

NM4 Experimental Enclosure Hazard Awareness Training [PDNM4EXP/CB/01]

Version 1.0
E1039 Installation
7 September 2018

Overview

This document is intended to inform you of the potential hazards you may encounter in the NM4 beamline and experimental enclosure and the proper precautions to take to reduce risks. Please read the entire document, then either take the [online test](#), or sign and submit the signature sheet at the end. As new phases are entered, updated versions of this document will be released and retraining will be required.

THIS DOCUMENT SUPERSEDES THE SEAQUEST HAZARD AWARENESS TRAINING DOCUMENT, SeaQuest Hazard Awareness Training [PDSEAQ01/CB/01]. PERSONNEL WHO HAD THE PREVIOUS TRAINING AND WILL BE ROUTINELY ENTERING NM4 NEED TO TAKE THIS TRAINING FOR ACCESS.

1 Introduction

The installation phase of the E1039 experiment presents many potential hazards. This document is intended to inform you of the potential hazards you may encounter in the NM4 beamline and experimental enclosure and the proper precautions to take to reduce risks. Please read the entire document, then either take the [online test](#), or sign and submit the signature sheet at the end. As new phases are entered, e.g. commissioning and operation with beam, updated versions of this document will be released and retraining will be required.

All personnel are required to immediately stop any activity that poses an imminent danger to personnel or the environment and notify the Installation Manager, their supervisor/point-of-contact (POC), and the Particle Physics Division (PPD) Division Safety Officer (DSO), Raymond Lewis (x8445, rhlewis@fnal.gov).

ES&H assistance and oversight will be provided by the PPD DSO, the PPD Radiation Safety Officer (RSO), Nino Chelidze (x2995, chelidze@fnal.gov), and other representatives of the ESH&Q Section. Issues of building maintenance should be directed to the NM4 Building Manager, Chris Richardson (x8615, crich@fnal.gov).

If you find a situation in which you need advice, training, review or a decision in regards to safety or safe operations, you should first consult with your immediate supervisor/point-of-contact (POC). If you and your supervisor/POC conclude that the matter goes beyond your own group, that you need assistance in resolving it, or that you need to arrange for safety training, you should contact the PPD DSO.

In the event of an emergency, you should call ext. 3131 from any Fermilab telephone.

Environmental Safety, Health & Quality (ESH&Q) materials referenced in this document can be consulted for guidance on ESH&Q issues. These materials can be found on-line at this URL: <http://eshq.fnal.gov/atwork/>

2 Work Planning and Coordination

Prior to initiating new work at NM4 you must notify the E1039 Installation Manager, Rick Tesarek (x8609, tesarek@fnal.gov). (The backup Installation Manager is Jonathan Lewis [x3779, jdl@fnal.gov]). The appropriate ES&H documentation, such as written hazard analyses, and sign-offs will be required prior to starting any new work.

All personnel entering and/or performing work must check the Daily Status Board located at the northeast entrance door to the NM4 building. This board will have information on the current access requirements and planned work activities. The board is maintained by the Installation Manager. Daily planning and coordination on site at NM4 will be performed by the Installation Manager.

3 NM4 Access Requirements

The access requirements for the NM4 enclosure will change through the course of the E1039 installation activities. Current access requirements will be indicated on the Daily Status Board, by signs posted on the enclosure access doors and the Radiological Work Permit (RWP) specific to NM4. Adherence to posted signs and RWPs is required at all times. A two-person rule applies to the experimental hall; see section 9. Below are the two modes of access controls expected during the installation phase of the project.

Supervised Access with the Gate Removed between NM3 and NM4

When the fence and gate between NM3 and NM4 is removed, the NM4 enclosure will be a posted Radiation Area and access will require entrants to obtain and carry a key (one per entrant) checked out from the Accelerator Main Control Room (MCR). The key, Rad Worker Training (Radiological Worker – Classroom [FN000470] and Radiological Worker – Practical Factors [FN000471]), this training, a dosimetry badge, pocket dosimeter, and signing of the general RWP for the area will be required for access. Untrained persons may enter the enclosure only with written permission of the RSO, which will include the requirements for entry.

Open Access when the Gate is in Place between NM3 and NM4

When the interlocked gate is in place between NM3 and NM4, the NM4 experimental area will typically be posted as a Controlled Area. Entrants will not be required to have a key for access to NM4 in this mode, but must have General Employee Radiological Training (GERT) or be escorted by a GERT or Rad Worker trained individual. In Open Access, certain areas within NM4 may be posted as Radiation Areas; only Rad Worker trained personnel who have signed the appropriate RWP (or under the supervision of a Radiological Control Technician [RCT]) and have the required dosimetry are permitted in these locally posted Radiation Areas.

Note that the NM3 beamline enclosure is controlled by the Accelerator Division. A key from the MCR is required in all cases for access to NM3.

4 Radiation Hazards and Radioactive Sources

NM4 contains areas where radiation hazards can be found. Radiation fields can be found near activated objects and radioactive sources. The ALARA (As Low As Reasonably Achievable) concept is used to keep doses to radiation workers at a minimum. Certain training and dosimetry requirements are also put in place to help keep doses ALARA.

When NM4 is posted as a Radiation Area, every entrant needs to have the following:

- Access Key from the Accelerator Main Control Room, plus read and sign the RWP in the MCR
- Current Rad Worker Training
- Current NM4 Hazard Awareness Training
- Dosimeter badge
- Pocket dosimeter

When posted as a Radiation Area, untrained persons may enter the enclosure only with written permission of the RSO, which will include the requirements for entry.

When posted as Controlled Area, every entrant needs to have GERT training or be escorted by a GERT or Rad Worker trained individual.

Only personnel who have current Rad Worker Training and Radioactive Source Training [FN000048] can sign out radioactive sources from the designated “source monitor”. The names of the source monitors for NM4 are posted on the radioactive source storage box.

5 Personal Protective Equipment (PPE)

All personnel entering the NM4 experimental hall must wear sturdy, closed-toe shoes, at a minimum, during all phases of installation. Other general PPE requirements for entrants will vary during the course of the project. Current general PPE requirements will be indicated on the Daily Status Board and by signs posted on the enclosure access doors. Hard hats will be required during much of the installation phase due to extensive crane usage and other construction-related activities.

The PPE required for specific installation activities will be determined based on the hazards of the specific tasks and must be described in the associated job hazard analyses.

6 Material Handling Equipment

Overhead cranes and hoists are permitted to be operated only by employees and users who have received credit for [Fermilab Crane Operator \[FN000005/CR/01\] Training](#) and the associated evaluation course. Users must receive explicit approval from the Installation Manager before using overhead cranes or hoists.

Forklifts are permitted to be operated only by employees and users who have received credit for [Fermilab Forklift Operator \[FN000014/CR/00\] Training](#) and the associated evaluation course. Users must receive explicit approval from the Installation Manager before using forklifts.

Subcontractor personnel’s use of Fermilab material handling equipment is governed by the applicable contracts.

7 Hazards Associated with Working at Heights

Work outside of areas protected by standard guardrails requires evaluation for the need for personal fall protection when the fall distance is 4 feet or greater. Only individuals who have received credit for [Fall Protection Orientation \[FN000304\] Training](#) are permitted to enter these areas and use personal fall arrest or restraint equipment. Any use of personal fall protection equipment will require a written hazard analysis and rescue plan.

Any ladder use on the surface or mezzanine levels where the ladder is placed within a ladder-height distance from any guardrail requires the use of personal fall protection equipment. Some unloading activities on the loading dock may expose personnel to a fall hazard that will require the use of personal fall protection equipment to mitigate. If an anchor point is not already established, contact the PPD DSO for assistance.

Individuals who operate personnel lifts (such as aerial or scissor lifts) must have received credit for the Fermilab Aerial Lift Training. Untrained individuals may be permitted to be riders on a scissor lift operated by a qualified lift operator at the discretion of, and after a briefing by, the PPD DSO. Subcontractor personnel's use of Fermilab aerial lifts is governed by the applicable contracts.

Hard hats are required whenever working in an area where personnel lifts (such as aerial or scissor lifts) are in use, or in locations where work is occurring overhead. Fall protection is required when working in aerial lifts (boom or articulating).

8 Hazard Analysis Requirements

Requirements for hazard analysis, including when written hazard analyses are required, are found in [Fermilab ESH&H Manual \(FESHM\) Chapter 2060](#).

Guidelines from FESHM 2060 (APPENDIX B Table 1 – Low and High Risk Hazards), for determining when written hazard analyses are required, is attached to this training document. Consult the on-line chapter for any up-to-dates to this information.

9 Two-Person Rule

At a minimum, two personnel must be present, and in close communication, during any access to the NM4 experimental enclosure. Personnel are not to enter alone unless they are meeting with personnel they know to have previously entered. If the expected personnel are found not to be in the enclosure, then the lone individual must exit.

10 Fire and Life Safety

Any work that involves welding, burning, brazing or spark-producing grinding or cutting is regulated through the use of a Burn Permit. See FESHM 6020.2 for the associated requirements. Areas where soldering is done must be kept clear of combustible material.

Personnel must clean up the areas affected by their work. Trash needs to be removed on a daily basis. Aisles, doorways, and stairs must remain clear and passable. Storage is also not permitted under stairwells, unless explicit permission is received from the PPD DSO.

11 Emergencies

Call ext. 3131 from a lab phone (630-840-3131 from a cell phone) in the event of an emergency situation, such as personnel requiring medical treatment for any reason. Stay on the phone until the emergency operator indicates that s/he has all of the necessary information, including your name, location and nature of the emergency.

11.1 Steady Alarm (Fire Alarm)

Exit via the closest exit door; gather at the emergency assembly area, located in the NM4 north parking lot.

11.2 Whooper Alarm (Hazardous Atmosphere Alarm)

Exit via the closest exit door; gather at the emergency assembly area, located in the NM4 north parking lot.

11.3 Sitewide Emergency Warning System (SEWS)

This is a verbal communication system broadcast throughout all areas of the laboratory. It is used to notify personnel when hazardous conditions exist and what protective actions to take. It is very important that you respond to its warning tones and messages and that you follow the transmitted instructions. If the nature of the message indicates severe weather (e.g. a tornado), promptly go to the designated shelter for your area.

The designated shelter areas are the NM4 building restrooms and the lowest level of stairwells. Remain in the shelter until given directions via the safety alert monitor that it is safe to exit.

ATTACHMENT 1

FESHM 2060 APPENDIX B Table 1 – Low and High Risk Hazards

Low-Risk General Hazard (If your task has TWO or more general hazards, write a Work Plan/Hazard Analysis/Procedure)	High-Risk Hazards (If your task has ONE high-level hazard, write a Work Plan/Hazard Analysis/Procedure)
<p>Chemicals, Hazardous or Toxic Substances</p> <ul style="list-style-type: none"> Use of chemicals/materials which under a normally controlled work environment do not pose a significant safety or health hazard. (Refer to the SDS). Contact DSO or ESH&Q Section for guidance in determine the hazard level of chemicals. 	<ul style="list-style-type: none"> Use of chemicals/materials which may pose a significant safety or health hazard. (Refer to the SDS). Contact DSO or ESH&Q Section for guidance in determining the hazard level of chemicals. (FESHM 4110)
<p>Confined Space Work</p> <ul style="list-style-type: none"> Work in a space that has limited or restricted means for entry or exit. Work in a “Non-Permit Required Confined Space” or a “Permit Required Confined Space” that has been reclassified as a "non-Permit Required Confined Space". (FESHM 4230) 	<ul style="list-style-type: none"> Entry into a "Permit Required Confined Space" when not all hazards can be incorporated into the permit (FESHM 4230)
<p>Crane, Hoist, & Forklift Use</p> <ul style="list-style-type: none"> Any material handling using these types of equipment “standard” crane or forklift operations where a load is being lifted within the rated capacity using approved lifting fixtures and devices. 	<ul style="list-style-type: none"> Load requires exceptional care in handling because of size, shape, weight, close tolerance installation, high susceptibility to damage, or other unusual factors (e.g. engineered lift). (FESHM 10100) Load tests at 100% or 125% of rated capacity (FESHM 10100) Lifts involving prototype or in-house lifting devices and fixtures or attachments Planned engineered lift
<p>Cryogenic Equipment or Systems</p> <ul style="list-style-type: none"> Working with solids, liquids, or gases colder than -150 C, 200 liter or less of cryogenic material. 	<ul style="list-style-type: none"> Working with more than 200 liters of cryogenic material Transporting cryogenic dewar in an elevator (FESHM 5030 series)

<p>Electrical Work</p> <ul style="list-style-type: none"> • Tasks during which workers are likely to be exposed to voltages, currents, or stored electrical energy of sufficient magnitude and duration to startle or injure if shocking, arcing, sparking, or heating should occur. • 130 VAC or less line to neutral or ground, and primary current is limited to 30 amperes or less by circuit breakers or fuses. 	<ul style="list-style-type: none"> • Work activities near or on exposed electrical conductors, circuits, or equipment that are or may be energized and where there is a significant and unmitigated (potential) exposure to electrical shock or a significant potential for arcing, flash burns, electrical burns, or arc blast • When not all hazards can be incorporated into the Electrical Hazard Analysis/Work Permit. (FESHM 9120) • Concrete coring and cutting when hazards cannot be adequately addressed in the Electrical Work Permit (FESHM 7040) • First-time, unattended operation of non-commercial electronics or with electronics modified at Fermilab (Divisional requirements may apply)
<p>Excavation and Digging</p> <ul style="list-style-type: none"> • Trenching or excavation less than 4 feet in depth (JULIE required at minimum). 	<ul style="list-style-type: none"> • Digging or excavating in area where the potential exists for encountering buried utilities • When not all hazards can be incorporated into the Excavation Permit. Employees entering excavation/trench that is > 4 feet in depth (FESHM 7030) <p>NOTE: All excavation must be overseen by excavation competent person.</p>
<p>Fall Exposure</p> <ul style="list-style-type: none"> • Work from a ladder at 6 feet or more above the floor. • Work from a scissors lift or articulating boom lift. 	<ul style="list-style-type: none"> • Fall potential is >4 ft. when performing maintenance work, and >6 ft. when performing construction work. NOTE: HA also requires rescue plan when using fall protection equipment (FESHM 7060) • Any use of scaffolding, including erection of the scaffolding. NOTE: Any erection or dismantling of scaffolding must be overseen by scaffolding competent person.
<p>"First time use" of new or unfamiliar equipment</p> <ul style="list-style-type: none"> • Potential hazard with any first time use of mechanical or electrical equipment if a significant injury could occur. • Consider ergonomic issues. Ergonomic issues are described in the "repetitive motion" box. • Activity presenting unfamiliar hazards to employees 	<ul style="list-style-type: none"> • First time production work with new equipment designed or modified at Fermilab if a <u>significant</u> injury or property damage potential exists. Examples: start of production with a large new mechanical machine is a high hazard, but starting use of a small low-power printed circuit board is not.

<p>Flammable Gas Areas</p> <ul style="list-style-type: none"> • Flammable gas areas are classified by fire risk and must be reviewed to determine the risk class (un-reviewed areas are Class 2). • Risk Class 0: risk of small local flash fire. 	<ul style="list-style-type: none"> • Work in a Flammable Gas Risk Class I: Risk of a local fire, Risk Class II: Risk of a general fire. • All un-reviewed Flammable Gas Risk areas are Class 2. (FESHM 6020.3)
<p>Hand Tools</p> <ul style="list-style-type: none"> • Using commercially available tools with a sharp blade or edge (i.e. an Exacto knife). • Using homemade tools with a sharp blade or edge. • Using a modified tool, a non-commercial tool and/or a tool designed or fabricated at Fermilab. 	<ul style="list-style-type: none"> • Changing the cutting mechanism or blade on a non-commercial tool. Handling a sharp blade or cutting tool while completing any type of maintenance on non-commercial tools. • Non-routine work requiring the use of sharp instruments or cutting tools where the worker is exposed to the unguarded cutting surface.
<p>Hydraulic and Pneumatic Systems (“Fluids such as oil, water, air, etc.)</p> <ul style="list-style-type: none"> • Connecting hoses or lines to pressurized oil, water, or air systems. • Pressure washing operations or power sprayers. 	<ul style="list-style-type: none"> • Any work where a sudden uncontrolled release (failure) of pressure or fluids could result in injury (e.g. people working around a heavy object supported hydraulically could get "caught between") or impact to the environment (air, land, or water). • Modifying or reconfiguring hydraulic or pneumatic systems. • Operating hydraulic cutters.
<p>Lasers</p> <ul style="list-style-type: none"> • Laser systems can present electrical, chemical, and eye or skin hazards from intense visible light. • Lasers are classified on a scale of 1 (safe) to 4 (dangerous). Refer to FESHM 4260. 	<ul style="list-style-type: none"> • Work with a Class 3b or 4 laser (FESHM 4260) <p>Note: Work with a class 3b or 4 laser requires Laser Safety Officer approval, eye examination and training.</p>
<p>Machining and Grinding</p> <ul style="list-style-type: none"> • Work requiring an unusual or awkward position (e.g. overhead grinding, etc.). • Any work that generates sparks in an area with flammable liquids or combustible materials, or in a confined space. 	<ul style="list-style-type: none"> • Machining or grinding hazardous materials such as lead, uranium, etc. • Removal of structural welds on large weldments. • Machinery operated without appropriate guards. This should only be done when there is no other option available.
<p>Magnetic Fields</p> <ul style="list-style-type: none"> • Magnetic fields as low as 2.5 gauss can cause cardiac pacemakers, metallic implants, and other medical devices to function improperly (FESHM 4270). 	<ul style="list-style-type: none"> • Work in > 2.5 gauss field if personnel are fitted with cardiac pacemakers or metallic implants • Work near any area with a fringe field of more than 1 kilogauss (FESHM 4270) • Any time averaged exposure of people to 300 gauss or more. • Any situation where ferrous objects can be subject to magnetic forces causing sudden or unexpected movement into the magnetic field.

<p>Noise Hazard</p> <ul style="list-style-type: none"> • Eight hours of work in an environment where you must raise your voice (but not shout) to be heard from a distance of 3 feet. • Communication is difficult due to noise 	<ul style="list-style-type: none"> • Two hours of work or more per day in an un-posted environment where it is necessary to shout in order to be heard from a distance of 3 feet. (FESHM 4140) • Work that exceeds a posted noise hazard limitation. (Typically 8 hrs. @ 85 dbA) (FESHM 4140).
<p>Other Work Environments</p> <ul style="list-style-type: none"> • Nuisance dust from general cleaning, sweeping, or windy conditions. • Work in areas of excessive heat or cold. 	<ul style="list-style-type: none"> • Exposure to animal feces during clean-up operations (birds, rodents, raccoons, etc.) • Prolonged work in temperatures above 86 degrees F or below 25 degrees F. (FESHM 4250)
<p>Radiation</p> <ul style="list-style-type: none"> • Work on Class 1 < 1mR/hr or Class 2 < 10mR/hr radioactive items except if a Radiation Work Permit is being followed. • Using radioactive sources. 	<ul style="list-style-type: none"> • When a Radiation Work Permit is required and not all hazards can be incorporated into the RWP. (See FRCM Article 322) • Moving sources between buildings. • Work that will generate a mixed (radioactive + regulated) waste.
<p>Repetitive Motion or Ergonomically Challenging Tasks</p> <ul style="list-style-type: none"> • Lifting unusually shaped or heavy (less than 50 lbs., greater than 50 lbs. requires assistance) objects. • Tasks with repetitive motion tasks, a workstation assessment should be considered (FESHM 4120) • Work conducted from awkward positions - stooping, twisting, stretching, etc. 	
<p>Respiratory Hazards</p>	<ul style="list-style-type: none"> • Work that requires respirator protection due to a potential overexposure. (FESHM 4150)
<p>Release/Spill Potential</p>	<ul style="list-style-type: none"> • Potential release of hazardous materials (list found in FESHM 8030, 40CFR302, and 40CFR355). • Potential release of chemicals, petroleum products, etc. to surface waters (streams or ponds) or drains that lead to surface waters. • Potential release, intentional or unintentional, of chemicals, petroleum products, etc. to the sanitary system.

<p>Stored Energy</p> <ul style="list-style-type: none"> • Work near equipment that has the potential to release stored energy through falling, rotating, or other unplanned movement NOT covered by a LOTO procedure. • Work on or near computer actuated mechanical equipment. 	<ul style="list-style-type: none"> • Any unusual arrangement of heavy objects. Other mechanical stored energy hazards (e.g. springs). • Work on equipment where there is potential for unexpected release of energy (hydraulic, pneumatic, thermal, potential, etc.) where LOTO is required.
<p>Waste Generation</p> <ul style="list-style-type: none"> • Work that will generate waste that has a flash point below 140 degrees F, a pH below 2 or greater than 12.5, or which contains any toxic substance (see Safety Data Sheet). 	<ul style="list-style-type: none"> • Work that will generate a mixed (radioactive + regulated) waste. • Work that will generate more than <u>5 gallons</u> of regulated waste.
<p>Welding, flame cutting, brazing, open flame work</p> <ul style="list-style-type: none"> • Welding work in an area where passers-by can see the arc. • Work requiring welding, brazing, or open flames (FESHM 6020.2) 	
<p>Work in spaces controlled by other D/S's</p> <ul style="list-style-type: none"> • This includes all Collision Halls. See High Hazard section. 	<ul style="list-style-type: none"> • Always considered a high hazard until analyzed to determine if the severity of an incident would have serious impact on operations.

Signature Page and Training Record

"I have read the **NM4 Experimental Enclosure Hazard Awareness Training [PDNM4EXP/CB/01] Handout** and understand the hazards present within the facility. Also, I agree to follow all of the listed work rules and emergency procedures."

Print your name: _____ Fermilab ID#: _____

Division/Section/Affiliation: _____ Department/Group: _____

Fermilab Phone #: _____ Mail Station: _____

Email address: _____

Your signature: _____

Today's Date: _____

If you have not completed this training online, please complete this form and return it to:

Raymond Lewis, MS 355

-----FOR ADMINISTRATIVE USE ONLY-----

Course: **NM4 Experimental Enclosure Hazard Awareness Training [PDNM4EXP/CB/01]**

TRAIN group assignment: _____

Authorization: _____

(Must be signed by ESH&Q personnel)