

## 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 QT cold heads warm-swap maintenance

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 \_\_\_\_\_

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ES&H Rep. \_\_\_\_\_

Phone \_\_\_\_\_ Page \_\_\_\_\_

### ***AT LEAST TWO SIGNATURES ARE REQUIRED***

TM/CC/SC/Work Planner \_\_\_\_\_ Date \_\_\_\_\_

Print Name \_\_\_\_\_

Authorizing Supervisor \_\_\_\_\_ Date \_\_\_\_\_

Print Name \_\_\_\_\_

Accepted as noted \_\_\_\_\_ Date \_\_\_\_\_

Print Name \_\_\_\_\_



**Description of Work: Open each cold-head (on liquefier A) housing to free mechanical motion**

**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.)

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

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

- |   |   |
|---|---|
| <input type="checkbox"/> Manipulative Energized Work                | <input type="checkbox"/> Diagnostic Energized Work (LOTO verification)    |
| <input type="checkbox"/> Working within 10 ft of overhead utilities | <input type="checkbox"/> 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  $\geq 100$  mrem/hr
- Worker receiving  $\geq 50$  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
- Bump cap
- Steel-toed boots
- Steel-toed shoes
- Gloves - leather
- Gloves - chemical
- Gloves - electrical
- Gloves - Cryogenic
- Gloves - Nitrile
- Tyvek Coveralls
- Tyvek Boot Covers
- Earmuffs / Ear Plugs
- High visibility clothing
- 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
- Other PPE not listed here?

**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.)

Hand tools, 99.999% pure 2200 bottle of He, FNAL pressure regulator, Aeroquip connectors with hand valves and pressure gauges connected through tubing to make an assembly, rope and utilities for safety boundary, Binary Gas Analyzer.

**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
1	Prepare to relieve cold head pressure	Miscommunication  Inappropriate equipment  Inadvertent exposure to high pressure gases	Communicate steps to those performing work  Use only approved fixturing  Rope off area and post signs to keep casual bystanders stay out of work area.  Ensure all participants have both ODH and pressure safety orientation (FN000271)
2	Remove supply and return lines of the cold-head and install Aeroquip device to relief the 220psi pressure safely (with low flow in order to reduce risk of ODH) on the supply line to atmosphere. Assume 20slm for a couple of minutes vented directly to the Hall on the cryo-platform.	Pressure hazard	All workers must have pressure training, wear safety glasses and hearing protection. Ensure fixture openings are pointed away from personnel. A fan is positioned to blow the exhausted gas away from the personnel and off the cryo-platform. The coldhead pressure remains isolated in the coldhead volume as there are no openings to the cold-box vacuum. The hand valve on the Aeroquip connector set is cracked open while monitoring the pressure in the cold-head. Once the pressure in the coldhead reaches atmospheric pressure the manual valve is closed and then the Aeroquip fitting is removed.
3	Once it is in atmosphere, then opening the cold-head to free piston mechanism	No hazard	N/A

4	Reassembling the cold-head and then re-pressurizing to initial pressure.	No hazard	N/A
5	With the custom fittings attached to a cylinder of 99.999% pure helium open the main cylinder valve and adjust the pressure down as low as possible.	Pressure hazard	Follow appropriate procedure when connecting and ensure regulator is completely close before beginning and pressurization.
6	Attach the Aeroquip connectors to the cold-head and close the hand valve and Binary Gas Analyzer (BGA) valve.	Pressure hazard	Only appropriate Aeroquip fittings should be used with an adjustable regulator on supply end with BGA valve on the return end to prevent over pressuring the 150 psi rate plastic tubing.
7	Open hand valve on the supply end and regulator pressure setting gradually to let gas flow, bringing pressure up to 140 psig. The BGA valve is cracked to measure purity.	Pressure hazard	The Aeroquip return assembly should not be pressurized over 140 psi while connected to the cold-head and the plastic tube should not be use at pressures above 140 psi as it is only pressure rated for 150 psig.
8	Once the BGA reads 99.9% pure, all valves are closed and the return Aeroquip fitting is removed from the return end.	ODH	Keep flow through BGA minimal with fan on to minimize ODH hazard
9	The pressure on the supply end of the cold head is then gradually increase to 220 psi with the regulator.	Pressure hazard when pressurizing	Only appropriate Aeroquip fittings should be used with an adjustable regulator to gradually re-pressurize to 220 psig on the supply end. A safety relief valve will be installed down stream of the regulator to ensure re-pressurization over 250 psig does not occur.
10	The valve to the regulator is then backed off, the hand valve is closed and the supply Aeroquip assembly is removed.	No hazard	N/A

<b>11</b>	All steps	ODH area	ODH qualification, oxygen monitors are required because the cold-heads are in the ODH-1 area.
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**GUIDELINES FOR COMPLETING THE HAZARD ANALYSIS**

<b>Phase of Work</b>	<b>Safety Hazards/Potential Environmental Impacts</b>	<b>Mitigations / Precautions/ Procedures/Controls</b>
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<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"> <li>(1) Elimination (physically remove the hazard)</li> <li>(2) Substitution (replace with something less hazardous)</li> <li>(3) Engineering controls (isolate the hazard)</li> <li>(4) Administrative controls (change the work)</li> <li>(5) Applicable / Specific PPE</li> </ol> <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>
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**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:** \_\_\_\_\_

<b>Name and ID (please print)</b>	<b>Signature</b>	<b>Date</b>

