

Target Insert loading/unloading with/without target material Procedure

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Revisions

Revision Date	January 17, 2024
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Changes in this revision	1. Specify how much pressure in the fridge is needed in step 14 and step 13 in loading and unloading procedure
Changes in previous revision	2. Added two ammonia-related training in the training requirements 3. Reworded the evacuation plan in case of building power outage
V25	1. Changed the wait time from 3 minutes to 1-2 minutes in the evacuation plan in NM3 target cave 2. Altered the order of the steps to address the two-person rule concern. 3. Added steps to notify Fire Department. 4. Replaced “swing pulley” with “jib crane”
Changes in v18	1. Added one sentence to address power outage in the evacuation and rescue plan
Changes in v17	1. Edited Section: Loading target Insert Step 5 and 20 to addressed to put a sign that says, “Target cave work in progress, DO NOT turn off”. 2. Edited Section: Unloading target Insert Step 1 and 19 to addressed to put a sign that says, “Target cave work in progress, DO NOT turn off”. 3. Added a verification step after entering NM3 before conducting the work.

Condition

- The target fridge should be no more than 50% full on nose level probe.
- ROOTS gate valve should be closed, the gate valve bypass should also be closed.
- The fridge pressure should be slightly above atmospheric pressure with a small backfill pressure flowing – backflow valve opens with back fill helium gas bottle regulator PRV-410-HE set to less than 1 psi.
- The operation fridge relief (CV-104-HE) is set to 0.5 psi.
- For loading the insert, the target insert should be prepared using procedure SEAQUEST-10411
- The portable handheld dewar is filled with 10L of LN2 following the procedure SEAQUEST-10358
- The work is carried out at the target prep area in NM4, and the target cave in NM3.

- The work is carried out by two workers, denoted as person A and person B.
- There is an active ODH and ammonia alarm and sensor system in the cave. When there is an alarm, you will hear a high-pitched siren and there will be a color indicator red (ODH), blue (ammonia).
- At least one person A or B must be trained by the target group and determined to be qualified by the target group leader in order to perform the procedure.

Training requirements

1. General Employee Radiation Training (GERT: FN000241)
2. Radworker Classroom (FN000470)
3. Radworker Practical Factors (FN000471)
4. Controlled Access (FN000311)
5. Cryogenic Safety (FN000115)
6. ODH training [FN000029/CR/02]
7. Crane Operator Training (FN000005/CR/EV/OJ)
8. NM4 Experimental Enclosure Hazard Awareness Training (PDNM4001)
9. Ladder User Safety Training (FN000654)
10. SpinQuest Ammonia Target Handling [FN000761/RR/01]
11. SpinQuest Ammonia Target Handling On the Job Training [FN000762/OJ/01]

Equipment and tools

Equipment:

- Target insert
- Target insert eyebolt (see Fig. 3)
- Target insert transfer rack (see Fig. 1)
- Target insert transfer dewar (see Fig. 2)
- Target insert transfer dewar holder (see Fig. 2)
- Portable handheld dewar with LN2
- Escape pack (OCENCO EEBD) (Request this at MCR prior to accessing NM3)

Tools:

- Wrench

PPE:

- Cryo-gloves
- Vented chemical goggles.
- Tyvek lab coats
- Face-shield (only needed for Person A during the process of adding LN2 to the transfer dewar)
- Closed-toe non-permeable shoes, and long pants.

Evacuation and Rescue plan:

Scenario 1: ODH audio alarm (and red warning light)

Both workers should immediately leave the equipment in the immediate work area, evacuate the experiment hall.

If an ODH alarm goes off in the middle of the job, then communicate and immediately leave the target cave NM3 and NM4 (exit the NM3 door dropping the interlock in the controlled access, and leave the door open), and call x3131.

Scenario 2: Ammonia audio alarm (with blue warning light), or ammonia spillage

Both workers should immediately leave the equipment in the immediate work area. The worker(s) not in the target cave should immediately evacuate the experiment hall. The worker(s) in the target cave should deploy the escape pack, stay in the target cave and wait for 1-2 minutes before leaving the target cave (exit NM3 dropping the interlock in the controlled access, and leave the door open), and evacuate from the experiment hall.

If the alarm occurs while one person is in the cave and one person is in the NM3 floor, then the person on the floor should move to the east side (stand near the NM3/NM4 gate), and wait until the person in the target cave is able to exit NM3 and NM4 (exit NM3 dropping the interlock in the controlled access, and leave the door open), evacuating from the experiment hall.

After evacuation, call x3131.

Scenario 3: Ammonia spillage during the transportation.

Both workers should immediately leave the equipment on the the immediate work area. Evacuate from the experiment hall by dropping the interlock and leaving the door(s) open. After evacuation, call x3131.

Scenario 4: Building Power Outage

In case of power outage, the workers should immediately stop the work, leave the equipment in the immediate work area, and evacuate the building. Then call ext. 3131 from a Fermilab phone or 630-840-3131 from a cell phone to report the event and the state of anhydrous ammonia and liquid nitrogen in NM4.

Procedure

Loading the target insert (start at the target prep area in NM4)

1. Notify the Fire Department when work is occurring in NM3 with dates activities will occur, SpinQuest contact, and primary hazards associated with the work.
2. Go to cryo-platform to open PRV-410-He to slightly less than 1psi, and open MV-402 to establish Helium gas pressure at the backfill panel.

3. Change the Target Cave ODH fan control from “AUTO” to “ON” before entering NM3. Put a configuration lock and a sign that says “Target cave work in progress, DO NOT turn off” to the control knob cage.
4. (Person A) Fill the blue transfer dewar with LN2. (**Hazard: cryogenic, Mitigation: Person A is wearing Tyvek coat, long pants, cryo-gloves and face-shield, Person B stays away from the work area**). After that the face shield should be removed.
5. (Person A) Put the target insert material end into the blue transfer dewar and hold it, while person B affix the collar around target insert in the wheeled rack and installs the blue transfer dewar holder and locks it.
6. (Person A) Move the target insert together with the fixtures to the insert transfer rack. Ensure the target insert handle is installed on the top of the target insert.
7. Move the target rack from the target prep area in NM4 to the NM3 in front of the target cave.
8. Check that both the curtain and ducted fans come on. Do not proceed with the rest of the procedure if one or more fans are not running.
9. In the event of an ammonia spill in the cave, persons A and B must promptly don the OCENCO EEBD Escape Pack. Each person should remain inside the cave, breathing with the escape pack, while the ventilation system mitigates the ammonia hazard. Waits for 1-2 minutes and then proceed to evacuate the cave. (**Hazard: ammonia spill, Mitigation: use escape pack**)
10. (Person A) Move the jib crane out of the target cave and lower it to the floor.
11. (Person B) Remove the insert from the transfer track, attach the insert handle eyebolt to the jib crane, hold the insert until person A starts pulling, then move away from the insert/dewar about 3 meters while its being lifted overhead.
12. (Person A) Keep pulling the insert into the target cave, and hold the target insert. (**Hazard: cryogen spillage, Mitigation: person B stays far away from the insert**)
13. After the insert is pulled into the cave, person B should go to the cave to assist person A.
14. (Person B) Open the valves on the backfill panel and check the manual pressure gauge in the backfill panel to make sure fridge pressure is about 1 psi above atmosphere and confirm slight flow from the check valve CV-104-HE.
15. (Person B) Open the fridge laddish clamp and remove the blank laddish flange.
16. (Person A) Move the target insert to slightly above the fridge so that person B can disconnect the blue transfer dewar and move it to the side.
17. (Person A) Lower the insert into the fridge until it is fully in place.
18. (Person B) Install the laddish clamp and affix.
19. (Person B) Close the valves on the back fill panel.
20. Connect microwave waveguide, NMR lines, and other electronic sensors.
21. (Person A) Attach the jib crane to the handle of the blue transfer dewar, and carefully lower it to the NM3 floor. (**Hazard: cryogen spillage, Mitigation: both workers stay in the target cave**)
22. (Person A) Hand-carry the blue transfer dewar from NM3 back to NM4 target prep area against the HVAC, and let the LN2 evaporate.
23. (Person B) Move transfer rack from NM3 back to the NM4 target prep area.
24. Go to cryo-platform to close MV-402 and PRV-410-He.

25. Remove the configuration lock and the sign on the control knob cage. Change the Target Cave ODH fan control from “ON” to “AUTO”.
26. Notify Fire Department after the procedure is completed.

Unloading the target insert (start in the target cave at NM3)

1. Notify the Fire Department when work is occurring in NM3 with dates activities will occur, SpinQuest contact, and primary hazards associated with the work.
2. Go to cryo-platform to open PRV-410-He to slightly less than 1psi, and open MV-402 to establish Helium gas pressure at the backfill panel.
3. Change the Target Cave ODH fan control from “AUTO” to “ON” before entering NM3. Put a configuration lock and a sign that says “Target cave work in progress, DO NOT turn off” to the control knob cage.
4. Check that both the curtain and ducted fans come on. Do not proceed with the rest of the procedure if one or more fans are not running.
5. In the event of an ammonia spill in the cave, persons A and B must promptly don the OCENCO EEED Escape Pack. Each person should remain inside the cave, breathing with the escape pack, while the ventilation system mitigates the ammonia hazard. Waits for 1-2 minutes and then proceed to evacuate the cave. (**Hazard: ammonia spill, Mitigation: use escape pack**)
6. (Person A) Fill the blue transfer dewar with LN₂ and bring all equipment to NM3 (**Hazard: cryogenic, Mitigation: Person A is wearing Tyvek coat, long pants, cryo-gloves and face-shield, Person B stays away from the work area**). After that the face shield should be removed.
7. (Person A) Climb to the target cave. Move the jib crane out of the target cave and lower it to the floor.
8. (Person B) Attach the handle of the blue transfer dewar to the job crane, hold the dewar until person A starts pulling, then move away from the dewar about 3 meters while its being lifted overhead.
9. (Person A) Keep pulling the blue transfer dewar into the target cave, and hold the dewar. (**Hazard: cryogen spillage, Mitigation: person B stays far away from the dewar**)
10. After the blue transfer dewar is pulled into the cave, person B should go to the cave to assist person A.
11. (Person A and B) Disconnect microwave waveguides, NMR lines, and other electrical connections.
12. (Person A) Attach the eyebolt to the insert and connect the jib crane to the eyebolt.
13. (Person B) Open the valves on the backfill panel and check the manual pressure gauge in the backfill panel to make sure fridge pressure is about 1 psi above atmosphere and confirm slight flow from the check valve CV-104-HE.
14. (Person B) Open the laddish flange clamp and take off the flange.
15. (Person A) Slowly pull the insert out of the fridge using the jib crane system, guide with hand if necessary.
16. (Person A) Once the insert is fully out, quickly put the material end into the blue transfer dewar.
17. (Person B) Put the laddish flange and clamp back on the fridge.

18. (Person B) Close the valves on the backfill panel.
19. (Person B) Attach the dewar holder to the insert.
20. (Person B) Climb out of the cave to the floor, but stay away from the area about 3 meters where target insert is hanging above.
21. (Person A) Lower the target insert from the cave to the floor. (**Hazard: cryogen spillage, Mitigation: person B stays far away from the insert**)
22. (Person B) Detach the jib crane and move the target insert to the transfer rack.
23. (Person A) Pull the jib crane up, then leave the target cave to join Person B.
24. (Person A) Move the target insert rack from NM3 to the target prep area in NM4.
25. (Person B) Hand-carry the blue transfer dewar to the target prep area against the HVAC, and let the LN2 evaporate.
26. Go to cryo-platform to close MV-402 and PRV-410-He.
27. Remove the configuration lock and the sign on the control knob cage. Change the Target Cave ODH fan control from “ON” to “AUTO” after leaving NM3.
28. Notify Fire Department after the procedure is completed.

Attachment



Figure 1 Target insert on the target transfer rack, the bottom of the target insert is in the transfer dewar with the dewar holder attached.



Figure 2 Target transfer dewar attached to the target insert using the dewar holder.



Figure 3 Target insert with the eyebolt attached.