* Visit with each beam line custodian to schedule a date and time to perform the survey.
* Send an email confirmation to the beam line custodian and the appropriate beam line personnel of the scheduled date and time that the survey is to be performed. Include a reminder of the beam criteria, along with the necessity to have the assistance of cognizant beam line personnel to establish the maximal operating conditions of the experiment station.
* A copy of this confirmation will also need to be sent to the appropriate Health Physics personnel and the UES Group.

(Example): The (XX)-ID beam line is due for the Annual Routine Radiation Survey in the month of (XXXXX). The Annual Routine Radiation Surveys are required by the Safety Assessment Document of the APS. A white beam enclosure will need to be surveyed in white beam. For the mono and pink beam enclosures we would like to have the maximum flux level as you determine. In the case of mono beam, we would like to see a high energy and flux configuration to optimize scattering. If mono beam has to travel from one station to the next in air, it is required that a vacuum pipe be installed to transport the beam to the next station. We request assistance from cognizant beam line personnel in establishing maximal operating conditions of the experiment stations.

We will need the beam line personnel to provide the necessary information to quantify the beam characteristics coming into the station.
The following information will be requested:
Beam Monitor Device: (Ion Chamber/Pin Diode)
Incident Beam Size:
Incident Beam Photons/second:

I will be coming to see you to schedule the survey.
Thank you for your time and assistance.

* Send a reminder to the beam line custodian, the appropriate beam line personnel, Health Physics personnel and the UES Group of the scheduled date and time of the Routine Radiation Survey two days before the scheduled survey time.

**Beam Criteria**

Surveys of the Experiment Enclosures should be conducted at the maximal operating conditions of the experiment stations. It is desirable to perform the Survey in White or Pink Beam Mode. If the stations are able to operate in White Beam Mode, it is necessary to perform the Survey in White Beam Mode.

The Survey can be performed in Mono Mode; but an A.R. will need to be issued that will restrict the White beam station to Mono Mode until the survey can be performed in the White Beam Mode.

The preferred beam current should be 100 mA; but no lower than 80 mA. In the case of Insertion Device beam lines, the insertion device gap should be at the operational limit. For the mono and pink beam enclosures we require the maximum flux~energy level achievable (as determined by the beam line personnel). For a Mono beam enclosure it is preferable to have at least 11 keV. There are enclosures that only operate at a fixed energy or a very low energy. In this situation it is only necessary to perform the survey at the highest energy level that the beam line is able to attain.

It is the responsibility of the Floor Coordinator to confirm the proper beam criteria for the Experiment Enclosure.

**Pre-Survey Communication**

Personal contact with the beam line personnel is necessary to ascertain that the proper beam criteria can be achieved to perform the survey. This should be verified approximately 30 minutes before the Survey time. Confirm with the Health Physics personnel when the beam line will be prepared for the survey.

Operation of the shutter(s) should be performed only by the beam line personnel unless instructed otherwise. Permission to access an enclosure should always be attained from the beam line personnel.

**Survey Locations**

All labyrinths, doors, windows, beam transport line ports, guillotines, beam transport joints, survey alignment ports, beam exit ports, front and rear panel/ratchet wall interface,

roof panel/mezzanine interface and panel/floor interfaces will need to be surveyed. Be certain to survey the overlap areas of doors, at the floor overlaps and at the joints.

Health Physics personnel will need to access the roof of all enclosures. There will need to be railings or a tie off point for the attachment of a lanyard of a fall protection harness.

**General Performance Points**

* Notify the Health Physics group of the time when the beam line personnel will have beam in the stations to begin the survey.
* Inquire with beam line personnel as to what station they would like to survey first, in order to ensure the least amount of disruption to their beam time.
* Inform the Health Physics personnel when there is beam in the station and what enclosures they will need to access to survey the back wall and/or common wall(s) of another enclosure.
* During the Survey it is important to direct, monitor and question the Health Physics personnel if certain areas were surveyed.

This is because an assumption can be made by one HP Technician that another Technician has surveyed an area and now a condition exists with an area that was not surveyed.

* Inquire of the beam line personnel to ascertain what devices are causing scattering within the enclosure (mask, mirror, crystal, window, sample, slits, filter, collimator, shutter, beam stop, phosphorus screen, air, etc.). Document this information on the Experiment Enclosure Survey Form.
* Inform the beam line personnel when the survey of the enclosure is complete and that you are ready for the next enclosure.
* At times a User may not be aware of the survey being performed and close a shutter in order to access a station.

While the survey is being performed, it is important at times to verify that there is still beam in the station.

* Inform the appropriate beam line personnel of the completion of the survey.

**First Optics Enclosures (FOE)**

* If an FOE has no white beam stop or shutter, beam will be stopped in the next white beam station and the FOE will be surveyed for scattered radiation from the masks, collimators, mirrors and/or slits.
* Determine from the beam line personnel that there is beam in the station and that the HP personnel can conduct the survey of the FOE, including any mini-enclosure(s) associated with the original enclosure.

**Beam Line Enclosures**

* Inquire with beam line personnel that there is a high flux~energy configuration in the enclosure. It is preferable to have the beam energy at the beam line operational limit, as determined by the beam line personnel.

With canted undulators, different stations and beam line personnel, they may not be aware of the necessary beam criteria.

* Inform the HP personnel that they can conduct the survey of the enclosure, including any mini-enclosure(s) and Shielded Beam Transport associated with the original enclosure.
* If mono beam has to travel from one station to the next in air, it is required that a vacuum pipe be installed to transport the beam to the station being surveyed.
* Document all parameters of the survey on the Experiment Enclosure Survey Form.
* Repeat the same sequence for all enclosures.

**Experiment Enclosure with a Movable Beam Stop**

* Determine from the beam line personnel that the movable beam stop located within the station to be surveyed is closed.
* Request that the beam line personnel open the shutter so that there is beam in the station or that the beam is striking the closed movable beam stop.
* Request to have access to the station of the next enclosure downstream of the closed movable beam stop in order for the HP personnel to conduct a survey of the back wall and Exit Port of the enclosure that is now taking beam.
* Document all parameters of the survey on the Experiment Enclosure Survey Form.
* Repeat the same sequence for all enclosures.

**Experiment Enclosures with a Common Wall**

* When two experiment stations have a common wall, it will be necessary to gain access to the interior of the adjacent enclosure.
* When the enclosure being surveyed has a common wall with an enclosure of a different beam line, it will be necessary to coordinate the survey with the adjacent beam line personnel. (It may be necessary to complete the survey of the beam line and then come back when the adjacent beam line personnel will allow access into their enclosure).
* HP personnel will need to gain access to all enclosures that have a common wall with the enclosure that is being surveyed, in order to survey the adjoining wall panel/floor interfaces.
* When the adjacent station is the FOE white beam station with a shared wall of the mono beam station that is being surveyed, it is not necessary to stop the beam in the white beam station for access to survey the exterior of the mono beam station wall. It is of greater importance to survey the floor/wall interface inside of the mono beam station looking for the possibility of white beam leakage into the mono beam station.

**Mitigation Requirements**

* If counts are detected during a Routine Radiation Survey, the results will be indicated by magnitude and location on the appropriate station map by the Health Physics Technician.
* If the exposure level is > 0.25 mR/h on the experiment hall floor or > 2.5 mR/h on the enclosure roof, proper mitigation is required.
* When survey counts are detected above the exposure level limits, the Floor Coordinator shall immediately inform the Radiation Safety Officer of the situation.
* If the levels detected are above the exposure limits in a readily accessible area, the area shall require immediate mitigation as determined by the Radiation Safety Officer.
* Mitigation may be completed in areas that are not readily accessible, at the discretion of the Radiation Safety Officer.
* After mitigation of the leakage has been performed, contact the Radiation Safety Officer to perform a Type C Survey of the area of the mitigation.
* When the mitigation and Type C Survey has been completed, the Floor Coordinator shall notify the appropriate Beam Line personnel.