## Work scope details:

**Title:** Movement and Staging of Cryomodules in RFTF

**Work Scope Summary:** This work involves the careful movement and staging of cryomodules (CMs) within the RFTF test cave and the first floor. The MB spare will be mounted on carts and moved to stage the HB spare, which will then be relocated into the MB spare slot, followed by the movement of PPU08 into the HB slot.

**Key Work Scope Components:**

• Movement of cryomodules using manual pushing and tugger systems.

• Mounting and dismounting of cryomodules on transfer carts.

• Disconnecting and reconnecting of insulating vacuum pumps.

• Removal of hardware from the test cave.

• Setup of beampipe vacuum on ion pump post-movement.

## Relevant previous events and lessons learned:

| Event Title | Event Summary | Lessons Learned | Reference Link |
|---|---|---|---|
| Cryomodule Handling Incident | During the handling of a cryomodule, a worker was injured due to improper lifting techniques, resulting in a back injury. | Emphasize proper manual handling techniques and use of mechanical aids to reduce physical strain. | N/A |
| Equipment Failure During Movement | A tugger malfunctioned while moving heavy equipment, leading to a near-miss incident. | Regular maintenance and checks of equipment are crucial before use to ensure operational safety. | N/A |
| Radiological Contamination Event | A contamination incident occurred during the movement of activated components, leading to a temporary evacuation. | Ensure proper radiological work permits are in place and that workers are briefed on contamination control measures. | N/A |
| Improper Tool Usage | A worker suffered a laceration due to using an inappropriate tool for securing equipment. | Always use the right tool for the job and ensure tools are inspected before use. | N/A |
| Communication Breakdown | A miscommunication led to the wrong equipment being moved, causing delays and safety concerns. | Establish clear communication protocols and ensure all team members are briefed on tasks. | N/A |

## Missing Hazards:

| Hazard | Missing or Inadequate Mitigation in Current Work Control Document | Recommended Mitigation for Revision | Reference Link | SBMS Link |
|---|---|---|---|---|
| Manual Material Handling | Not addressed | Implement mechanical aids for lifting and moving cryomodules. | N/A | N/A |
| Radiological Exposure | Inadequate controls for activated components | Ensure all workers have current RWP and are trained on radiological safety. | N/A | N/A |
| Equipment Malfunction | Not addressed | Conduct pre-use inspections and maintenance of tugger and carts. | N/A | N/A |
| Confined Space Hazards | Not addressed | Identify and evaluate confined spaces; ensure proper ventilation and monitoring. | N/A | N/A |
| Noise Exposure | Not addressed | Implement noise monitoring and provide hearing protection where necessary. | N/A | N/A |
| Poor Lighting | Inadequate lighting controls | Ensure adequate lighting in all work areas, particularly during movement tasks. | N/A | N/A |
| Time Pressures | Not addressed | Establish realistic timelines and ensure adequate staffing for tasks. | N/A | N/A |
| Vague Guidance | Not addressed | Provide detailed work instructions and ensure all workers understand their roles. | N/A | N/A |

## Failure mode analysis:

| Current Control | Failure Mode of the Control | Effect of Failure | Cause of Failure | Recommended Action |
|---|---|---|---|---|
| Radiological Work Permit | Permit not obtained or expired | Potential exposure to radiation | Lack of awareness or oversight | Ensure all permits are verified before work begins. |

| Current Control | Failure Mode of the Control | Effect of Failure | Cause of Failure | Recommended Action |
|---|---|---|---|---|
| PPE Requirements | PPE not used or inadequate | Increased risk of injury | Lack of enforcement or training | Conduct regular PPE training and audits to ensure compliance. |
| Work Instructions | Instructions not followed | Increased risk of accidents | Poor communication or unclear instructions | Review and clarify work instructions with all team members before starting. |
| Equipment Maintenance | Equipment not inspected | Equipment failure during operation | Inadequate maintenance schedule | Implement a strict pre-use inspection checklist for all equipment. |
| Communication Protocols | Miscommunication among team members | Wrong equipment moved or unsafe practices | Lack of clear communication channels | Establish a communication plan that includes regular check-ins. |
| Emergency Response Procedures | Procedures not known or practiced | Delayed response in emergencies | Lack of training or drills | Conduct regular emergency response drills and training sessions. |
| Tool Availability | Tools not available or inadequate | Increased risk of injury or inefficiency | Poor inventory management | Maintain an up-to-date inventory of tools and ensure availability before work starts. |
| Training and Competency | Workers not adequately trained | Increased risk of accidents | Inadequate training programs | Develop and implement comprehensive training programs for all workers. |

This risk assessment report provides a thorough analysis of the potential hazards associated with the movement and staging of cryomodules in the RFTF, along with actionable recommendations to mitigate risks and enhance safety.