

Brookhaven National Laboratory/ LIGHT SOURCES DIRECTORATE			
Subject:	Securing the X-Ray Tunnel		
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*Approval signatures on file with master copy.

[Revision Log](#)

1.0 PURPOSE

The purpose of this procedure is to provide guidance for the Operations Group personnel and other qualified persons performing a search of the X-Ray tunnel and X17 Small Transport Enclosure for operational purposes. Also provided is how to Un-Secure/break security from a secured X-Ray Tunnel and X17 Small Transport Enclosure.

2.0 SCOPE

The X-Ray tunnel is the most extensive High Hazard Radiation Area at the NSLS. To ensure the utmost in personnel safety at the NSLS, personnel listed in "Qualified Search Personnel for NSLS Accelerators" must complete the search of this area or break security in the tunnel to allow personnel access. The X17 Small Transport Enclosure (STE) contains the X17 shutters (STRESS – Small Transport Enclosure Safety Shutter) and is interlocked to the X-Ray tunnel as part of the Plug Door Interlock String. This enclosure is located downstream of the X17 Front End, is an extension of the x-ray tunnel in terms of radiation hazard, and must be properly searched and secured before the x-ray tunnel can be secured.

3.0 RESPONSIBILITY

Searchers: The searchers must assure that no person remains inside the X17 Small Transport Enclosure (STE) and X-ray tunnel after the search has been completed. These individuals are also required to assure all main magnet power supplies have been turned off prior to breaking security in the tunnel.

Control Room Operator: The on duty Operator must always be aware of the status of the interlocks and in control of the status.

4.0 PREREQUISITES

4.1 Two people are required to search the X-Ray tunnel. One of these searchers must be either an Operator or an Operations Coordinator and the other must also be selected from the list of qualified searchers (refer to "Qualified Search Personnel for NSLS Accelerators, LS-ESH-0009").

One Qualified searcher is needed to complete the search of the X17 Small Transport Enclosure (STE).

4.2 All plug doors must be properly closed with interlock connections made. If work was completed in a front end area that requires a safety inspection, assure all permits are cleared and the Safety Officer or Safety Engineer has completed the inspection prior to closing the plug door.

4.3 Permission for securing the X-Ray tunnel must be given by the Control Room Operator on duty.

4.4 The searchers should determine that all work in the tunnel and STE has been completed and cleanup work done. This often requires a walk around in the tunnel before the search and/or an announcement made using the PA system stating that the tunnel will be secured. Anyone in the tunnel should be asked to leave at this time.

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4.5 The "RF System Test Mode" and "Magnet Test" Kirk Keys must be in place in the X-Ray security rack.

4.6 Ring interlock faults RIA/RIB should be cleared.

4.7 The emergency exit door must be closed and the fault must be reset at SR100.

4.8 All Red Tags must be removed from the "Security System Red Tag Switch" at SR100.

4.9 The STE must be searched to ensure no personnel remain inside. Note that the STE does not contain search buttons. Searchers must announce they are closing up the X17 STE during the STE search process. Once the panels/doors are closed, all panel/door keys must be placed in the STE transfer key bank (located adjacent to STE) then the STE transfer key can be inserted in the SRU at X-Ray Security Rack SR100. Upon completion of the transfer, the plug door faults at SR100 must be cleared prior to attempting to secure the x-ray tunnel.

5.0 Search/Secure X-Ray Tunnel

Refer to the [Appendix](#) for the X-Ray tunnel diagram, check station locations, emergency stop locations, tunnel search paths, and photos of the Small Transport Enclosure area.

5.1 The actual search must be accomplished without interruption.

- a.) The search must be completed without waiting for work in the tunnel to be completed or without extraneous tasks, such as collecting and carrying objects out of the tunnel during the search.
- b.) If an interruption occurs, the search should be dumped by pressing and then resetting an emergency stop button. The problem(s) must be addressed before attempting to re-search the tunnel.

5.2 The search of the X-Ray tunnel is started and completed at the double doors that provide access to the tunnel.

- a.) The searchers are to hang the "DO NOT ENTER, SEARCH IN PROGRESS" sign on the door before they enter the tunnel.
- b.) The searchers enter the ring through the double doors and the doors are closed making sure the fixed door is latched in place
- c.) Searcher #1 turns right into the tunnel and proceeds to DG/START SEARCH. Searcher #2 turns left into the tunnel and awaits the illumination of the "Interlock" sign (located by DG/START SEARCH) in the tunnel.
- d.) Searcher #1 presses the first Check Station, DG/START SEARCH. Pressing DG/START SEARCH does the following:
 - 1.) Starts the six-minute time limit.
 - 2.) Illuminates the "Interlock" sign inside the tunnel.
 - 3.) Illuminates the "Radiation Area - Entry Is Prohibited" sign over the entrance doors outside of the tunnel.

If either entrance door is opened before the searchers have completed their concentric circuit and are ready to leave, the search will dump and will have to be started over.

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e.) Searcher #1 proceeds around the tunnel to CS-1. Searcher #2 proceeds around the tunnel to CS-2.

f.) During the search through the tunnel, the searchers must do the following:

- The searchers must look carefully for any persons who may be in the tunnel. In particular, the "SAWTOOTH" areas must be examined using the mirrors provided and by looking around the magnets.
- **The searchers must announce verbally that the ring is being secured, numerous times throughout the search process.**
- The space between the magnets and the outer wall must be checked.
- In addition, the searchers should check that all plug doors are in place and that the shielding has not been removed from the "WINDOWS" where the beam pipes pass out of the tunnel.

g.) If any person is encountered during the first half of the search, they should be told to move ahead of the searcher toward the entrance doors, but not to open the door since this would dump the search.

WARNING - If a person is found in one of the sawtooth areas or on the magnets, the search must be dumped and restarted only after they are out.

h.) Searcher #1 presses CS-1 when it is reached. Searcher #2 presses CS-2 when it is reached.

- The pilot lights on CS-1 & CS-2 remain on, indicating that the search relays are latching properly.

i.) Both searchers proceed to the 180-degree point where CS-3 is located. The first searcher to reach the 180-degree point waits for the other searcher to arrive.

j.) One of the searchers guards the tunnel while the other searcher enters the emergency exit area, verifies that no one is there, assures the emergency door is fully closed, and presses CS-3.

- The pilot light on CS-3 remains on, indicating that the search relays are latching properly.

k.) Both searchers continue around the tunnel in their original directions and from this point on they must insist that any person encountered must move ahead of them toward the tunnel entrance.

l.) When both searchers arrive back at the entrance doors, they compare notes and verify that every person who has been in the tunnel is at the entrance and ready to leave.

m.) Searcher #2 presses check station DG/START SEARCH that provides a ten second interval during which the exit doors may be opened and everyone leaves the tunnel.

n.) One of the searchers opens the entrance door to the tunnel. Both searchers and all persons encountered during the search exit the tunnel.

o.) One of the searchers closes the entrance door and removes the Kirk Key.

p.) After the entrance door is closed, the other searcher must press CS-E until the audible warning is heard from the tunnel.

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q.) The searchers must remove the "Do Not Enter" sign from the entrance door and place it aside.

r.) The door Kirk key must then be inserted into the SRU at SR100 and then turned clockwise into place. Note: Both the X-Ray Tunnel and STE Key must be in place in order to turn the keys.

s.) The searchers must remain at SR100 until the "Time Delays Completed" light comes on, indicating that the warning interval has been successfully completed. The control room operator on duty must then be informed that the X-Ray tunnel has been secured.

6.0 Un-secure/Break Security in X-Ray Tunnel and X17 Small Transport Enclosure (STE)

6.1 The machine operator must command all X-Ray main power supplies OFF.

6.2 An authorized searcher listed on LS-ESH-0009 must verify that all indicators on the power supply status panel at SR-100 all indicate OFF. If all main power supplies indicate off then the searcher removes the tunnel door key or X17 STE transfer key from the SR-100 Solenoid Release Unit (SRU). To access the X-Ray Tunnel transfer the tunnel door key into the X-Ray tunnel main entrance door and open the door to break security. To access the X17 STE transfer the STE transfer key to the STE Transfer key bank (located adjacent to the STE) to remove door/panel keys.

* * *

APPENDIX

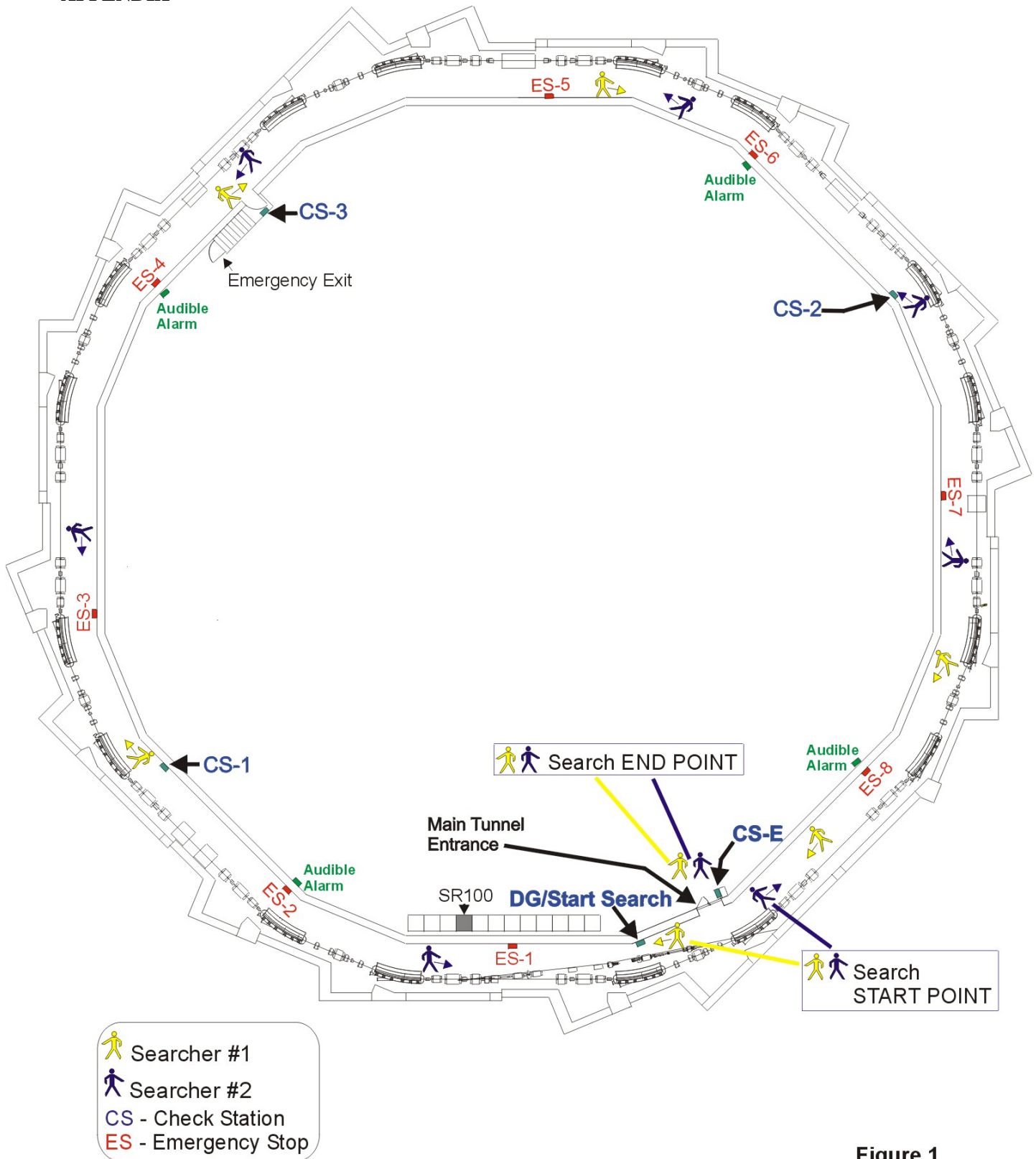


Figure 1

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Figure 2: Small Transport Enclosure (STE) downstream access door/panels



Figure 4: Solenoid Release Unit (SRU) at X-Ray Security Panel SR100



Figure 4: STE Upstream Access panel and STE Transfer Key Bank

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Document Review Frequency

3 Years

Review signatures on file
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LIGHT SOURCES DIRECTORATE REVISION LOG

Document Number:	LS-OPS-0001	
Subject:	Securing the X-Ray Tunnel	
Rev	Description	Date
0	Initial Document	12/15/1997
B	Changed reference for Qualified Searchers to new document LS-ESH-0009 and removed section 6 for qualified searchers. Added the requirement to check the emergency tunnel door during the search - step 5.2(j). Revision changed to letter scheme.	2/1/2002
C	<ul style="list-style-type: none"> • Changed scheme for two check stations from “CS-5 to DG/Start Search” and “CS-4 to CS-E” to be consistent with other systems. • Added instructions on how to Un-secure the X-Ray Tunnel in various sections including a new section 6.0. • Figure 1 changed to illustrate changes in check station scheme. • Changed review frequency from 2 to 3-years. 	7/16/2008
D	<ul style="list-style-type: none"> • Sections 1,3,4, and 6 revised to capture new X17 Small Transport Enclosure search and access requirements. • Added photos of STE area and new SRU at X-ray Ring Security panel SR100. • Added the verification of plug doors closed and safety inspection of front ends prior to closing plug doors. • Added additional text throughout document to provide more details for the step or requirement. 	3/10/2010