

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 Richard G. Tesarek Date 12/2/22

Print Name Rick Tesarek 126804

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)

- 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
- Working above others
- Biological Hazards
- 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 - solid
- Barricades - soft (caution tape)
- Road Closure
- Soil/erosion control
- 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

Work Plan History Information: (List any lessons learned from this job, tips from previous jobs)

N/A

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

If lessons have been learned to improve this or similar tasks, please update the Standard Operating Procedure or HA for future reference. If lesson learned has lab-wide implications please enter it into the [Lessons Learned Database](#).

Check One:

- Yes** we have considered lessons learned and accepted feedback on this job and will communicate such information so that future work plans may be improved.
- Yes** we have considered lessons learned feedback and determined that future work plans do not need 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
0	<p>Ensure everyone working in the target cave on this activity understands the job and hazards.</p> <p>Also, make sure everyone understands the tight work space for all activities in the target cave. (applicable to all steps in the target cave)</p> <p>Confirming stability of the LHe dewar on its cribbing (before starting)</p>	N/A	<p>N/A</p> <p>Limiting the number of people to two in the cave.</p> <p>Check the stability of the wooden blocks (4"x4" and 2"x4" blocks) on the platform.</p>
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	<p>ODH system in the cave is already operational. Evacuate immediately if there is an ODH alarm.</p> <p>Limiting the number of people to two in the cave.</p> <p>Use PPE (Cryogenic gloves and safety glasses).</p>
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

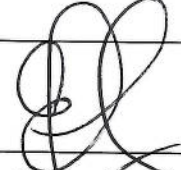




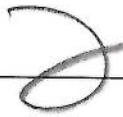
GUIDELINES FOR COMPLETING THE HAZARD ANALYSIS

Phase of Work	Safety Hazards/Potential Environmental Impacts	Mitigations / Precautions/Procedures/Controls
<p>Examining a specific job by breaking it down into a series of steps or tasks, will enable you to discover potential hazards employees may encounter.</p> <p>Each job or operation will consist of a set of steps or tasks. For example, the job might be to move a box from a conveyor in the receiving area to a shelf in the storage area. To determine where a step begins or ends, look for a change of activity, change in direction or movement.</p> <p>Picking up the box from the conveyor and placing it on a hand truck is one step. The next step might be to push the loaded hand truck to the storage area (a change in activity). Moving the boxes from the truck and placing them on the shelf is another step. The final step might be returning the hand truck to the receiving area.</p> <p>Be sure to list <i>all</i> steps needed to perform the job. Some steps may not be performed each time; an example could be checking the casters on the hand truck. However, if that step is generally part of the job it should be listed.</p> <p>Close observation and knowledge of the job is important. Examine each step carefully to find and identify hazards- the actions, conditions, and possibilities that could lead to an accident. Compiling an accurate and complete list of potential hazards will allow you to develop the recommended safe job procedures needed to prevent accidents.</p>	<p>A safety hazard is a potential danger to a person or equipment. An environmental impact is a change to the environment. The purpose of the Hazard Analysis (HA) is to identify ALL hazards- including those produced by the environment, those connected with the job procedure, and those with the potential to result in an environmental impact.</p> <p>To identify hazards, ask yourself these questions about each step:</p> <p>Is there a danger of the employee striking against, being struck by, or otherwise making injurious contact with an object?</p> <p>Can the employee be caught in, by, or between objects?</p> <p>Is there potential for slipping, tripping, or falling?</p> <p>Could the employee suffer strains from pushing, pulling, lifting, bending, or twisting?</p> <p>Is the work environment hazardous to safety and/or health (toxic gas, vapor, mist, fumes, dust, heat, or radiation)?</p> <p>Are there electrocution hazards?</p> <p>Will action require soil/erosion control?</p> <p>Will chemicals or petroleum products be used in an area where they could be released into the environment?</p> <p>Will action have the potential to affect storm water (drains, ponds, or streams in the vicinity)?</p> <p>Will action have the potential to affect the sanitary water system?</p> <p>Will action involve refrigerants?</p> <p>Will any regulated or recyclable waste be generated?</p>	<p>Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the hazards that could lead to an accident, injury, or occupational illness.</p> <p>Consider the hierarchy of controls:</p> <ol style="list-style-type: none"> (1) Elimination (physically remove the hazard) (2) Substitution (replace with something less hazardous) (3) Engineering controls (isolate the hazard) (4) Administrative controls (change the work) (5) Applicable / Specific PPE <p>List the recommended safe operating procedures. Begin with an action word. Say exactly what needs to be done to correct the hazard, such as, "lift using your leg muscles." Avoid general statements such as, "be careful", "use caution", and "be alert".</p> <p>List the required or recommended personal protective equipment necessary to perform each step of the job.</p> <p>Give a recommended action or procedure for each hazard.</p> <p>Serious hazards should be corrected immediately. The HA should then be changed to reflect the new conditions.</p> <p>Finally, review your input on all three columns for accuracy and completeness. Determine if the recommended actions or procedures have been put in place. Re-evaluate the job safety analysis as necessary.</p>

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: Dustin Keller

Pre-Job Briefing Conducted By: Dustin Keller

Name and ID (please print)	Signature	Date
Ernesto Diaz Fernandez 90999 U		12/02/2022
Ishara Fernando 41284 V		12/02/2022
Muhammad Farooq 46173 V		12/02/2022
Kenichi Nakano 14489 V		12/02/2022
Vibodh Bhandu 41542 V		12/02/2022
Dustin Keller 13081 V		12/02/22