

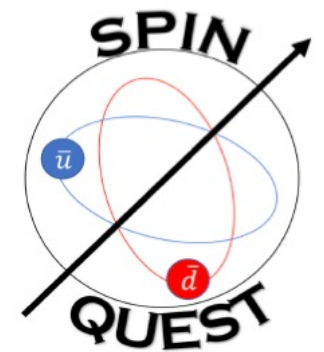
SpinQuest Polarized Target System: ORCs & HAs

SpinQuest Polarized Target group

02/06/2023



UNIVERSITY
of VIRGINIA



This work is supported by DOE contract DE-FG02-96ER40950

Main Resource

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Annual Site Environmental Reports
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ESH internal site

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Fermilab Environment, Safety and Health Manual (FESHM)

The Fermilab Environment, Safety and Health Manual (FESHM) is a living document that contains Fermilab's policies and procedures designed to manage environmental, safety and health (ES&H) hazards in accordance with the requirements set in the ES&H standards attached to the U. S. Department of Energy contract. These practices have been developed over many years at Fermilab and have been found to be both efficient and effective. Nevertheless the ES&H program is one of continuous improvement and comments and suggestions are always solicited.

External Access to FESHM Chapters

- + 1000. Policy and Administration
- + 2000. Planning For Safe Operations
- + 3000. Investigation and Reporting
- + 4000. Industrial Hygiene
- + 5000. Mechanical, Cryogenic and Structural Safety

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Related Links

- [Fermilab policies](#)
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How to submit an ORC

<https://fermipoint.fnal.gov/service/tsworc/SitePages/Home.aspx>

TSW No Beam Forms

Forms:

ID	Title	Created	Modified	Status
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TSW Beam Forms

Forms:

ID	Title	Created	Modified	Status
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How to submit an ORC

ORC-2055

Form status: Initial email sent



View Mode



Exit

ORC No Beam Title
olarized Target (summary for the final walkthrough)

ORC ID
ORC-2055

This ID field will be auto-populated with a Fermilab ID number.

<Info

Requester

Enter full name of the requester

Full Name
M. A. Ishara P. Fernando

Email
ishara@jlab.org

Fermi ID
41284V

ORC No beam Notes:

Empty text area for ORC No beam Notes.



How to submit an ORC

ORC-2055

Form status: Initial email sent



View Mode



Exit

Experiment

Describe the process, system and/or technology being reviewed

Description of Equipment to be Reviewed

This ORC is basically including the list of all the sub-systems ORCs related to the SpinQuest (E1039) experiment's polarized target system, and also the Superconducting magnet operation procedure, 30-Gauss boundary of the magnetic field as well.

Attachments

Attachments	Discussion Board	
30 Gauss-Boundary of the Magnetic Field.pdf	Discussion 0 posts, Last reply: (8/4/2022 12:11 PM)	
Addendum_for_ORC2055-E1039_Polarized_Target_Fridge.pdf	Discussion 0 posts, Last reply: (11/14/2022 11:16 PM)	
MagnetOperations.pdf	Discussion 0 posts, Last reply: (8/4/2022 12:11 PM)	
ORC2055-E1039_Polarized_Target_system_final_walkthrough.pdf	Discussion 0 posts, Last reply: (10/5/2022 2:55 PM)	
ORC2055-Responses-to-Recommendations.pdf	Discussion 0 posts, Last reply: (8/16/2022 12:01 AM)	
UTube_Transferline_new.pdf	Discussion 0 posts, Last reply: (8/15/2022 11:54 PM)	



How to submit an ORC

ORC-2055

Form status: Initial email sent



View Mode



Exit

Location

Please select the location of the equipment

Do you know where you set up ?

- I don't know
- No
- Yes

- ▼ PPD Locations
NM4,
- ▼ AD Locations
- ▼ CD Locations
- ▼ ND Locations
- ▼ TD Locations
- ▼ ESHQ Locations

Schedule

How to submit an ORC

ORC-2055

Form status: Initial email sent



View Mode



Exit

Reviewers Comments

Reviewers enter comments and photos here

5 posts, Last reply: M. A. Ishara P. Fernando (8/15/2022 11:58 PM)

08/10/2022 10:15:45 : William M. Soyars:

Update PID with UVa comments and corrections noted during installation. Update PID per panel comment to indicate that LHe supply to separator is u-tube connection. Currently, shown as simple line only. Check PID for other u-tubes that are inconsistently indicated.

08/10/2022 10:20:16 : William M. Soyars:

For magnet safety relief lines flex hose to rupture disk, one of the KF flange seals is reddish color while other seals are black. Check temperature compatibility of seals for these lines.

- a. Project engineering team needs to inspect system for other KF flange seals to confirm compatible temperatures if they can get cold.

Experiment respoused "The experiment is ensuring that cryogenic seals are used everywhere the cryogenic vapor is used. Aluminum knife edge EVAC seals will be used." Please confirm when this is done for equipment to be operated during next phase of commissioning

08/10/2022 10:27:47 : William M. Soyars:

For LHe flow to the separator vessel, the small Cryofab u-tube does not have relieving of insulating vacuum space in the event of internal leak and warming of gas. Currently, it has isolation valve and blanked off KF flange. Replace that setup with one that provides adequate relieving (for example, pump-out that cannot hold pressure)

- a. Project engineering team needs to inspect system for other utube installations to confirm they have adequate insulating vacuum relieving.

Project reports that they have "taken the steps to acquire a u-tube with SV-9 pump-out port (pump-out port is also functioning as an emergency relief valve)." Please confirm this is not needed for magnet commissioning operation.

Please provide results of other utube installation inspections.

08/10/2022 10:30:33 : William M. Soyars:

Cryo safety panel walkthrough did not consider magnet operation. Details for that should either be addressed in another ORC, or add another reviewer to comment on that.

08/15/2022 23:58:16 : M. A. Ishara P. Fernando:

Thanks for the recommendations. A single .pdf file addressing all the above concerns recommendations is attached along with the two additional .pdf files for the u-tube drawings (current one, and the revised one with relief as recommended from the committee). For the P&ID updates, Dustin has already contacted Grace.

[View Attachments](#)



How to submit an ORC

SharePoint

Organization Project Service Collaboration Experiment

BROWSE ITEMS LIST

TSW ORC HOME

All Items Bob ORC Approved Ishara

View	TSWID	Title	Beam	Requester	WF_Status	Created	Title
	ORC-2056.01	Edit: Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarized Target Magnet and Fridge Cooldown	... No		Approved	November 16, 2022	Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarize Cooldown
	ORC-2071	Edit: Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarized Target Magnet Power-up	... No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	October 5, 2022	Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarize
	ORC-2056	Edit: Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarized Target Magnet Cooldown	... No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	August 6, 2022	Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarize
	ORC-2049	Edit: E1039 Operation Readiness Clearance (ORC) of SpinQuest (E1039) Superconducting magnet electronics (in the target cave) at NM4	... No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	July 12, 2022	E1039 Operation Readiness Clearance (ORC) of SpinQuest (E1039) electronics (in the target cave) at NM4
	ORC-1888.01	Edit: E1039 Operational Readiness Clearance of the UVA-NMR system Part 2 (Commercial Components) at NM4	... No		Approved	March 23, 2022	E1039 Operational Readiness Clearance of the UVA-NMR system Par at NM4
	ORC-1888	Edit: E1039 Operational Readiness Clearance of the UVA-NMR system Part 2 (Commercial Components) at NM4	... No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	July 27, 2021	E1039 Operational Readiness Clearance of the UVA-NMR system Par at NM4
	ORC-1854	Edit: E1039 Operational Readiness Clearance of the UVA-NMR system Part 1	... No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	April 22, 2021	E1039 Operational Readiness Clearance of the UVA-NMR system Par NM4

ORC -Approved

EDIT LINKS

View in New Design

Exit classic experience

Addendums
Are relatively
Convenient!

How to submit an ORC

Important points:

1. When you have the first draft, then obtain feedback from Rick Tesarek or from the DSO.
2. If there are parts in the system that needs continuous modifications, then make sure to communicate that the ORC committee via the documents as well as verbally to ensure that you are not stopped when you really want to do those adjustments during operations.

Cryogenic ORCs

<https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=528>



ES&H DOCUMENT DATABASE

Environment, Safety and Health website: [public](#) | [internal](#)

ESH DocDB Document 528-v14

FESHM Chapter 5032: Cryogenic System Review FINAL

Document #: ESH-doc-528-v14
Document type: Manuals
Submitted by: Unknown
Updated by: Dave Skrivan
Document Created: 03 Aug 2009, 15:17
Contents Revised: 06 Jan 2020, 15:16
Metadata Revised: 13 Jun 2022, 11:47
Watch Document

Abstract:

APPROVED September 2018

Files in Document:

- [FESHM Chapter 5032: Cryogenic System Review pdf](#) (FESHM-5032_Dec-2019.pdf, 162.9 kB)

Other Files:

- [Approval Memo](#) (FESHM 5032 Approval Memo.pdf, 428.4 kB)
- [FESHM Chapter 5032: Cryogenic System Review docx](#) (FESHM-5032_Dec-2019.docx, 34.8 kB)

Get all files as [tar.gz](#), [zip](#).

Topics:

- [Fermilab ES&H Committee:Cryogenic Safety Subcommittee](#)

Authors:

- [William M. Soyars](#)

Keywords:

[FESHM 5032: Cryogenic System Review](#)

Referenced by:

- ESH-doc-1231: [FESHM Chapter 5032 Form: Failure Mode and Effect Analysis](#)
- ESH-doc-571: DRAFT - FESHM Chapter 5032: Cryogenic System Review

6.0 TECHNICAL APPENDICES

6.1 CRYOGENIC SAFETY ANALYSIS PROCEDURE

Documentation shall be prepared to demonstrate to the review panel that aspects of the system which could present a hazard to equipment or personnel have been examined. A Cooldown Recommendation Request Form should be completed to indicate to the Cryogenic Safety Panel (CSP) the scope of review; see Technical Appendix Section 6.5.

6.1.1. System Design Documents

- (1) A system equipment and operation description shall be prepared that will serve as an overview of the system for the review panel and as an introduction for the trainee.
- (2) Complete and accurate flow sheets shall be prepared. The final flow sheets must be signed off as checked and approved.
- (3) An active component list (instrument and valve summary), labeling and describing all active devices of the system shall be prepared. These devices would normally include valves, gages, transducers, brakes, pressure and temperature switches, and rupture disks. In the physical system installation, all of these devices shall be tagged and identified with permanent tags.
- (4) A list and description of the system control loops and interlocks critical to safety shall be prepared. Examples include, but are not limited to, the following:
 - All control loops and interlocks referenced by the Safety Analysis per section 3.0 of this technical appendix that are required to maintain a safe condition
 - All control loops and interlocks required by the FESHM 4240 Oxygen Deficiency Hazard engineering note
 - Any other control loops or interlocks required to protect pressure containing or restraining components from damage due to non-pressure hazards such as high temperature, low temperature, temperature differentials, or fluid freezing. Emphasis should be given to controls where damaged component could result in loss of fluid containment, present a hazard to personnel, or cause costly equipment damage for a DOE-reportable event per the Occurrence Reporting and Processing System

6.1.2. System Operating Documents

- (1) Operating procedures shall be prepared for the system. All revisions to the operating procedures which could present a hazard to personnel shall be submitted to the review panel.
- (2) Operating procedure preparation shall include a description of the system design features for Lockout/Tagout (LOTO) and configuration control. Note the specific LOTO and configuration control procedures are outside the scope of this chapter and

covered by FESHM 2100. However, the cryogenic system review shall review the design features of the system with respect to LOTO and configuration control for reasonably expected future maintenance and system upgrades. Examples of design features include:

- Energy isolation (e.g. Can the instrument air supply for a fail-closed control valve be locked out and vented?)
- De-energization (e.g. Are there suitable vent and drain valves that can be used to depressurize the system and prevent re-energization in the event of a leak?)
- Verification (e.g. Can de-energization be verified using vents or pressure indicators/transducers?)

- (3) Any checklists required for startup, shutdown or normal operation of the system shall be provided for review.
- (4) The qualification and training requirements of cryogenic personnel, beyond those required in this chapter, shall be defined by line management and documented.

6.1.3. Safety Analysis Documents

- (1) A FMEA (Failure Mode and Effect Analysis) shall be performed. The recommended scope and method is described in Appendix 6.2, *Failure Mode and Effects Analysis*.
- (2) A what-if analysis shall be performed. The recommended scope and method is described in Appendix 6.3, *What-If Analysis*.
- (3) A hazard analysis shall be performed. The recommended scope and method is described in Appendix 6.4, *Hazard Analysis*.
- (4) FMEA, What-If, and Hazard Analyses may, in some cases, be substituted for each other with the agreement of the reviewers. An adequate review may not require the completion of all three analyses.
- (5) Documentation necessary to demonstrate that other chapters of FESHM are followed shall be prepared. Particular attention will be paid to those chapters of FESHM noted in paragraph 1.0 of this chapter.

6.1.4. Engineering Documents

- (1) Calculations and/or test results demonstrating the adequacy of the relief system shall be prepared.
- (2) Calculations and/or test results shall be prepared to verify that stress levels in materials are acceptable per the applicable FESHM chapter listed in 5.0, REFERENCES.

Cryogenic ORCs (an Example)

View	TSWID	Title	Beam	Requester	WF_Status	Created	Title	
	ORC-2056.01	Edit: Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarized Target Magnet and Fridge Cooldown	...	No	Approved	November 16, 2022	Operation Readiness Cooldown	
	ORC-2071	Edit: Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarized Target Magnet Power-up	...	No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	October 5, 2022	Operation Readiness
	ORC-2056	Edit: Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarized Target Magnet Cooldown	...	No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	August 6, 2022	Operation Readiness
	ORC-2049	Edit: E1039 Operation Readiness Clearance (ORC) of SpinQuest (E1039) Superconducting magnet electronics (in the target cave) at NM4	...	No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	July 12, 2022	E1039 Operation Rea electronics (in the tar

Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarized Target Magnet Cooldown

[ORC - 2056](#)

[SpinQuest Polarized Target Group](#)

We included the complete system (Superconducting Magnet)'s operations procedures, also a "What If analysis" required by the ORC committee

Table of Contents

- 1. Introduction..... (1)
- 2. Superconducting magnet operation procedure..... (2)
- 3. 30-Gauss boundary of the magnetic field.....(6)
- 4. Liquid Nitrogen fill procedure.....(8)
 - 4.1 Conditions for a Liquid Nitrogen Fill from the Outside Storage Dewar..(8)
 - 4.2 Liquid Nitrogen Fill for the QT purifier.....(8)
 - 4.3 Liquid Nitrogen Fill for the Target Magnet Shield.....(9)
- 5. Liquid Helium fill procedure..... (9)
 - 5.1 Conditions for a Liquid Helium transfer from QT Dewar to magnet... (9)
 - 5.2 Fill control options.....(10)
 - 5.3 Automatic fill.....(10)
 - 5.4 Manual fill.....(11)
- 6. Magnet pre-cool procedure..... (12)
- 7. Magnet cool-down procedure.....(14)
- 8. What-If analysis for magnet cooldown.....(18)
- References*.....(19)

Cryogenic ORCs (an Example)

What If Analysis

During LHe Transfer	During LN2 fill	During Filling of Magnet LN2	During Filling of Magnet LHe	During LHe Transfer	State or scenario
Blockage from any part of	Loss of thermocouple	overfilling	overfilling	Loss of vacuum in any part of	Failure
Frozen contamination	Sensor or connection	No level indication, level	No level indication, level	Impact causing rupture or broken	Cause
LHe not flowing and sensor are	Readout data is bad	Filling stops	Filling stops	LHe turned to gas and not able	Impact
No level increase during fill, and	Readout indication	Level in QT storage dewar is	Level in QT storage dewar is	Sensors on magnet and	Detection
2	1	1	1	2	Severity 10=high
2	1	1	1	2	Occurrence 10=likely
4	1	1	1	4	Risk 10=high
N/A	Restrict access to cave	Restrict access to cave	Restrict access to cave	Restricted access to platform,	Safety mech.
Repair by warming blowing	Repair during downtime	Control system will proceed with	Control system will proceed with	Control system will proceed with	Recommendation
Control system and operator	Control system and operator	Control system and operator	Control system and operator	Control system and operator	Responsibility
		Cannot overfill beyond capacity	Connot overfill beyond capacity	Vacuum should be checked and	Notes

LCW loss	Pneumatic air loss	Power outage	State or scenario
Only affect the QT system, ROOTs	Cannot fill the magnet with LN2 and LHe	Loss of vacuum in magnet IVC	Failure
NA	Lack of air pressure	Loss of turbo pumping	Cause
NA	Possible quench	LHe vaporizes and the magnet quenches	Impact
NA	Vapor out of magnet helium return line	Vapor out of magnet helium return line	Detection
NA	0	2	Severity 10=high
NA	1	2	Occurrence 10=likely
NA	0	2	Risk 10=high
NA	Restricted access to cave	Restricted access to cave	Safety mech.
NA	Wait until power returns, inform target expert on shift	Wait until power returns, inform target expert on shift	Recommendation
NA	Shift Leader	Target shift operator	Responsibility
NA	Shift leader should immediately contact FNAL		Notes

Cryogenics HA (examples)

Hazard Analysis Form

This form can be used by Fermilab Employees, Fermilab Supervisors, Fermilab Task Managers, Construction Coordinators, Service Coordinators, Work Planners and Fermilab Subcontractors. This is a dynamic document which may require modification as the project moves from start to finish and should be readily available at the site where the work is being performed.

Note: Not all sections of the first page are applicable to every job or task, complete what is necessary for your specific job or task.

Job Title Helium transfer from Commercial Dewar in the cave

Job Location NM4

Contract/Work Order # _____

TO BE COMPLETED FOR WORK INVOLVING SUBCONTRACTORS

Subcontractor (if applicable)

Fermilab

Company _____ Project Eng/C.M. SpinQuest

Project Manager _____ Phone _____

Phone _____ Page _____ TM/CC/SC _____

ESH Rep. _____ Phone _____ Page _____

Phone _____ Page _____ ES&H Rep. _____

Phone _____ Page _____

AT LEAST TWO SIGNATURES ARE REQUIRED

TM/CC/SC/Work Planner Dustin Keller Date 12/02/2022

Print Name Dustin Keller

Authorizing Supervisor Rick Tesarek Date 12/2/22

Print Name Rick Tesarek

Accepted as noted _____ Date _____

Print Name _____

Description of Work: Helium transfer from Commercial Dewar in the cave

COVID-19 Protective Measures: (Check all that are required for the job.)

- Maintain 6 ft. or greater social distance when possible
- Face Covering (Cloth Face Mask or Disposable Face Mask)
- Face Shield
- Safety Glasses / Goggles
- Impervious Gloves
- Clean Surfaces Used
- Wash/Sanitize Hands
- Other Protective Measures Not Listed Above

Industrial Hazards: (Check all that apply to the job.)

- Flammable Gas Areas
- Heat Stress / Cold Stress
- Structural Demolition
- Excavation
- Scaffold Erection / Scaffold Use
- Ladder Use
- Non-ionizing radiation (lasers, RF, UV, magnets)
- Confined Space
- Silica
- Asbestos (presumed or suspected materials)
- Nanomaterial (1-100nm, 3D print, etc.)
- Beryllium
- Steel Erection
- Fall Exposures > 4ft (>6ft for construction)
- Heavy Equip. Ops. (crane, boom lift, excavator)
- Critical Crane Lift
- Rotating Equipment
- High Pressure air / fluids
- Welding / Cutting / Brazing / Grinding
- Lead (paint, bricks, cutting sheets, soldering)
- Chemical Use (cleaners, solvents, adhesives, etc.)
- Ergonomics (overexertion, repetition, lifting)
- Loud Noise (continuous, instantaneous)
- Potential Oxygen Deficiency - ODH 1 or 2 areas

Electrical Hazards: (Check all that are required for the job.)

- Manipulative Energized Work
- Working within 10 ft of overhead utilities
- Diagnostic Energized Work (LOTO verification)
- Working within 25 ft of 345kV overhead utilities

Environmental Hazards: (Check all that are required for the job.)

- Impact or release to surface, sanitary, or ground water
- Impact to new or existing air emission sources, including equipment/generators
- Generation of regulated waste (hazardous, special, universal)
- Use of refrigerants
- Use of Oil (> 55 gal) or new oil filled equipment
- Release of a chemical or use of a new chemical
- Impact to a naturally sensitive area or historical site

Radiation Safety: (Check all that are required for the job.)

- Posted Radiological Area (Radiation Area, HRA, Contamination, Airborne)

Fermilab ESH Manual

WARNING: This manual is subject to change. The current version is maintained on the ESH Section Website.

HA Form 2060-2
Rev. 06/2020

- Radioactive Material, Ionizing Radiation, Radiation Sources, RGDs, RAW systems, Exhaust Systems, Beamline Components - including targets & absorbers
- Area working in >= 100 mrem/hr
- Worker receiving >= 50 mrem for the job

General Hazards: (Check all that are required for the job.)

- Traffic Control
- Biological Hazards
- Working above others
- Other Hazards not listed here?

Personal Protective Equipment (PPE): (Check all that apply to the job.)

- Hardhat
- Steel-toed boots
- Gloves - leather
- Gloves - electrical
- Gloves - Nitrile
- Tyvek Boot Covers
- High visibility clothing
- Safety goggles
- Safety goggles - impact/face shield
- Fall Protection
- Respirators - supplied air
- Long Pants without Cuffs
- Leg - cut protection
- Whole body - electrical
- Other PPE not listed here?
- Bump cap
- Steel-toed shoes
- Gloves - chemical
- Gloves - Cryogenic
- Tyvek Coveralls
- Earmuffs / Ear Plugs
- Safety Glasses
- Safety goggles - chemical
- Welding goggles/helmet
- Respirators (air purifying), cartridge
- Long Sleeve Shirts
- Arm - cut protection
- Apron - Cryogenic
- Whole body - Dust, chemical, heat

Controls: (Check all that are required for the job.)

- Danger tape & signage
- Barricades - soft (caution tape)
- Soil/erosion control
- Barricades - solid
- Road Closure
- Site dust control

Environmental Impacts (Required - check one):

- Yes, I have thought about the potential environmental impacts (see Guidelines for Completing the HA on page 6) of this job and will document such impacts and mitigation steps within this document.

Yes, I have thought about the environmental impacts of this job and no such credible impacts exist and therefore do not need to be written in this document.

Equipment required for the job: (List the tools needed to perform the job.)

Variable wrenches, LHe transfer line, ladder, Portable He dewar placed on middle platform on wooden cribbing in target cave

Fermilab ESH Manual

WARNING: This manual is subject to change. The current version is maintained on the ESH Section Website.

HA Form 2060-3
Rev. 06/2020

Cryogenics HA (examples)

Utilizing the format below, identify hazards and environmental aspects, and their corresponding safety precautions/procedures to mitigate hazards. Use as many sheets as necessary.

HAZARD ANALYSIS

Step	Description of Step	Safety Hazards/ Potential Impacts to Environment	Mitigations / Precautions / Safety Procedures / Controls
0	Ensure everyone working in the target cave on this activity understands the job and hazards. Also, make sure everyone understands the tight work space for all activities in the target cave. (applicable to all steps in the target cave) Confirming stability of the LHe dewar on its cribbing (before starting)	N/A	N/A Limiting the number of people to two in the cave. Check the stability of the wooden blocks (4"x4" and 2"x4" blocks) on the platform.
1	Cribbing the LHe dewar on top of wooden blocks	The dewar can fall in the cave if there is instability occurred	Evacuate immediately if the dewar is flipped, or if there is an ODH alarm
2	Set Valve PSV-401-He to 0.5 psig	No Hazard	Use the procedure on docdb 10333
3	Connect a helium gas bottle to the stinger side and crack the transfer line at the connection between the stinger side and QT transfer line so gas can flow out of the brass collar fitting. Flow gas for about 5 minutes to clean out the line. Flow helium through both sections (flex portion and L-portion).	N/A	ODH system in the cave is already operational. Evacuate immediately if there is an ODH alarm. Limiting the number of people to two in the cave. Use PPE (Cryogenic gloves and safety glasses).
4	Connect the L-portion of the transfer line to the magnet file riser.	No Hazard	N/A
5	Insert stinger through Goddard fittings using a ladder with a hand-railing. Then, tighten Goddard fittings hand tight and gradually lower stinger into dewar letting pressure build.	Cryogenic Hazard	Use PPE (Cryogenic gloves and safety glasses). Here care should be taken to ensure there is no horizontal force (at all times) on the LHe portable dewar induced by the transfer line.
6	Regulate the flow out of the transfer line into the cave using the transfer line valve. Once a helium jet is visible insert the	Cryogenic Hazard	This must be done in a timely manner so that no atmosphere is tapping in the line and the lines don't

	stinger in the L-portion and tighten the brass collar quickly.		freeze while trying to connect them. Evacuate immediately if there is an ODH alarm. Use PPE (Cryogenic gloves and safety glasses).
7	Monitor the pressure on the magnet via the magnet helium return pressure sensor, and use the dewar heater to maintain a consistent 4 psi on the external helium dewar so that there is continuous liquid helium flow to the magnet.	No Hazard	N/A
8	In parallel, use the QT system also to fill very slowly and continuously.	No Hazard	This is to ensure there is continuous LHe flow to the magnet during switching external dewars.
9	Once the external dewar is empty, then stop the transfer by turning off the dewar heater and closing the transfer line delivery valve.	No Hazard	If the magnet temperature sensors stop cooling, the external dewar is likely empty and needs to be swapped.
10	After a couple of minutes remove the stinger from the commercial dewar while leaving it in the L-portion in the magnet.	Cryogenic Hazard	Evacuate immediately if there is an ODH alarm. Use PPE (Cryogenic gloves and safety glasses).
11	Install new commercial dewar and begin again. This process will likely take 4 dewars to complete the cooling phase.	Cryogenic Hazard	Evacuate immediately if there is an ODH alarm. Use PPE (Cryogenic gloves and safety glasses).
12	To switch to operations mode, close transfer line delivery and disconnect the transfer line from L-portion. Have a small amount of back pressure on the magnet (around 1 psi) and pull out the L-portion of the transfer line. Put the plug into the fill port.	Cryogenic Hazard	Evacuate immediately if there is an ODH alarm. Use PPE (Cryogenic gloves and safety glasses).
13	The main QT fill line can then be moved to the fill port where the L-portion was. To do this have QT dewars closed and backfill with helium gas through QT transfer line. Remove QT transfer line, then plug. Remove the plug in fill port and install QT transfer line. Tighten the fitting to seal.	Cryogenic Hazard	Evacuate immediately if there is an ODH alarm. Use PPE (Cryogenic gloves and safety glasses).
14	Set Valve PSV-401-He to 5psig	No Hazard	Use the procedure on docdb 10333

Carefully identify all Possible Hazards and mitigation plans

Cryogenics HA (examples)



Hazard / Mitigation

Step #	Critical Step	Process Step	Hazard Details	Mitigation Details
1	No	Cryogenic Training	Exposure to cryogenics	Personnel need to have general cryogenic safety training (FN000115) when handling cryogenics. Large portable liquefied gas dewar handling training (FN000475) is required for moving any 160L/240L dewars. Use proper PPE for cryogenics.
2	No	Connecting dewar and vent lines to purifier	Accidental exposure to cryogenics. Release of cryogenics.	Ensure the line going from the dewar to the purifier has all fittings leak tight. Line should be insulated. Vent line should also have leak tight connections and be insulated. A check valve must be attached to end of vent line to prevent back flow of air. Vent line needs to be secured to railing.
3	No	Monitor purifier pressure	Possible over pressure of vessel and lifting of relief valves. Release of cryogenics.	Purifier LN2 space pressure should be continuously monitored to ensure pressure does not increase beyond 10psig. Relief valves lift at 15psig. This is monitored via PTA_T in the PLC
4	No	Monitor Liquid Level of Purifier	Over filling of purifier	The liquid level of the purifier LN2 space should be continuously monitored. This is monitored via the PLC.
5	No	Close portable dewar valve when filling is complete.	Over filling of purifier. over pressurizing of purifier.	Ensure that the portable dewars isolation valve is completely closed when done filling.
6	No	Clean any condensation	Slipping/falling	Any condensation that has accumulated should be wiped up to prevent slipping and falling.

Managed by Fermilab Research Alliance, LLC for the
U.S. Department of Energy, Office of Science
www.fnal.gov



Fermilab

Fermil National Accelerator Laboratory

Work Package # 21102 - LN2 Dewar to Purifier Filling

Hazard Analysis - Form 2022-12206

Dates 28-MAR-2022 — 01-APR-2022

Managed By PPD — Particle Physics Division

Performed On Particle Physics Division

Authorizing Supervisor Allspach, Del (07201N) 630.840.3493

Project Name E1039

Prepared By Bohn, Jordan (36690N) 630.840.4686

Job Description This is for the filling of a cryogenic purifier using a LN2 dewar. To ensure it is done safely and no hazards are introduced.

Electrical/Electronics

<https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=2781>



ES&H DOCUMENT DATABASE
Environment, Safety and Health website: [public](#) | [internal](#)

ESH DocDB Document 2781-v8

Electrical Design Standards for Electronics to be used in Experimental Apparatus at Fermilab

Document #:
ESH-doc-2781-v8

Document type:
[Guidance/Information](#)

Submitted by:
[Mike Utes](#)

Updated by:
[Mike Utes](#)

Document Created:
16 May 2014, 10:39

Contents Revised:
13 Feb 2020, 12:12

Metadata Revised:
13 Feb 2020, 12:12

[Watch Document](#)

Abstract:

These electrical design standards are to assist the system designer during the early stages of the experiment electronics design. In addition, they are used by Fermilab appointed reviewers during the safety inspection of experiment electronics installations.

Files in Document:

- [Electrical Design Standards for Electronics to be used in Experimental Apparatus at Fermilab](#) (FNAL_Electrical_Design_Standard_7.5_200201.pdf, 1.4 MB)

Other Files:

- [Electrical Design Standards source file](#) (FNAL_Electrical_Design_Standard_7.5_200201.doc, 23.7 MB)
- [Supporting wire gauge ampacity information](#) (HookupWireGauge.xlsx, 570.2 kB)

Get all files as [tar.gz](#), [zip](#).

Topics:

- [Technical Notes:Fire Safety Technical Notes](#)
- [Safety & IH:Electrical Safety](#)
- [Fermilab ES&H Committee:Electrical Safety Subcommittee](#)

Authors:

- [David Mertz](#)
- [Mike Utes](#)

Keywords:

[electrical standard wire gauge fuse bus](#)

Viewable by:

- [waspublic](#)
- [eshadm](#)
- [Manual Authors](#)

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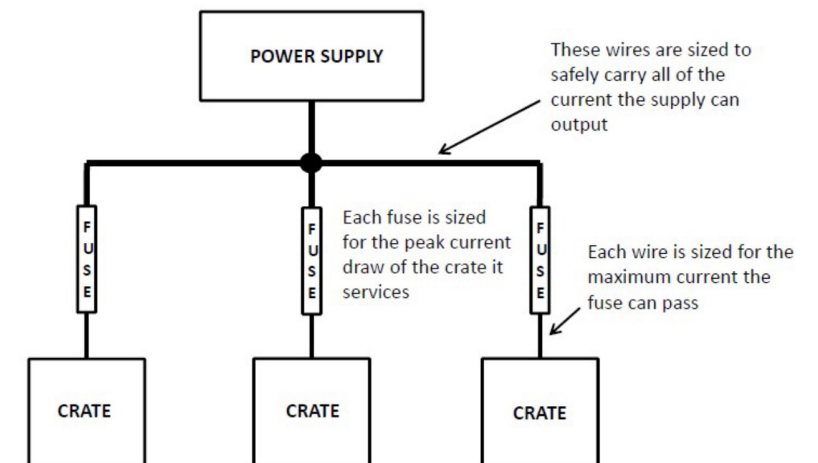
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- [ESH-doc-2781-v7](#)
30 May 2019, 11:30
- [ESH-doc-2781-v6](#)
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- [ESH-doc-2781-v3](#)
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“ Fermilab is required by contract with the DOE to adhere to OSHA requirements for Safety in General Industry (29 CFR 1910). One consequence of this is that all equipment such as power supplies, wall transformers, oscilloscopes, vacuum pumps, etc. is required to be listed by a Nationally Recognized Testing Laboratory (NRTL). In addition, no Fermilab employee has the authority to approve non-listed equipment if a listed equivalent exists.”

Important points for Electrical/Electronics ORCs

- AC Power cords shall be rated for the maximum current they may carry. Power Strips must be plugged into premises receptacles and must not be daisy-chained.
- Proper FUSE configuration is very important!
- Documentation:
“It is essential to have well-written documentation for the electronics system in order to ensure that the system can be reviewed, that it can be maintained, and that others can be trained to operate it in the shortest amount of time.”
- Total power budget
- Refer to <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=2781> for more information



Electrical/Electronics ORC (examples)

view	ISWID	Title	Beam	Requester	WF_Status	Created	
	ORC-2056.01	Edit: Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarized Target Magnet and Fridge Cooldown	...	No		Approved	November 16, 2022
	ORC-2071	Edit: Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarized Target Magnet Power-up	...	No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	October 5, 2022
	ORC-2056	Edit: Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarized Target Magnet Cooldown	...	No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	August 6, 2022
	ORC-2049	Edit: E1039 Operation Readiness Clearance (ORC) of SpinQuest (E1039) Superconducting magnet electronics (in the target cave) at NM4	...	No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	July 12, 2022
	ORC-1888.01	Edit: E1039 Operational Readiness Clearance of the UVA-NMR system Part 2 (Commercial Components) at NM4	...	No		Approved	March 23, 2022
	ORC-1888	Edit: E1039 Operational Readiness Clearance of the UVA-NMR system Part 2 (Commercial Components) at NM4	...	No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	July 27, 2021
	ORC-1854	Edit: E1039 Operational Readiness Clearance of the UVA-NMR system Part 1 (Custom Components) at NM4	...	No	<input type="checkbox"/> M. A. Ishara P. Fernando	Approved	April 22, 2021

Electrical/Electronics ORC (examples)



Operation Readiness Clearance (ORC) of SpinQuest (E1039) Polarized Target Magnet Power-up

ORC - 2071

SpinQuest Target Group



Table of Contents

1. Introduction.....	(1)
2. List of ORCs.....	(1)
3. Superconducting magnet operation procedure.....	(2)
4. 30-Gauss boundary of the magnetic field.....	(6)



Operation Readiness Clearance (ORC) of SpinQuest (E1039) Super conducting magnet electronic connectors (in the target cave)

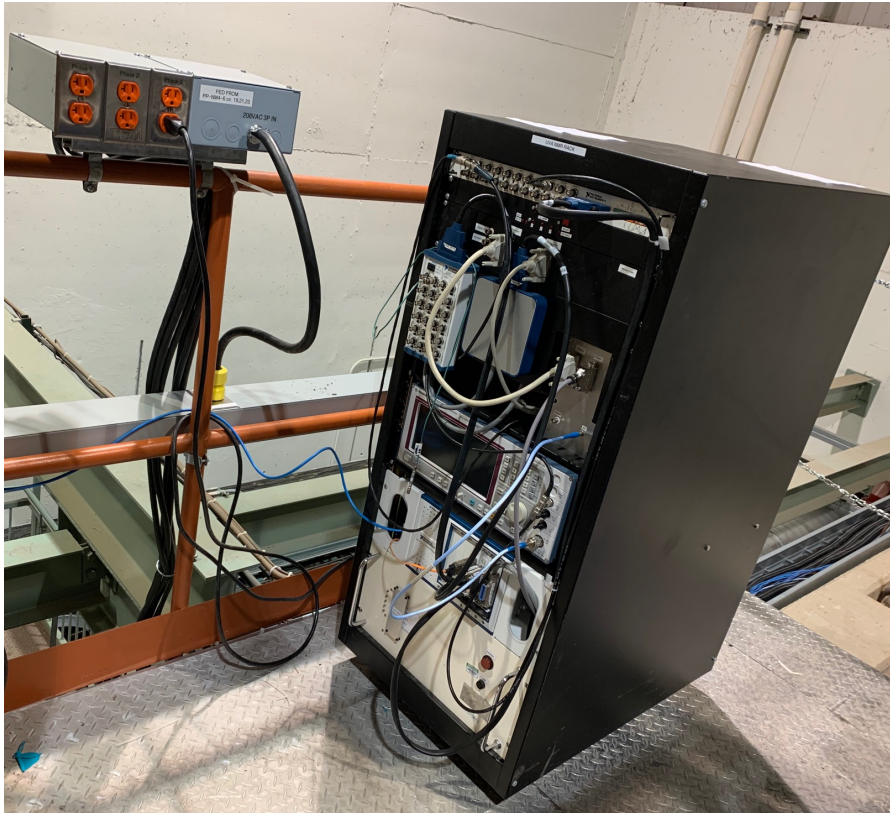
ORC - 2049



Table of Contents

1. Introduction.....	(1)
2. Magnet power connectors.....	(2)
3. Shim power connectors.....	(3)
4. Heater Connector.....	(4)
5. ITM10 connector.....	(5)
6. Level probes.....	(6)
7. Thermocouple feedthrough.....	(7)
<i>References</i>	(7)

Electrical/Electronics ORC (examples)



Operation Readiness Clearance (ORC) of SpinQuest (E1039) UVA-NMR Part 1 (Custom Components)

ORC - 1854

Dustin Keller, Ishara Fernando & Waqar Ahmed



Operation Readiness Clearance (ORC) of SpinQuest (E1039) UVA-NMR Part 2 (Commercial Components)

ORC - 1888

Dustin Keller, Ishara Fernando & Waqar Ahmed



Electrical/Electronics ORC (examples)

Fermi National Accelerator Laboratory



Operating UVA-NMR Rack in the NM4 facility
(Hall and Counting House)



Figure 1.1: UVA-NMR System in the hall (front view (left) and back view (right))
Please refer to ORC #1888 and #1854 for custom and commercial components approved to operate in the NM4 counting-house

This is a “portable system” and should be allowed to run anywhere on the bottom floor of NM4 and NM3 which includes the front of the cave the back area where the material is made and the cryo-platform as well as the counting-house. Operating this portable system in the counting-house is already approved (see ORC#1854 and 1888). When it is in the cryo-platform, power will be taken from the quiet power supply mounted on the hand-railling in this picture, and the signal cables (Lambda/2) from the target insert will be connected to the Q-meter (low current system; see ORC #1854). The Lambda/2 cables are low power (50 mW) RF and cannot be any fire hazard. The lambda/2 cable length is adjusted for tuning multiple times depending on the RF environment at each and every location, therefore the length changes even if the NMR is never moved.



Fermi National Accelerator Laboratory



Operation Readiness Clearance (ORC) of SpinQuest (E1039) UVA-NMR [Addendum]

[Addendum to ORC – 1888 and ORC - 1854](#)

Fall Protection

- You must have the “FN00304/CR” training completed.
- An HA needs to be submitted through the “IMPACT tool” and need to wait until it gets the full approval before performing the task.

TRAIN Online Class Schedule

Course Fall Protection Orientation[FN000304/CR/01]

Requal. Interval 24 Months

Contact [Thomas Gibbs](#)

Directive/Requirement 29 CFR 1910.28

Authorized Instructors [Thomas Gibbs](#) (ES), [David Cathey](#) (ES), [Eric McHugh](#) (ES), [Jonny Staffa](#) (ES), [Simon Pollard](#) (LBNFDUNE/LBNF), SURF INSTRUCTOR (), CERN INSTRUCTORS ()

Reference Material [Fall Protection Training Presentation - ***View before taking online test***](#)

[Printable Fall Protection Training Materials](#)

[FESHM 7060 - Fall Protection](#)

[The ABCs of Fall Protection video](#)

Target Audience People working at height of 4 ft. or more and who are required to use fall protection.

Objective To raise awareness of fall hazards and the equipment that is available to protect against such hazard. The merits of each fall protection system will be discussed and analyzed.

Course Content Introduction of fall hazard work rules, fall prevention methods, and characteristics of personal fall arrest systems. Discussion of FESHM Chapter 7060, how employee should read and use the chapter. Various types of fall protection equipment will be shown. Students are expected to study the reference material above before attending class. The training session consists of a Q&A period for students to ask questions formulated during their study of the reference material. The instructor will demonstrate donning the harness and will show other fall protection equipment available in the marketplace. Finally, a test will be administered that you must pass with a grade of 80 percent or better to receive credit for the course.

Online Test: [Available](#)

Fall Protection (example HAs)

Hazard Analysis Form

This form can be used by Fermilab Employees, Fermilab Supervisors, Fermilab Task Managers, Construction Coordinators, Service Coordinators, Work Planners and Fermilab Subcontractors. This is a dynamic document which may require modification as the project moves from start to finish and should be readily available at the site where the work is being performed.

Note: Not all sections of the first page are applicable to every job or task, complete what is necessary for your specific job or task.

Job Title Install cabling from slow control Rack to the Target cave.

Job Location NM4 facility (experimental hall)

Contract/Work Order # _____

TO BE COMPLETED FOR WORK INVOLVING SUBCONTRACTORS

Subcontractor (if applicable)	Fermilab
Company _____	Project Eng/C.M. _____
Project Manager _____	Phone _____
Phone _____ Page _____	TM/CC/SC _____
ESH Rep. _____	Phone _____ Page _____
Phone _____ Page _____	ES&H Rep. _____
	Phone _____ Page _____

AT LEAST TWO SIGNATURES ARE REQUIRED

TM/CC/SC/Work Planner _____ Date March 8 2021
 Print Name Waqar Ahmed (39293V)

Authorizing Supervisor Richard J. Tesarek Date 3/26/21
 Print Name Richard J. Tesarek

Accepted as noted _____ Date _____
 Print Name _____

Description of Work: Install cable from slow control rack to Target cave. In cable tray east of the platform through a penetration near the fire suppression system piping

into the target cave.

COVID-19 Protective Measures: (Check all that are required for the job.)

- Maintain 6 ft. or greater social distance when possible
- Face Covering (Cloth Face Mask or Disposable Face Mask)
- Face Shield
- Safety Glasses / Goggles
- Impervious Gloves
- Clean Surfaces Used
- Wash/Sanitize Hands
- Other Protective Measures Not Listed Above

Industrial Hazards: (Check all that apply to the job.)

- Flammable Gas Areas
- Heat Stress / Cold Stress
- Structural Demolition
- Overhead Crane or Aerial Lift
- Excavation
- Scaffold Erection / Scaffold Use
- Ladder Use
- Non-ionizing radiation (lasers, RF, UV, magnets)
- Confined Space
- Silica (machining – concrete, grout, mortar, etc.)
- Asbestos (presumed or suspected materials)
- Nanomaterial (1-100nm, 3D print, etc.)
- Beryllium
- Steel Erection
- Fall Exposures > 4ft (>6ft for construction)
- Powered Industrial Truck (e.g. forklift)
- Mobile Crane
- Critical Crane Lift
- Rotating Equipment
- High Pressure air / fluids
- Welding / Cutting / Brazing / Grinding
- Lead (paint, bricks, cutting sheets, soldering)
- Chemical Use (cleaners, solvents, adhesives, etc.)
- Ergonomics (overexertion, repetition, lifting)
- Loud Noise (continuous, instantaneous)
- Potential Oxygen Deficiency – ODH 1 or 2 areas

Electrical Hazards: (Check all that are required for the job.)

- Manipulative Energized Work
- Working within 10 ft of overhead utilities
- Diagnostic Energized Work (LOTO verification)
- Working within 25 ft of 345kV overhead utilities

Environmental Hazards: (Check all that are required for the job.)

- Impact or release to surface, sanitary, or ground water
- Impact to new or existing air emission sources, including equipment/generators
- Generation of regulated waste (hazardous, special, universal)
- Use of refrigerants
- Use of Oil (> 55 gal) or new oil filled equipment
- Release of a chemical or use of a new chemical
- Impact to a naturally sensitive area or historical site

Radiation Safety: (Check all that are required for the job.)

- Posted Radiological Area (Radiation Area, HRA, Contamination, Airborne)
- Radioactive Material, Ionizing Radiation, Radiation Sources, RGDs, RAW systems, Exhaust Systems, Beamline Components - including targets & absorbers
- Area working in >= 100 mrem/hr
- Worker receiving >= 50 mrem for the job

General Hazards: (Check all that are required for the job.)

- Traffic Control
- Biological Hazards
- Working above others
- Other Hazards not listed here?

Personal Protective Equipment (PPE): (Check all that apply to the job.)

- Hardhat
- Steel-toed boots
- Gloves - leather
- Gloves - electrical
- Gloves - Nitrile
- Tyvek Boot Covers
- High visibility clothing
- Safety goggles
- Safety goggles - impact/face shield
- Fall Protection
- Respirators - supplied air
- Long Pants without Cuffs
- Leg - cut protection
- Whole body - electrical
- Other PPE not listed here?
- Bump cap
- Steel-toed shoes
- Gloves - chemical
- Gloves - Cryogenic
- Tyvek Coveralls
- Earmuffs / Ear Plugs
- Safety Glasses
- Safety goggles - chemical
- Welding goggles/helmet
- Respirators (air purifying), cartridge
- Long Sleeve Shirts
- Arm - cut protection
- Apron - Cryogenic
- Whole body - Dust, chemical, heat

Controls: (Check all that are required for the job.)

- Danger tape & signage
- Barricades - soft (caution tape)
- Soil/erosion control
- Other Controls not listed here?
- Barricades - solid
- Road Closure
- Site dust control
- Orange Construction Fence / Snow Fence

Environmental Impacts (Required - check one):

- Yes, I have thought about the potential environmental impacts (see Guidelines for Completing the HA on page 6) of this job and will document such impacts and mitigation steps within this document.
- Yes, I have thought about the environmental impacts of this job and no such credible impacts exist and therefore do not need to be written in this document.

Fermilab ESH Manual
 WARNING: This manual is subject to change. The current version is maintained on the ESH Section Website.

HA Form 2060-3
 Rev. 10/2020

Fall Protection (example HAs)

Equipment required for the job: (List the tools needed to perform the job.)

Harness, retractable lanyard, Screw driver, wrench, Pliers

Work Plan History Information: (List any lessons learned from this job, tip

Improvement/Feedback: At the conclusion of the job, the Task Manager, Supervisor, Work Planner or Project Leader shall work with those involved and receive feedback in order to improve future work plans.

If lessons have been learned to improve this or similar tasks, please update Operating Procedure or HA for future reference. If lesson learned has been learned, please enter it into the Fermilab Quality Tool Suite - Lessons Learned

Check One:
 Yes we have considered lessons learned and accepted feedback on this job to improve information so that future work plans may be improved.
 Yes we have considered lessons learned feedback and determined that future work plans to be improved.

Utilizing the format below, identify hazards and environmental aspects, and their corresponding safety precautions/procedures to mitigate hazards. Use as many sheets as necessary.

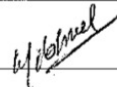


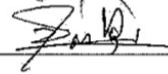
HAZARD ANALYSIS

Step	Description of Step	Safety Hazards/ Potential Impacts to Environment	Mitigations / Precautions / Safety Procedures / Controls
1	Install three cable filled conduits one by one inside the cable tray up to the south wall	Fall Exposures is < 6 ft	wear harness/retractable lanyard, Mask and gloves. the shielding block lifting points will be used as the anchor points
2	lower the cable filled conduits behind the fire pipe into the target cave	Fall Exposures is < 6 ft	wear harness/retractable lanyard, Mask and gloves. the shielding block lifting points will be used as the anchor points
3	One person in the work party must stay off of the shielding blocks, and must be available to summon assistance in case one of the other workers falls.	N/A	Calling the fire department x3131 for rescue
4			The entire job required ~ 1 hours
5			
6			
7			
8			
9			
10			

I have reviewed this hazard analysis and I understand the hazards and required precautionary actions. I will follow the requirements of this hazard analysis or notify my supervisor or Fermilab contact if I am unable to do so.

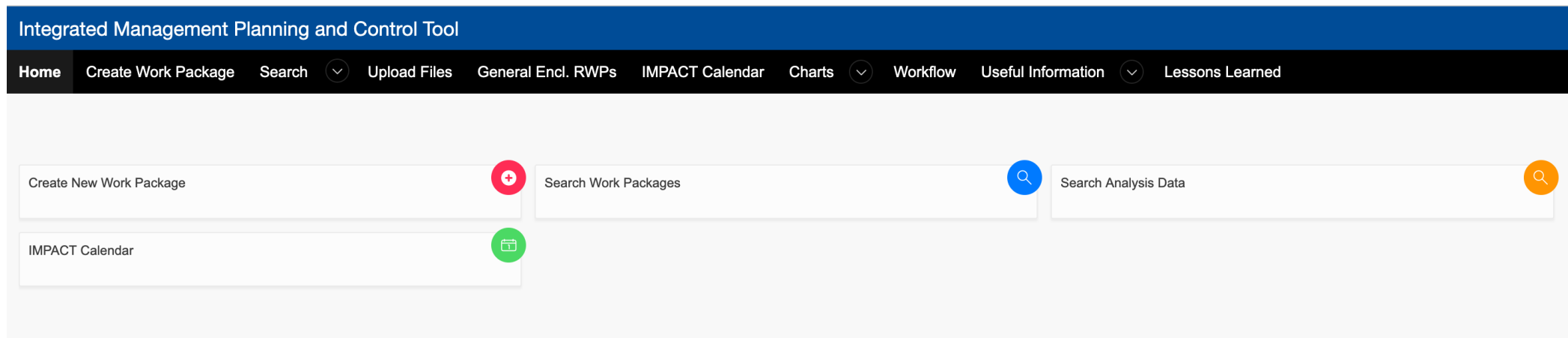
Point of Contact: _____

Pre-Job Briefing Conducted By: _____

Name and ID (please print)	Signature	Date
Waqar Ahmed (39293V)		28/03/21
Anchit Arora (39535V)		28/03/2021
Ernesto Diaz(40999V)		08/19/2021
Vibashn Brandon (41542V)		

How to submit an HA through the IMPACT tool?

- Write down the steps/procedure of the task
- Discuss with Rick Tesarek regarding the steps and revise.
- Log in to the IMPACT tool using your Fermilab SSO credentials.
<https://www-esh.fnal.gov/pls/apex/f?p=129:1:10858616596881:::>



How to submit an HA through the IMPACT tool?

Integrated Management Planning and Control Tool

Home **Create Work Package** Search Upload Files General Encl. RWPs IMPACT Calendar Charts Workflow Useful Information Lessons Learned

WKPG

Work Package

Cancel Create

Job Title *

Managed By Org * ~Select~ ?

Performed For Org * ~Select~ ?

Job Description *

Est Start Date * DD-MON-YYYY ?

Actual Start Date DD-MON-YYYY ?

Est End Date * DD-MON-YYYY ?

Actual End Date DD-MON-YYYY ?

Project Name ?

Project/Work Order Number ?

Additional Contact Info

Status New ?

Subcontractor Work

TM/CC/SC/Work Planner Fernando, M.A. Ishara ?

Comments

Locations * **Filter**

KTeV / NM4 [630] AFM: (Huey, Steve) TL: (Nelson, Leonard) [PPD]	<input type="button" value="S"/>	<input type="button" value="^-"/>
KTeV / NM4 Ground Floor [630] AFM: (Huey, Steve) TL: (Nelson, Leonard) [PPD]	<input type="button" value=">>"/>	<input type="button" value="^"/>
KTeV / NM4 Lower Level 1 [630] AFM: (Huey, Steve) TL: (Nelson, Leonard) [PPD]	<input type="button" value=">"/>	<input type="button" value="v"/>

How to submit an HA through the IMPACT tool?

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Home Create Work Package Search Upload Files General Encl. RWPs IMPACT Calendar Charts Workflow Useful Information Lessons Learned

Work Package 28201 -- Fernando, M.A. Ishara (41284V) x ishara@jlab.org

Print Cancel Add Lesson Learned Add To Favorites Sign-off Sheet Save

Job Title * Routing NMR cables

Managed By Org * PPD Performed For Org * PPD

Est Start Date * 24-JAN-2023 Actual Start Date DD-MON-YYYY

Est End Date * 24-JAN-2023 Actual End Date DD-MON-YYYY

Project Name Project/Work Order Number

Status New Subcontractor Work

TM/CC/SC/Work Planner * Fernando, M.A. Ishara

Job Description * Routing NMR cables between the cryo platform and the target cave at NM4 with appropriate fall protection equipment.

Additional Contact Info

Comments

Locations * Filter

1 Che Che Pinqua - Kuhn Barn [070] AFM: (Ferguson, Harry, III) TL: (Ferguson, Harry, III) [FE] KTeV / NM4 [630] AFM: (Huey, Steve) TL: (Nelson, Leonard) [PPD]

How to submit an HA through the IMPACT tool?

Integrated Management Planning and Control Tool

Home Create Work Package Search Upload Files General Encl. RWPs IMPACT Calendar Charts Workflow Useful Information Lessons Learned

Work Package # 28201 - Routing NMR cables Estimated 24-JAN-2023 – 24-JAN-2023

WPKG Add Form HA

Hazard Analysis - Form 2023-19864

Edit Form Print Form Clone Email Form URL Apply Changes

Title * Hazard Analysis

Prepared By Fernando, M.A. Ishara 41284V

Comments I provisionally approve with the understanding that the use of a ladder represents an industrial hazard that wasn't checked.

Start Date 24-JAN-2023 Enter ONLY if different than the package Start Date

End Date 24-JAN-2023 Enter ONLY if different than the package End Date

Required * Yes

124 of 32767

Form Package Locations Workers Task Training Attachments Hyperlinks People To Notify Governing Chapters Contractors Workflow Authorizing Supervisors Role Report Additional Wor >

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Hazard Analysis

Work Package # 28201 - Routing NMR cables

https://www-esh.fnal.gov/pls/apex/f?p=129:9:10858616596881:::P9_PACKAGE_ID,P9_MF_ID,P0_PACKAGE_ID:28201,1,28201

How to submit an HA through the IMPACT tool?

Integrated Management Planning and Control Tool

Home Create Work Package Search Upload Files General Encl. RWPs IMPACT Calendar Charts Workflow Useful Information Lessons Learned

Form Package Locations Workers Task Training Attachments Hyperlinks People To Notify Governing Chapters Contractors Workflow **Authorizing Supervisors** Role Report Additional Wor >

Fermilab
Fermi National Accelerator Laboratory

Hazard Analysis

Work Package # 28201 - Routing NMR cables
Hazard Analysis - Form 2023-19864
Dates 24-JAN-2023 — 24-JAN-2023
Managed By PPD — Particle Physics Division
Performed On Particle Physics Division
Authorizing Supervisor Tesarek, Rick (12680N) 630.840.8609
Prepared By Fernando, M.A. Ishara (41284V) 630.840.
Job Description Routing NMR cables between the cryo platform and the target cave at NM4 with appropriate fall protection equipment.
Workflow Status **Approved**
Comments I provisionally approve with the understanding that the use of a ladder represents an industrial hazard that wasn't checked.

Point of Contact _____

Pre-job Briefing Conducted by _____

Package Location

Type	Name	Building Manager	Org
Property	KTeV / NM4 [630]	AFM: (Huey, Steve) TL: (Nelson, Leonard)	PPD

Hazard Analysis

How to submit an HA through the IMPACT tool?

Integrated Management Planning and Control Tool

Home Create Work Package Search Upload Files General Encl. RWP's IMPACT Calendar Charts Workflow Useful Information Lessons Learned

Hazard Analysis

Check the MS Equipment Database for equipment you can use to complete your job: [\(MS Equipment DB\)](#)

Check out questions that should be used when job planning or conducting pre-job briefing: [\(Job Planning/Pre-Job Brief Questions\)](#)

Emergency Work

Check this box to indicate this is emergency work that is required to be done immediately before electronic approvals can be obtained. (NOTE: Electronic approvals should still be obtained retroactively.)

Additional Details

Fall Protection rescue plan : Call 3131 and wait for the Fire Department

Check the boxes next to all types of work and known hazards you may encounter on this job.

COVID-19 Protective Measures [\(Guidance Documents\)](#)

- Maintain 6 ft. or greater social distance when possible
- Surgical Mask or other Lab-approved Mask
- Face Shield
- Safety Glasses / Goggles
- Impervious Gloves
- Clean Surfaces Used
- Wash/Sanitize Hands
- Other Protective Measures Not Listed Above (List in Text Box below)

How to submit an HA through the IMPACT tool?

Integrated Management Planning and Control Tool

Home Create Work Package Search Upload Files General Encl. RWPs IMPACT Calendar Charts Workflow Useful Information Lessons Learned

Industrial Hazards




- Flammable Gas Areas
- Heat Stress / Cold Stress
- Structural Demolition
- Excavation
- Scaffold Erection
- Scaffold Use
- Ladder Use
- Steel Erection
- Fall Protection - Fall Exposures >4 feet (>6 feet for construction)
- Overhead Crane
- Powered Industrial Truck (e.g. forklift)
- Mobile Elevating Work Platform (MEWP) (e.g. Scissor Lift, Aerial Lift, Bucket Truck, etc.)
- Mobile Crane
- Below-the-Hook Lifting Device
- Critical Crane Lift
- Crane Personnel Basket
- Rotating Equipment
- High Pressure air/fluids
- Welding/Cutting/Brazing/Grinding
- Lead (Lead paint, moving bricks, cutting sheets, soldering)
- Chemical Use (cleaners, solvents, adhesives, etc.) - If checked attach or link SDS to the HA [Upload Files](#) [Add Hyperlinks](#)
- Lasers
- Non-ionizing radiation (RF, UV, magnets)
- Confined Space
- Ergonomics (overexertion, repetition, heavy lifting, awkward lifting, static posture)
- Silica (machining - concrete, asphalt, grout, mortar)
- Loud Noise (continuous, instantaneous)
- Asbestos (presumed or suspect building materials, e.g. tile, pipe insulation, roofing materials, etc.)
- Nanomaterial (1-100nm, ex. buffing solutions, surface material coating, 3d printing)
- Beryllium
- Potential Oxygen Deficiency - ODH 1 or ODH 2 Area
- Robotics

Electrical Hazards

- Manipulative Energized Work
- Diagnostic Energized Work (inc. LOTO verification)

How to submit an HA through the IMPACT tool?

Integrated Management Planning and Control Tool

Home Create Work Package Search  Upload Files General Encl. RWPs IMPACT Calendar Charts  Workflow Useful Information  Lessons Learned

Check the boxes next to all types of PPE and Controls you will need for this job.

Personal Protective Equipment (PPE)

- Hardhat
- Bump cap
- Steel-toed boots
- Steel-toed shoes
- Gloves - leather
- Gloves - chemical
- Gloves - electrical
- High visibility clothing
- Gloves - Cryogenic
- Gloves - Nitrile
- Safety Glasses
- Safety goggles
- Safety goggles - chemical
- Safety goggles - impact/face shield
- Welding goggles/helmet
- Fall Protection
- Respirators (air purifying), cartridge
- Respirators - supplied air
- Long Sleeve Shirts
- Long Pants without Cuffs
- Arm - cut protection
- Leg - cut protection
- Apron - Cryogenic
- Whole body - electrical
- Whole body - Dust, chemical, heat
- Tyvek Coveralls
- Tyvek Boot Covers
- Earmuffs (enter noise reduction rating (NRR) in text box below)
- Ear Plugs (enter noise reduction rating (NRR) in text box below)
- Other PPE not listed here? Enter them in the text box below.

How to submit an HA through the IMPACT tool?

Integrated Management Planning and Control Tool

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Hazard / Mitigation

Step #	Critical Step	Process Step	Hazard Details	Mitigation Details
1	No	We will use two strings (one from the cryoplatfrom and one from the cave with the help of 1/4 stainless steel tube through the penetration where ODH tubing in was installed into the target cave) to route the NMR cable(s).	N/A	N/A
2	No	One person (Person A) with cable ties and cable cutter, will wear the fall protection equipment and attach it to the anchor point located near the stairs where the quite-power supply isolation transformers located at. Step over the hand rail across the ventilation duct to reach the shielding blocks.	Fall Hazard	Use Fall Protection equipment with Fall protection training.
3	No	Another person (Person B) needs go to the cryoplatfrom with one of the ~20ft string, and pass one-end of the string to Person A.	No Hazard	N/A
4	No	Person A will rout the string through the PVC pipe and let the string's end fall down to the ground-floor near the ODH fan area in front of the east penetration; and also will check PVC pipe attached to the cable tray is stable, otherwise tight it with more cable ties.	No Hazard	N/A
5	No	Then Person A should come back safely to the stairs and remove the fall protection equipment and then go to the ODH fan area on the ground-floor in front of the east penetration and hold that end of the string.	No Hazard	N/A
6	No	Person C will be in the cave and attach the 1/4" stainless-steel tube to the end of the NMR cable(s); then attach a ~20ft string to the other end of the 1/4" stainless-steel tube, and route through the penetration.	No Hazard	N/A
7	No	Person A near the ODH fan, use a ladder to help receiving the string coming from the penetration from Person C. And, once that string reached Person A will attach both strings (one from the cryoplatfrom and the one from the cave).	Fall Hazard	Use ladder with Fall protection training.
8	No	After communicating to Person B on the cryoplatfrom, will start pulling the string gently.	No Hazard	N/A
9	No	Person A needs to be watching all the time and communicate to B and C, to make sure the cable move towards the cryoplatfrom properly and safely.	No Hazard	N/A
10	No	Once Person B receives the NMR cable completely, detach the string from the NMR cable(s) and keep pulling until Persons A and C confirms that the cable routing is completed.	No Hazard	N/A

How to submit an HA through the IMPACT tool?

Workflow | State Complete | Outcome Approved

Workflow Tasks

Role	State	Submitted	Responder	Comments	Responded	Outcome
Start Notification	Complete	20-JAN-2023 11:42			20-JAN-2023 11:42	Notified
WPC_Construction_Safety	Complete	20-JAN-2023 11:42	Beebe, Robby	Looks good. Please remember to inspect all of the fall protection equipment prior to use. Tag and damaged equipment out of service.	20-JAN-2023 13:00	Reviewed
WPC_Fall Protection	Complete	20-JAN-2023 11:42	Cathey, David	To ensure each job step is understood and hazards associated with each step please have a verbal job walk down of the entire job.. Please discuss hazard mitigation during the job walk down.	20-JAN-2023 12:12	Reviewed
WPC_Hazardous_Work_SME	Complete	20-JAN-2023 11:42	Satti, Paul		20-JAN-2023 15:59	Reviewed
Supervisor 12680N	Complete	20-JAN-2023 16:00	Tesarek, Rick	I provisionally approve noting that the use of a ladder is an industrial hazard that is not checked, though called out in the steps.	21-JAN-2023 09:31	Approved
Notify	Complete	21-JAN-2023 09:31			21-JAN-2023 09:31	Notified

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www.fnal.gov




Fermi National Accelerator Laboratory

Work Package # 28201 - Routing NMR cables
Hazard Analysis - Form 2023-19864
Dates 24-JAN-2023 — 24-JAN-2023
Managed By PPD — Particle Physics Division
Performed On Particle Physics Division
Authorizing Supervisor Tesarek, Rick (12680N) 630.840.8609
Prepared By Fernando, M.A. Ishara (41284V) 630.840.

How to make a “Procedure” and post it on docdb

- Date, Version #, docdb ID and Author’s name should be on the top.
- Add training requirements
- Required Initial conditions, PPE and rescue plan (for example: if Fall protection is required)
- List all tools, equipment and materials.
- Clearly define the steps in the correct sequence.
- Check all the steps with you supervisor, Rick Tesarek and, Dustin Keller for Target, Cryogenics related
Kun Liu for Spectrometer setup related
- Upload your document to docdb as a .pdf file **with the source file.**

Viewable by:

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 - Target Polarized
 - Target Unpolarized
 - Tracking
- Physics
- Upgrades
 - E1027
 - E1039

An example for a “Procedure”

An example

SEAQUEST

SEAQUEST Document 10357-v6

Procedure for routing NMR cables through the dedicated penetration on the east-side of NM4

Document #:
SEAQUEST-doc-10357-v6

Document type:
[Memo](#)

Submitted by:
[Ishara Fernando](#)

Updated by:
[Ishara Fernando](#)

Document Created:
13 Jan 2023, 09:14

Contents Revised:
05 Feb 2023, 17:02

Metadata Revised:
05 Feb 2023, 17:02

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Abstract:
Please see the attached file.

Files in Document:

- [Procedure for Installing NMR Cables.docx](#) (17.2 kB)
- [Procedure for Installing NMR Cables.pdf](#) (65.9 kB)

Get all files as [tar.gz](#), [zip](#).

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Authors:

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Other Versions:
[SEAQUEST-doc-10357-v5](#)
03 Feb 2023, 00:31

[SEAQUEST-doc-10357-v4](#)
24 Jan 2023, 10:53

An example for a “Procedure”

Author : Ishara Fernando

Date : 02/05/2023

Version 6

docdb 10357

Steps to rout NMR lambda/2 cables through the cable penetration on east side of NM4

HA for the following procedure was approved on FERMILAB IMPACT- tool : HA #28201

Note: This procedure covers the procedure of routing one or multiple lambda/2 cables through the dedicated penetration that is located between the shielding block where the ODH ¼” tubing also routed.

Training Requirement

Fall Protection (FN000304 / CR)

PPE: Hardhat

Fall Protection rescue plan: Call x3131 and wait for the Fire Department

Tools, equipment and materials

1. NMR cable(s).
 2. Cable ties and cable cutters.
 3. ¼” stainless steel tube (length: ~ 8-9 ft)
 4. Two strings (~20 ft).
 5. Fall protection equipment
-
1. We will use two strings (one from the cryoplatfrom and one from the cave with the help of ¼” stainless steel tube through the penetration where ODH tubing was installed into the target cave) to route the NMR cable(s).
 2. One person (**Person A**) with cable ties and cable cutter, will wear the fall protection equipment and attach it to the anchor point located near the stairs where the quite-power supply isolation transformers located at. Step over the hand rail across the ventilation duct to reach the shielding blocks.

So far.. 40+
Procedures...

Here's the full list of procedures to our knowledge, some of which have already been approved by Rick and carried out. However, Fermilab management appears to require a re-examination of all of them before the work-pause can be lifted.

	Version 7	2/3/23	
	Edited : Ishara Fernando	docdb 10409	
	Procedure	Docdb ID	Previously Reviewed
1	QT system startup and shutdown	10364	No
2	Pumping and purging (generic)	10184	Yes (Rick)
3	Leak checking (generic)	10188	Yes (Rick)
4	Dewar evacuation	10178	Yes, HA
5	QT Purifier LN2 fill	10337	Yes (Jordan)
6	Magnet pre-cool	10032	Yes, ORC-2056.01
7	Magnet cooldown	9651	Yes, ORC-2056.01
8	Magnet operations	10062	Yes, ORC-2071
9	Magnet fill from commercial LHe Dewar	10056	Yes, ORC-2056.01
10	Magnet LHe fill	9670	Yes, ORC-2056.01
11	Magnet shield LN2 fill	10337	Yes, (Jordan)
12	Outside gHe tank refill	10198	Yes, (Jordan)
13	Routing NMR cables	10357	Yes, HA
14	UVA-NMR system shutdown, startup, tuning, data-taking	10367	No
15	Slow Control System turn on/off	10369	No
16	Annealing System turning on/off	10372	No
17	Adjusting the Parallel plate valve PSV-401-He	10333	Yes (Rick)
18	Fridge LHe fill	10375	Yes, ORC-2056.01
19	Filling magnet shield with portable LN2 Dewar	10053	Yes, HA
20	Manually vented He Gas Storage Tank to the Atmosphere	10285	No (Sent to Rick)
21	Leak Checking in the Cave (Target Magnet)	10308	Yes, (Rick)
22	HR3 Compressor Oil, Oil filter replacement	10320	No
23	Helium boiloff capture procedure	10282	In Progress
24	Handling Target material NH3/ND3	10360	In Progress
25	Filling the portable handheld dewar	10358	In Progress
26	Cold-heads warm-swap procedure	10378	Yes, HA
27	Target lifter system powering up and shutting down procedure	10381	No
28	Filling Purifier LN2 space using portable LN2 Dewar	10053	Yes, HA (Jordan)
29	Procedure for draining LCW from roots pumps	10384	Yes, HA (Rick)
30	LHe transfer using commercial LHe Dewar in the cave	9670	Yes, HA (Rick)
31	Microwave system powering up, Operation, and shutting down	10387	No
32	LHe transfer to QT storage dewars	10389	Yes, HA
33	Installation of a transfer stinger to a Liquid Helium Dewar (generic)	10392	No
34	Cold LHe Transfer	10395	No
35	QT Liquefier Dewar level cleaning and Dewar cleaning	10401	In Progress
36	UVA-QT Purifier Helium Space Cleaning Procedure	10404	Yes
37	UVA-QT Purifier LN2 Space Cleaning Procedure	10407	Yes
38	Handling Target material CH2/CD2	10411	In Progress
39	A Detailed description of upcoming plan	10417	In Progress
40	Plan for the usage of Ammonia for the target	10414	In Progress
41	Target insert loading/unloading procedure	10355	In Progress
42	Cleaning Procedure of roots LCW regulator	10420	No

Thank you

