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## Confined Space Entry Procedure

### REVISION

Rev No.	DCN No.	Change Summary	Release Date	DCN Initiator	Document Owner
12	DCN3595	Updated Section 14 for prewalk.	June 2024	P. LaFountain	K. Rydberg

Prior revision history, if applicable, is available from the Document Control Office.

## 1. PURPOSE

- 1.1 The purpose of this procedure is to establish minimum rules to protect the health and safety at the Albany NanoTech Complex (ANC) employees, tenants, or contractors required to enter confined spaces to work, clean, repair, inspect or perform other duties.
- 1.2 This procedure is not intended to provide the basis for establishing more detailed entry and work procedures for permit required confined spaces. The procedures used will depend on the scope of work, size of space, material, and equipment to be used in the [confined](#) space.
- 1.3 Although this procedure describes specific safety steps to be taken for entry into permit required confined spaces, it is not intended to prevent the use of any additional measures that may be deemed necessary for a particular situation. Each situation must be reviewed on an individual basis by the responsible Supervisor.
- 1.4 This procedure is not intended to list the confined spaces that are associated with tenant owned and operated equipment or tools.

## 2. SCOPE

- 2.1 This program applies to all NY CREATES employees, tenants, and contractors who may be entering confined spaces. Any deviations from the requirements set forth in this procedure require Environmental, Health and Safety (EHS) approval.
- 2.2 This program establishes the minimum requirements for entering confined spaces at the ANC. Tenants, contractors, and sub-contractors may comply with their own organization's program provided that it meets and/or exceeds the minimum requirements set forth in this procedure.
- 2.3 NY CREATES employees, tenants, and contractors must follow this program and are required to comply with the restrictions and limitations imposed upon them during confined space activities.

### 3. DEFINITIONS

3.1 A confined space is defined by OSHA as a space that:

- Is large enough for a worker to enter and perform work
- Has limited or restricted entrances or exits
- Is not designed for continuous employee occupancy

3.2 A permit-required confined space (PRCS) (permit space) is a confined space that, in addition to the above, poses any one or more of the following hazards:

- Potentially hazardous atmosphere
- Potential engulfment of a worker
- An internal configuration, such as a tapered floor, which could cause a worker to become trapped

3.2.1 All manholes at ANC are PRCS.

3.3 A potentially hazardous atmosphere is defined as any atmosphere that could cause death, incapacitation, injury, or acute illness, impairment of ability to self-rescue, and would include any of the following:

- An atmosphere with a build-up of flammable gases or vapors in excess of 10% of the LEL
- Excessive airborne combustible dust
- An oxygen deficient (less than 19.5%) or an oxygen enriched (greater than 23.5%) atmosphere
- Atmospheres containing acutely toxic contaminants at a concentration level greater than the permissible exposure limit (PEL) or the threshold limit value (TLV)

### 4. ASSOCIATED DOCUMENTS

4.1 **ANT-00004** - Contractor Safety Guide

4.2 **EHS-00007-F1** - Confined Space Entry Permit

## 5. PERSONNEL ROLES AND RESPONSIBILITIES

Personnel who are involved with routine permit confined space entry will perform one of the three roles. These roles are:

- Authorized Entrant(s) - Person(s) physically entering the confined space
- Attendant - Person(s) monitoring on the outside
- Entry Supervisor - Person supervising activities which require permit confined space entry.
- Rescue and Emergency Personnel - the personnel designated to rescue employees from permit spaces.

5.1 **Authorized Entrants** are personnel who enter permit spaces to perform work. In addition to safely performing the assigned task within the permit space, their responsibilities are to:

- Know the hazards and potential hazards associated with the permit space and their effects
- Properly use the equipment required for entry
- Maintain a continuous means of communication with the attendant
- Alert the attendant in the event of an emergency
- Evacuate the space if an emergency occurs

5.2 **Attendants** are personnel stationed outside the permit space to monitor the conditions in and around the space and the authorized entrants. They additionally coordinate rescue efforts in the event of an emergency. Their specific responsibilities are to:

- Know the hazards and potential hazards associated with the permit space and their effects
- Maintain an accurate account of the authorized entrants
- Remain at their assigned station until relieved by another attendant or until the permit space entry is complete and authorized entrants have exited the space
- Monitor conditions in and around the permit space

- Contact the entry supervisor who will summon rescue and applicable emergency services in the event of an emergency
- Perform continuous monitoring of the space
- Perform non-entry rescue procedures
- Perform appropriate measures to prevent unauthorized personnel from entering the permit space

5.3 **Entry Supervisors** are personnel who supervise activities, which require a permit confined space entry. Their responsibilities are to:

- Know the hazards and potential hazards associated with the permit and their effects
- Verify that the safeguards required by the permit have been implemented
- Terminate entry and cancel the permit when the entry operations have been completed or a condition arises that is not allowed under the entry permit
- Remove personnel who are not authorized to enter the permit space during entry operations
- Determine, when appropriate, that the entry operation is performed consistent with the requirements of the permit space entry procedures and that acceptable entry conditions are maintained

5.4 **Rescue and Emergency Services** are personnel that have been trained and designated to provide rescue services when needed and in the case of being on stand-by for confined space work.

5.4.1 There must be a means in place for Emergency Services to be summoned at the onset of a needed rescue or emergency during an entry such as phone, radio or other.

## 6. HAZARDS

- 6.1 The potential hazards which may be encountered in permit required confined spaces are the following:
- A lack of or excess oxygen, which may cause asphyxiation or increased fire hazard.
  - Flammable gases or liquids in excess of their lower explosive limit (LEL).
  - Toxic gases, vapors, and liquids in excess of their threshold limit values (TLVs).
  - Injury caused by direct contact with corrosive or dermatitis producing chemicals.
  - Physical hazards, such as slipping and falling.
  - Electric shock from portable lights and tools.
  - Inability to readily get into or out of the space due to the location and/or size of openings.
  - Any other hazard or combination of above that would be immediately dangerous to life or health (IDLH) or any other condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a space.

## 7. ENTRY REQUIREMENTS

- 7.1 All individuals associated with a permit required confined space entry shall be properly trained in safe entry and rescue procedures, use of protective equipment, and instructed as to the hazards they may encounter.
- 7.2 The entry supervisor is responsible for assuring that the workers are properly instructed as stated above for each job requiring confined space entry.
- 7.3 Entry into permit required confined spaces shall be by written entry permit (**EHS-00007-F1 – Confined Space Entry Permit**), issued and approved by ERT / EHS and Entry Supervisor(s). The purpose of the entry permit is to ensure that a checklist of precautions has been reviewed prior to entry. This permit describes:

- The work to be done
- Time and date
- Nature of space
- Inspection checklist
- Protective and rescue equipment requirements
- Approvals for entry

7.4 This permit is an authorization and approval in writing certifying that all existing hazards have been evaluated and necessary protective measures have been taken to ensure the safety of the entrant(s).

7.5 This permit expires after eight hours from the date and time issued.

7.6 The space shall be emptied, flushed, or otherwise purged of flammable, injurious or incapacitating materials as much as possible.

7.7 The confined space shall be isolated by:

- Promptly guarding the opening (when entrance covers are removed) by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening, and that will protect each employee working in the space from foreign objects entering the space
- Disconnecting, blinding, or blocking off any piping, lines or vents which may convey flammable, injurious or incapacitating materials into the space
- De-energizing and locking or tagging out any machinery, mixers, or agitators
- All items above which have been disconnected, blanked, capped, blocked off or turned off, shall be identified with a Lock Out/Tag Out "DANGER" tag which shall not be removed until the entrants are out of the space and the work complete

- 7.8 The air in the **confined** space shall be tested for contaminants listed below. The space shall be tested prior to entry and periodically while an entrant is in the space:
- Flammable or combustible vapors using a combustible gas meter.
  - Oxygen deficiency or excess using a properly calibrated oxygen meter.
  - Toxic or corrosive contaminants using a suitable meter. The choice of test will depend on whether the space contained any particular corrosive or toxic chemicals or whether any such chemical will be used during entry operations, such as cleaning.
  - Tests shall be performed by a qualified person who has been trained in proper sampling methods, correct interpretation or results, and proper calibration and limitations of test instruments.
  - ERT / EHS will issue a Confined Space Permit sign (signed and dated) when this permit has been issued. This sign will be posted for the duration of the work. The purpose of this signage is for passersby to be aware the area is a Confined Space (entry by permit only) and for other employees to know this permit has been approved and signed off by ERT / EHS. Upon completion of the work, the contractor or supervisor will either return this sign to ERT / EHS. This will notify ERT / EHS that the work is complete, and the time will be noted on the permit.

## 8. VENTILATION

- 8.1 Proper and adequate ventilation of the space with safe respirable air shall be required if one or more of the following conditions exist or could exist during the course of the work:
- Flammable or combustible vapors are present above 10% of the LEL.
  - Combustible dust is present.
  - Toxic or corrosive contaminants are present above the TLV.
  - The oxygen concentration is below 19.5% or above 21.5%.
  - Toxic or other contaminants which:
    - Have no rated TLV
    - Cannot be accurately determined to be present with field testing instruments



- 8.2 Oxygen shall not be used to ventilate a confined space.
- 8.3 Equipment used for ventilation shall be suitable for the atmosphere which is being ventilated. When flammable contaminants are present, only equipment designed for use in hazardous locations shall be employed. Sources of ignition shall be eliminated.

## 9. PROTECTIVE EQUIPMENT REQUIREMENTS

- 9.1 Appropriate protective equipment for eyes, ears, head, hands, feet, and body shall be provided to the entrant prior to entry.
- 9.2 If necessary, the appropriate respiratory equipment shall be provided by the entrant's organization, provided it is listed under their organization's Respiratory Protection Program.
- 9.3 The use of approved respiratory protection with separate air supply shall be required when one or more of the following conditions exists, or could exist during confined space operations:
- Flammable or combustible vapors greater than 10% of the LEL
  - Oxygen content below 19.5% or above 21.5%
  - Toxic or corrosive contaminant above the TLV
- 9.4 Approved safety belts or harnesses and safety lines shall be provided. Lines shall be at least 1/2 inch in diameter, 2,000-pound test, and long enough to be secured outside the entry opening.
- 9.5 Approved rescue equipment shall be pre-positioned near the entrance prior to the entry into the confined space. This is to cut down on the response time should a rescue be required.
- 9.6 An effective means of communication between employees inside a confined space and an attendant shall be provided and used whenever:
- The use of respiratory equipment is required
  - The employees inside the space are out of sight of the attendant or "buddy"
- 9.7 In spaces which require lighting and there exists the potential for flammable vapors above the LEL, lighting shall be explosion proof and rated for hazardous locations.

## 10. PERSONNEL REQUIREMENTS

- 10.1 Only trained personnel shall be utilized for confined space operations.
- 10.2 An attendant must be present whenever an employee is inside a permit required confined space. At least one employee shall stand by outside the space to [aid](#) in case of emergency. This person shall remain in visual contact or have direct communication with the employee inside the space and have no other duties except to [aid](#) in case of an emergency.
- 10.3 The permit required confined space work team shall have at least one person who is trained in CPR. This person must remain outside the space and be immediately available.

## 11. SPECIAL REQUIREMENTS FOR PERMIT REQUIRED CONFINED SPACE OPERATIONS

- 11.1 If the concentration of flammables or combustibles exceeds 20% of the LEL, entry into a confined space shall "NOT" be made and existing operations shall be terminated if this condition occurs during the entry. Workers shall leave the space immediately. Approved ventilation shall be used to lower the concentration to 10% LEL and the source eliminated.
- 11.2 Sources of ignition are prohibited within the confined space, except where hot work is required. A separate Hot Work Permit, **EHS-00029-F1**, is required whenever the use of flame, arc, or spark, such as welding or cutting, is necessary.
- 11.3 Whenever oxygen consuming equipment, such as torches, are used, or welding is performed, adequate local exhaust venting shall be provided.
- 11.4 When required, the attendant, as well as the employee in the space, shall be equipped with appropriate respiratory protective apparatus, including an independent source of breathing air. The equipment must be available for immediate use.
- 11.5 Periodic testing of air in confined spaces shall be performed with sufficient frequency to assure that dangerous air contaminants and/or oxygen deficiency (or excess) does not occur during confined space operations.

## 12. TRAINING

- 12.1 Authorized Entrants, Attendants, Entry Supervisors, and individuals with rescue and emergency services must receive formal training concerning their roles and responsibilities. Formal training ensures that they have acquired the understanding, knowledge, and skills necessary to perform their assigned duties. Training for each authorized person is provided:
- Before personnel are assigned duties outlined in this plan,
  - When their assigned duties change, and/or
  - When there is a change in a permit space that creates hazards of which affected personnel have not been informed.
- 12.2 Each Authorized Entrant, Attendant and Entry Supervisor receives refresher training annually in confined space entry procedures. ERT members shall also receive annual training on the use, care, maintenance, and inspection of the Personal Fall Arrest System.
- 12.3 Training records are maintained by the EHS Department and Entry Company.

## 13. RESCUE AND EMERGENCY SERVICES

- 13.1 Contractors are responsible for providing rescue and emergency services and equipment for its employees' confined space entry work that meets regulations such as in the OSHA 1910.146.
- 13.2 ERTs will provide rescue and emergency services for NY CREATES and tenant confined space entries contingent on a 10 (ten) day advance notification, duration of the work and availability of ERT staffing. Work Permits must be submitted within this timeframe or if sooner, proof of advance notification and scheduling must accompany the Work Permit.
- 13.3 A method of communication such as telephone or radio must be in place between the Attendant and Entry Supervisor during a permit confined space entry. If multiple confined space entries are performed, sufficient emergency personnel must be available to perform simultaneous rescues at each entry location.
- 13.4 Requests for rescue and emergency services must be made by telephone or two-way radio directly to the Entry Supervisor. The Entry Supervisor will then contact Security at X78600 or 518-437-8600, who will dispatch the ERT for assistance.

- 13.5 In accordance with OSHA regulations (29 CFR 1910.146), an emergency rescue drill, including emergency responders and authorized personnel, will be performed annually.
- 13.6 During the annual training drill, the ERT are evaluated in terms of proficiency with rescue-related tasks and equipment, and whether they function appropriately while rescuing entrants from a permit-required confined space.

## 14. CONTRACTOR ENTRY COORDINATION

- 14.1 Permit-required confined space entries, which may involve Authorized Entrants from more than one contractor must be coordinated with NY CREATES EHS and ERT. The ERT / EHS and Entry Supervisor(s) will review the hazards of the work to be performed by all Authorized Entrants, and ensure that the activities of one contractor or sub-contractor do not endanger employees of another.
- 14.2 A pre-walk of the work location should be conducted at least 7 days prior to the date of the lift. ERT, EHS, and all other effected departments shall be notified via a calendar meeting invite.
- 14.3 The Work Sponsor is the responsible for ensuring that the permit is completed prior to the start of work, a pre-walk of the work location is conducted (unless EHS approves in writing that a walk is not required), and that the Contractor and the Operator follow all procedures and that the equipment listed on the relevant permits is used on the day(s) the work is performed. Any changes in equipment must be reviewed by EHS.
- 14.4 Prior to the work being scheduled, the site project coordinator or work sponsor will:
- Inform the contractor that the workplace contains permit-required confined spaces and that entry into such spaces is allowed only through compliance with a Confined Space Entry Program meeting the requirements of 29 CFR 1910.146.
  - Review and approve the contractor's Confined Space Entry Program.
  - Ensure that contractor personnel have received the required confined space entry training as required by 29 CFR 1910.146.
  - Submit training certifications for both the entrant and attendant at the Work Permit Meeting, along with the Work Authorization Permit and Confined Space Permit.

- 14.5 Prior to entry or the work being performed, the site project coordinator or work sponsor or contractor must contact Security to dispatch ERT to ensure the contractor monitors the space prior to and during entry and completes a Confined Space Entry Permit form (**EHS-00007-F1**).
- The Confined Space Entry Permit (**EHS-00007-F1**) is posted at the work.

## 15. **APPENDIX**

**Appendix A** – Confined Space Sign

**Appendix B** – Procedure for Entering the Automated Material Handling System (AMHS) Confined Spaces

### Appendix A –Confined Space Sign

After ERT / EHS signs off on the Confined Space Permit, if there is not currently a sign at the space, they will issue this sign (signed and dated by ERT / EHS) to be posted in the area of the work. Upon completion of the work, the contractor or supervisor will either return this sign to the ERT / EHS. This will notify ERT / EHS that the work is complete, and the time will be noted on the permit.



## APPENDIX B

### Procedure for Entering the Automated Material Handling System (AMHS) Confined Spaces

The AMHS system by Muratec is an automated overhead track system that moves wafers between the NFN and NFX Fabs using rail mounted vehicles (robots) to carry the FOUPs. This area is a permit required confined space due to the fall hazard, mechanical hazards, and electrical hazards. Under normal conditions, there are no atmospheric hazards in this space. This document describes the specific hazards and procedures for entering these confined spaces to access the AMHS.

#### B1 DEFINITIONS

- B1.1 **Air Doors** - Air doors open to allow robots carrying wafers to access out of and into the NFN and NFX cleanroom. There are two sets of air doors in NFN Tunnel and two sets in NFX (Figure 1).



**Figure 1.** Air Doors

- B1.2 **Air Door Controller:** Used to control and reset the air doors. Located in the NFN tunnel right of entry door along the wall (Figure 2).



**Figure 2.** Air Door Controller

### B1.3

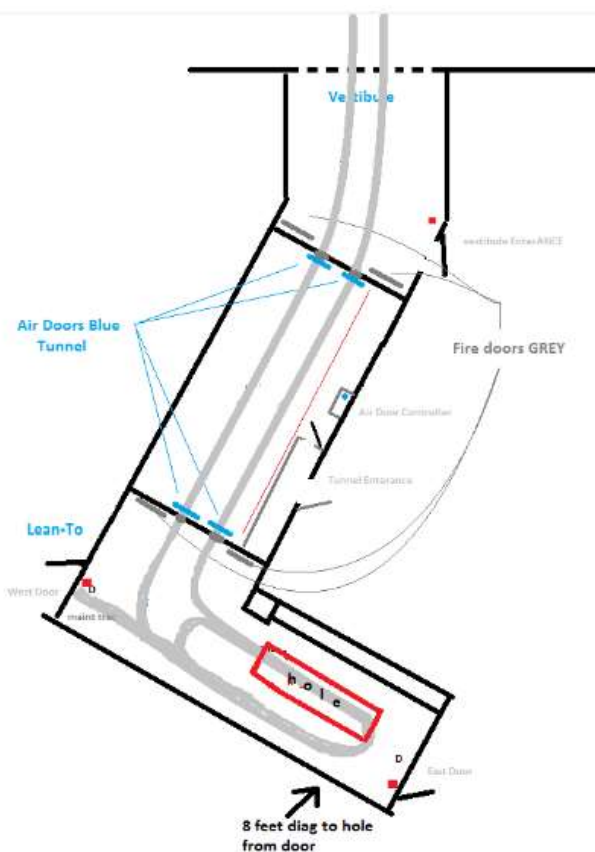
**Automated Material Handling System (AMHS)** – An automated overhead track system (Muratec) with robot vehicles that carry FOUPs to and from the NFN and NFX Fabs by crossing into “dirty” spaces via the NFN-NFX link. For working on the AMHS in NFX, electrical and mechanical hazard must be mitigated, and an elevated work platform or ladder must be used since the ceiling tiles are not rated to support an employee’s weight.

In NFN, the AMHS has three separate accessible areas, each with its own hazards (See Figure 3):

- **Lean-To:** Opens down to the cleanroom stocker via an opening in the floor with a 16’ drop. Accessible through two access doors (east and west) on NFN 3<sup>rd</sup> floor near freight elevator. A key is needed for lean-to access. Fire doors are located between the Lean-to and tunnel area.
  - **Hazards:** Fall hazard into stocker, mechanical hazard (e.g., pinch points, getting struck by robot), electrical hazard
  - **Required PPE:** Fall protection gear, hard hats, safety glasses.



- **Tunnel:** Located between the lean-to and vestibule, this area allows access to the air doors in NFN and contains the air door controller. The tunnel is accessed from the NFN roof and is located next to the 3<sup>rd</sup> floor freight elevator in NFN. The rooftop is accessed on the 3<sup>rd</sup> floor north wall, east of the elevator. A key is needed for roof and room access.
  - Hazards: Mechanical, electrical
  - Required PPE: Hard hats, safety glasses
- **Vestibule:** Area where the FOUP-carrying robots enter from the NFN-NFX link. Fire doors are located between the vestibule and tunnel area. The vestibule is accessed through the vestibule exterior door via the roof from the 3<sup>rd</sup> floor of NFN (next to Lean-to East door). A key is needed for access.
  - Hazards: Fall when working 6 feet from the link opening, mechanical, electrical hazard
  - Required PPE: Fall restraint system when working 6 feet from the opening, hard hats, safety glasses.

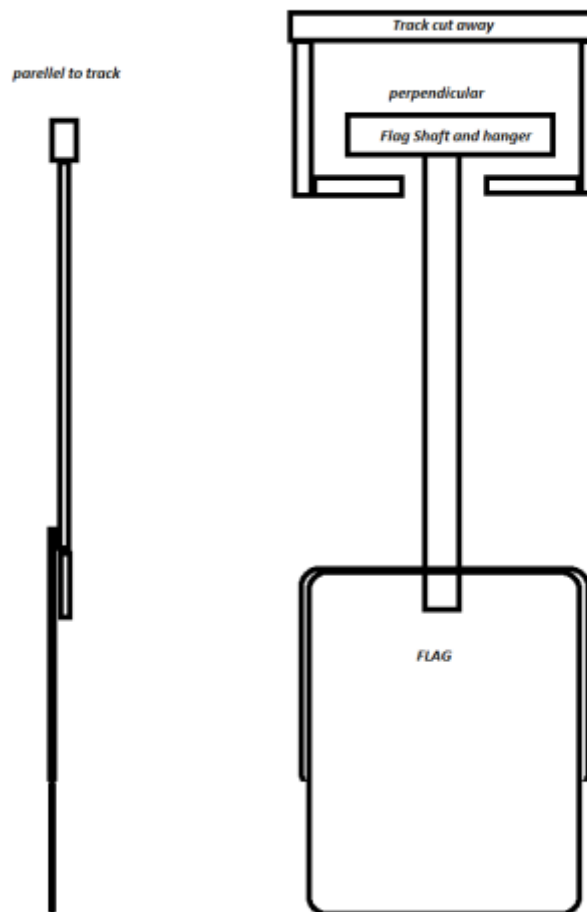


**Figure 3.** NFN AMHS Space - North side of NFN 3<sup>rd</sup> floor

B1.4 **Automation Stop Flags:** Used as safety devices to prevent workers from being struck by the robot and should be installed in front of and behind area to be worked (Figure 4). They are stored in NFX and in the Tunnel when not in use.

The flags are installed by:

- Lift Flag
- Rotate it parallel to the track.
- Insert top into track inner space.
- Rotate perpendicular.
- Drop into the track.
- Leave there for duration of needed work.



**Figure 4.** Automation Stop Flag

- B1.5 **Fire Doors** – A door with a fire resistance rating to help reduce the spread of fire or smoke. Two sets of fire doors are located in NFN, and two sets of fire doors are located in NFX. Resetting the fire doors require fall protection in the NFX ceiling, safety glasses and hard hats. See Figures 5 and 6, below.



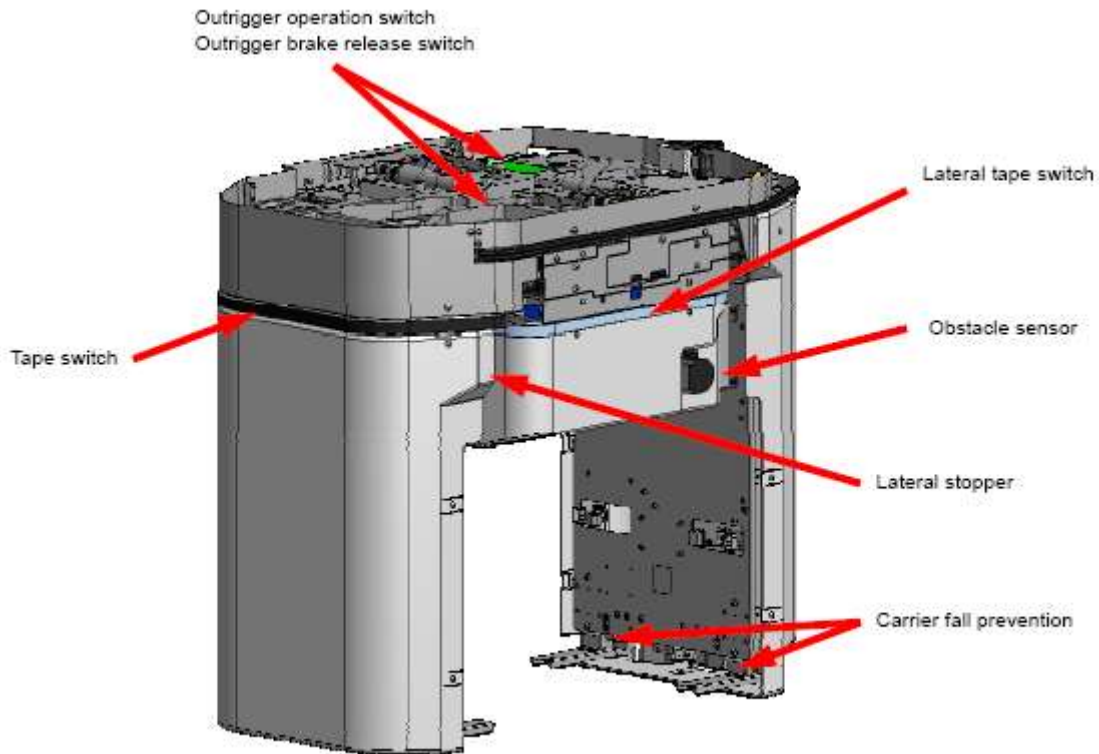
**Figure 5.** Fire Doors in NFX Link Area



**Figure 6.** Fire Doors in NFN Tunnel Area

- B1.6 **Graphical User Interface - (GUI):** This is the Murata computer interface that posts Alarms, monitor track status, and can reset most Murata software systems. Operators and maintenance use this for feedback on track system status. The locations for these terminals are at the stockers: GTA02, CTA01, CNA10, and GNA01.

- B1.7 **Robot / Vehicles** – Automated carriers that hold MACs / FOUPs at times containing wafers and transport them along a track system between NFN and NFX Fabs (Figure 7).



**Figure 7.** Robot or OHV (bump and proximity sensors)

## B2. PROCEDURE TO OBTAIN ACCESS TO NFN AMHS CONFINED SPACES

- B2.1 IBM or Equipment support EST and Murata FSE to notify each other of the need to access the NFN AMHS. IBM or EST will assist Murata FSE with AMHS maintenance / recovery activity. Buddy system to be used and posted signage observed.
- B2.2 Go to Security Officer at NFE Security Control Center and request the “AMHS Murata Confined Space Key Sign-out Sheet” (see last page of this Appendix).
- B2.3 If the activities to be performed are listed on that sheet, complete the information required on the sheet (Date, Name, which activity you are performing that is listed by number and time the key is signed out). Sign the key out and proceed to the AMHS access door.

- B2.4 If the activity you intend to perform is NOT listed on the “AMHS Murata Confined Space Key Sign-out Sheet” **STOP**; more work must be completed to proceed:
- B2.4.1 The Confined Space Permit must be submitted along with the Work Authorization Permit to the morning permit meetings 3 days prior to the work being performed (refer to **CFM-00004** for full details).
- B2.4.2 The requestor (e.g., Murata, EST) must fill out the Confined Space Entry Permit (**EHS-00007-F1**) submit the completed permit to the NY CREATES Permit Box in CESTM.
- B2.5 Before the work commences, go to Security to sign out the access key for the NFN Lean-To, NFN Vestibule, NFN Tunnel and NFN roof door, and ask Security to dispatch ERT / EHS to the Confined Space to meet the requestor and review the Permit.
- B2.6 Requestor and ERT / EHS will proceed to the NFN tunnel to review confined space procedure and safety requirements prior to accessing area. Once safety requirements are met, ERT/EHS will sign the permit and the requestor may proceed with work. Safety requirements include, but are not limited to:
- Locking out and tagging out electrical system
  - Installing automation stop flags.
  - Wearing hard hats, safety glasses, and fall protection equipment where required (always in the Lean-to; and 6 feet from opening in Vestibule).
- B2.7 Once completed with task, wipe down and HEPA-vacuum area of work.
- B2.8 Return Murata NFN Vestibule, Lean-To, Tunnel and Roof access keys to NY CREATES Security Control Center when work is completed in these spaces.

## B3. SPECIFIC TASKS & PROCEDURES

Due to mechanical, electrical, and fall hazards, the AMHS NFN Tunnel, Vestibule, and Lean-to areas have been identified as permit-required confined spaces. However, for the following tasks, the Tunnel will be reclassified as a non-permit confined space once the hazards have been mitigated by personnel (e.g., Murata Service Engineers and ESTs) who have been trained to work with the Murata AMHS for the tasks identified in this document.

Any maintenance or activities performed beyond what is described below (e.g., that require approaching robots or working on live electrical or mechanical items on the track/robot system) should be performed by trained Murata personnel who must adhere to the safety requirements located in the vendor safety procedures and manuals.

### B3.1 Air Door and Stranded Robot Recoveries

#### TUNNEL

The NFN Tunnel contains electrical and mechanical hazards if in proximity to the track. These hazards are mitigated by prohibiting the employee within 3 feet of the track (stay outside the taped area). The long-term solution is to have a proximity sensor/light curtain type device that will shut down the track if it senses anything in proximity. For recovering air doors or robot, the worker should not have to cross into the path of the robot. If crossing or working in the path of the robot is required, then automation stop flags should be installed.

**LEAN-TO:** Fall protection is always required when entering this space.

**VESTIBULE:** If one enters within 6 feet of the opening to the link area below, fall protection is required.

- B3.1.1 Get appropriate EST personnel guide traffic around work and tooling as needed.
- B3.1.2 Obtain a trained assistant (attendant), and the AMHS remote control pendant from NFN stocker control room or stocker in NFX cleanroom.
- B3.1.3 Using the GUI, identify the locations of robots on the track and idle the robots in place.
- B3.1.4 Follow procedure in Section 2 to obtain the key from Security and with a hardhat and safety glasses, access appropriate door.
- B3.1.5 Enter a few feet and look for the stranded robot or air doors. Do not cross into the track pathway staying at least 3 feet away from the track.

- B3.1.6 To recover the robot:
- 1) Locate the robots. If they need to be moved in order to reset the door, point the remote-control pendant, and input the correct sequence to enable communication, move the robot, and/or reset the robot / system, if required.
  - 2) If the robot will not reset with the pendant, try resetting the controller.
  - 3) If the robot is still down, put the track down, lock the area, and call Murata Service.
- B3.1.7 To reset the air doors, determine if the door is past the outer stop limit sensor. If so, the door must be manually raised to the other side of the sensor.
- B3.1.7.1 Set the door in manual by:
- 1) Opening the door to the Door Controller panel.
  - 2) Placing the door in manual.
  - 3) Raising the door up past the sensors.
  - 4) If that does not work, cycle the door breaker, repeat the last 2 steps.
- B3.1.8 If the problem is not fixed, try resetting the controller and re-try the above. If the problem still cannot be fixed, leave system down and call Murata Service.
- B3.1.9 Once the door is reset and/or the robot has been recovered, return the system to normal, close the panel, lock the outer Tunnel door, and return the key to Security in NFE. Set the door in automatic and home after recovery of position error.

## B3.2 Fire Door Recoveries – Vestibule and Lean-To

**LEAN-TO:** Fall protection is always required when entering this space.

**VESTSIBULE:** If one enters within 6 feet of the opening to the link area below, fall protection is required.

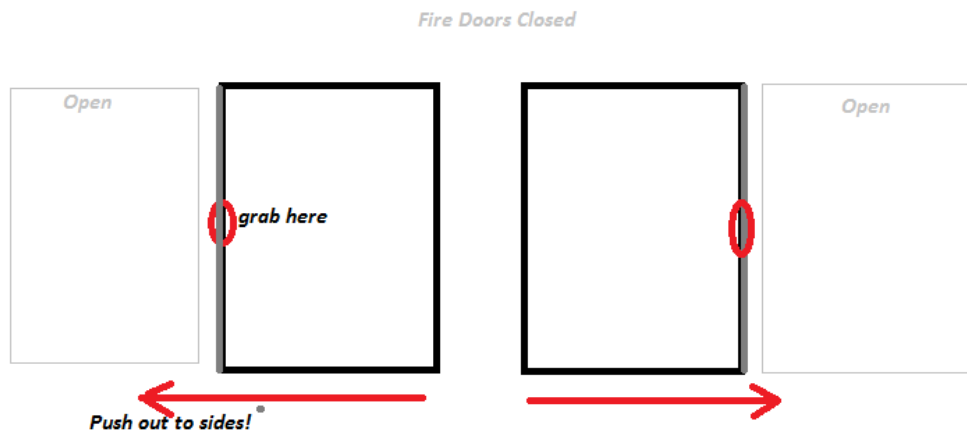
Fire doors will close for 3 reasons: Fire, Test, and Mechanical Failure. When the fire doors are closed, the tool is unable to operate robots into this area, however, there may be a robot stopped in this space. Flags can be used to stop the robots from passing into this area while resetting the fire doors if the track was to be reset before the work is done. These flags are also good indicators to others that work is being done on parts of the system.

Fire Doors can be reset with power on or off. To place hands on the fire doors to move it, one will need to kneel due to the space height. Appropriate EST personnel should assist and guide traffic around work and tooling, as needed.

**NOTE:** Fire safety systems should only be reset once the cause of the issue is discovered and resolved.

- 1) Obtain 1 Attendant (EST).
- 2) Obtain the keys to the door from Security following procedure in Section 2.
- 3) Enter space with hard hat, safety glasses, and fall protection. The attendant should be positioned at the door and maintain communication with the entrant.
- 4) Approach fire door and place hand on central part of fire door's outer edge (Figure 8).
- 5) Slide each of the doors to the outside until the magnets grab the door again.
- 6) Once both doors are reset, leave the space, **and** close and lock the door.
- 7) Restart the AMHS and clear errors if any.

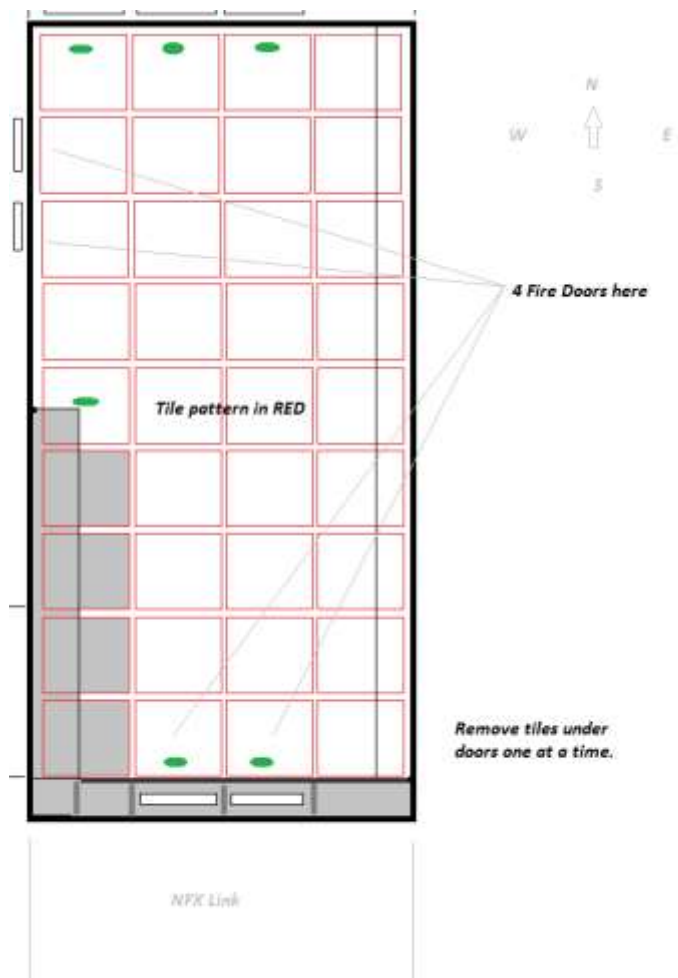




**Figure 8.** Fire Doors

## **B4. PROCEDURE TO OBTAIN ACCESS TO NFX AMHS DROP CEILING**

- B4.1** The NFX side of the AMHS unit is not a permit required confined space. However, safety and notification procedures must still be followed due to the mechanical and electrical hazards of the overhead track units, use of ladders or elevated work platforms used to remove ceiling tiles to access the AMHS unit, and potential for equipment or tools falling on items / personnel below (Figure 9).
- B4.2** IBM EST and/or Murata FSE to notify each other of the need to access the NFX AMHS blocked in ceiling area at the entry to NFX. IBM or EST will assist Murata FSE with AMHS maintenance / recovery activity. Buddy system to be used and observe posted signage. The area will need barricades or traffic managers with the ceiling open and workers on ladders or elevated work platforms.



**Figure 9.** NFX Drop Ceiling

## **B5. RESETTING FIRE DOORS - NFX CEILING PROCEDURES**

Fire doors will close for 3 reasons: Fire, Test, or mechanical failure. Due to the mechanical, electrical, and fall hazards identified, hazards must be mitigated by following these procedures. Doors can be reset with track power on or off. Resetting the fire doors is a mechanical operation which does not require going fully above the tiles. If going above the tiles, fall protection is required. An 8-foot ladder is needed to remove or move tiles. To place hands on the fire doors, a 10-foot ladder is recommended.

Any maintenance or activities performed beyond what is below (e.g., that require approaching robots or working on live electrical or mechanical items on the track/robot system) must be performed by trained Murata personnel who must adhere to the safety requirements located in the vendor safety procedures and manuals.

When the fire doors close (due to error or alarms), the tool is unable to operate robots into this area; however, there may be a robot stopped above this space. Automation stop flags can be used to stop the robots from passing into this area while resetting the fire doors if the track is reset before the work is done. These flags are also good indicators to others that work is being done on parts of the system.

- 1) Get appropriate EST personnel to help assist you and guide traffic around ladders and [openings](#).
- 2) Remove the ceiling tile under the fire door to be reset (Figures 10 and 11).
- 3) Place [a hand](#) on central part of fire door's outer edge.
- 4) Slide [the door](#) to the outside until the magnets grab the door again.
- 5) Once all 4 doors are reset, replace ceiling tiles, and restart the AMHS.
- 6) Fire safety systems should only be reset once the cause of the issue is discovered and resolved.



Figures 10 & 11. NFX Link Fire Door Set- Ceiling Tiles Removed

## **B6. MANUALLY RESET THE OVERHEAD GUIDED VEHICLES (ROBOTS) – NFX CEILING PROCEDURES**

- 1) Obtain 1 Assistant (EST).
- 2) Obtain a ladder.
- 3) Cordon off area around tile to be lifted.
- 4) The assistant should monitor the area before the tiles are removed.

- 5) Remove the ceiling tile under the stranded robot.
- 6) Once the robot is spotted, point the remote-control pendant, and input the correct sequence to enable communication and reset the robot/system.
- 7) If the problem is fixed, replace the tiles, leave the area.
- 8) If the problem is not fixed, try resetting the controller. If the problem still cannot be fixed, leave the system down and call Murata.

## **B7. TRAINING**

- B7.1 Prior to entering these spaces to perform any of these tasks, the employee must be trained on the hazards of this space and these procedures.
- B7.2 Employees entering these spaces to perform any of these tasks must have confined space entry training, fall protection training, and electrical safety / LOTO training.
- B7.3 Refresher training should be taken annually or if an employee is observed to be in non-compliance with the procedures.

### AMHS Murata Confined Space Key Sign-out Sheet

The key to access the AMHS can be signed out without a confined space permit to individuals who have been trained for the following activities listed in **EHS-00007 – Confined Space Entry Procedures, Appendix B - Procedure for Entering the Automated Material Handling System (AMHS) Confined Spaces:**

- 1. Air Door Recoveries in **NFN Tunnel**
- 2. Stranded Robot Recoveries in **NFN Tunnel**
- 3. Stranded Robot Recoveries in **NFN Vestibule**
- 4. Stranded Robot Recoveries in **NFN Lean-to**
- 5. Fire Door Recoveries in **Vestibule**
- 6. Fire Door Recoveries in **Lean-to**

For any other activities not listed above, a Confined Space Entry Permit will need to be completed and ERT / EHS called.

Date	Name	Activity	Key Out Time	Key Return Time