Fermilab	ESH Section Procedures	
Procedure Number/Name ESH-RPE-INTLK-2118 – MTA Radiation Monitor Test Procedure		**Revision Number:** 6
Written by: Glenn Federwitz		**Revision Date:** 7/20/2020

MTA Radiation Monitor Test Procedure

REVIEWED BY: _____ DATE 9/8/2020
ESH Section Assigned Radiation Safety Officer

REVIEWED BY: _____ DATE Adam Olson Digitally signed by Adam Olson Date: 2020.09.08 15:55:15 -05'00'
ESH Section Interlock Engineer

APPROVED BY: _____ DATE Adam Olson Digitally signed by Adam Olson Date: 2020.09.08 15:55:38 -05'00'
ESH Section Radiation Physics Engineering Department Head

Revision History

Revision Number	Author	Description of Change	Revision Date
5	J. Federwitz	Reformatted (now ESH&Q procedure)	10/3/2017
5	G. Federwitz	Cleaned up some formatting.	10/3/2017
6	G. Federwitz	Removed Q from ESH&Q and Removed 2 Rad monitors and added 1 (MTA Berm) (Green sheet #549). See Change request #254.	8/26/2020

Table of Contents

1.0 Purpose and Scope

The purpose of this procedure is to thoroughly test the MuCool Beam Line Radiation Monitors.

2.0 System Testing Approach

The majority of the system will be tested using an event / response relationship. This will be accomplished by causing a system violation and verifying that the system reacts correctly.

3.0 Marking Procedure

The Test Director shall document the results of safety system testing with the following colors:

a. Red for system malfunction or failure;

b. Blue for correct operation; or

c. Green for editorial comments or changes in the procedure.

The Test Director shall document the results of safety system tests in the test record and ensure all test team members and test escorts sign the test record.

The test record is written with the response yes or no for each item tested. The test director shall circle the yes response for correct system operation or the no response for system malfunction or failure.

4.0 Modifications of Safety System Interlock Procedures

In the event of non-standard situations, the test director may deviate from the approved test procedure if the intent of the procedure is being followed. The test director shall document the deviation on the test procedure as stated above.

5.0 Reporting Non-conformance during use of Safety System Interlock Test Procedures

Tested items that fail during testing or which are found in an inoperable condition during the test will be replaced or repaired, documented, and fully retested prior to acceptance of the system.

MTA Radiation Monitors

Date Tested_____

Test Director

_____ Date _____

Test Team

_____ Date _____

_____ Date _____

_____ Date _____

_____ Date _____

Accepted by:

_____

ESH Section Radiation Physics Engineering Department Head Date

6.0 Radiation Monitor Test

Purpose

Radiation monitors are (chipmunks and/or scarecrows) placed in certain locations of beam areas to ensure personnel are not exposed to high levels of radiation.

Quality Factor Check. The chipmunk can be in any of four different quality factors / modes. The setting is at the discretion of the Radiation Safety Officer. The quality factor determines sensitivity. The first test is to ensure that the chipmunk is in the quality factor that it was intended to be in. This is a visual test that is performed locally at the radiation monitor. *Quality factor of "10", Quality Factor of "5" (Neutron), Quality Factor of "2.5" (Mixed), & Quality Factor of "1" (Muon).*

Fail Safe Voltage Monitor Test. Here we are checking that if the chipmunk or scarecrow internal interlocks fault, that the interface card detects the missing Fail Safe Voltage and trips.

Identification Voltage Monitor Test. Here we are checking that if the chipmunk or scarecrow identification voltage fails, that the interface card detects the missing Identification Voltage and trips.

Rate or Integrate Check. Here we are checking that the radiation interface card is set to the proper function of "Rate" or "Integrate".

Trip Point Test. Here we are interested in ascertaining that the chipmunk interface card trips at the radiation level it was set to trip at. The test is performed with the aid of a pulse generator referred to as the Rate / Integrate Test Box. This test is performed locally at the interface card location.

Safety Trip. Here we are interested in knowing with certainty if the radiation monitor interface trips, it will interrupt the radiation A and B loops.

Procedure

Use the procedures below to perform each of the five tests for chipmunks.

Quality Factor Check. Visually examine the chipmunk and compare the specified mode in the table with the mode actually found. Circle YES to indicate that the mode is correct.

Fail Safe Voltage Monitor Test. Press the "FS Test" (Fail Safe) switch on the interface card to interrupt the Fail Safe voltage, the interface should trip the radiation A and B loops in less than 5 seconds. Circle YES in the fail-safe test columns to indicate correct operation.

Identification Voltage Monitor Test. Press the "ID Test" (Identification) switch on the interface card to interrupt the Identification voltage, the interface should trip the radiation A and B loops in less than 5 seconds. Circle YES in the Identification test columns to indicate correct operation.

Rate or Integrate Check. Verify the interface card is set to the desired function stated on the test by checking the front panel RA (rate) and INT (integrate) LEDs. Circle YES to indicate that the card is set correctly

Trip Point Test and Safety Trip. Using the Rate / Integrate Test Box for a "rate" trip point setting, set the Rate / Integrate switch to Rate, and the mRem level to the stated trip level. The test box in the "Low" position automatically puts out a rate of .1mRem below the trip point. In the "High" position the test box puts out a rate of 10% above the trip setting. Move the "Run / Test" switch on the interface card to the test position. Next, toggle the "High / Low" switch on the test box. The test box will now be in the high position. The interface card should now trip the radiation A and B loops. Circle YES in the rad trip columns to indicate correct operation. Toggle the "High / Low" switch, the test box will now be in Low. Interface card is now ready for a reset. Place the "Run / Test" switch back in the "Run" position.

For "integrating" trip cards, on the test box set the Rate / Integrate switch to Integrate and the mRem level to the stated trip level. Then press the "setup" switch. The test fixture will output a string of pulses equivalent to the mRem trip setting. Next press the single pulse switch. The interface card should now trip the radiation A and B loops. Circle YES in the rad trip columns to indicate correct operation. Reboot the interface card and press the single pulse switch to send one pulse to the interface card, the card is now ready for a reset. Place the "Run / Test" switch on the interface card back in the "Run" position.

In testing of scarecrows, the visual "Mode" test is not performed as the mode of a scarecrow is fixed. Fail Safe Voltage Monitor Test, Identification Voltage test, trip point test, and the safety trip tests need to be performed. The trip levels in the test table are in mRem. The scarecrow outputs a pulse for every 25 or 250 uRem (depending upon its output connector pin out) of radiation detected, where the chipmunk outputs a pulse for every 2.5 uRem. In all cases where a scarecrow is being tested the Rate / Integrate Test Box "Trip Point" will be noted below the chart. This is done due to the fact that each scarecrow installation could be pinned out for either a times ten (normal scarecrow pin-out) or times one hundred output.

MTA Radiation Monitor Tests

Radiation Detector Location	Rate or Integrate		Trip Point		Quality Factor		Fail Safe Test		ID Test		Rad. Loop	
and Mux Channel Number	Preset	Actual	Preset	Actual	Preset	Actual	A	B	A	B	A	B
MTA Berm (2-045)	Integrate	Yes No	50 mRem	Yes No	5	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No	Yes No

6.3 Critical Device Input Verification

Purpose

To verify that the loss of the Radiation Monitor Loops removes the A & B Radiation Inputs to the MTA CDC.

MTA	MTA CDC	Radiation Input
Radiation Monitor Loop	A Input	B Input
Trip	Yes No	Yes No

6.4 Section 2 Conclusion

Purpose

The tests of the MTA Radiation Monitors are now complete.

6.5 Rate / Integrate Test Box

Purpose

To ensure the Rate / Integrate Test Box used for testing the radiation monitor cards is returned and not left in the system.

Rate Integrate Test Box returned by _____Initial