



FESHM 2060: WORK PLANNING and HAZARD ANALYSIS

Revision History

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1.0 INTRODUCTION

The goal of the work planning and hazard analysis (HA) process is to initiate thought about the hazards associated with work and how it can be performed safely. Careful planning of a job assures that it is performed efficiently and safely. Work planning ensures the scope of the job is understood, appropriate materials are available, all hazards have been identified and mitigation efforts established, and all affected employees understand what is expected of them. Hazard analysis is a critical part of work planning.

This policy applies to all Fermilab personnel; including experimenters, temporary employees and subcontract/term employees. Specific procedures for service and construction subcontractors may be found in the FESHM 7000 chapter series.

2.0 POLICY

All work activities shall be subject to work planning and hazard analysis. Depending on the complexity of the task and the hazards involved, the HA process may be a mental exercise and verbal discussion, or it may be more formal with a written hazard analysis and pre-job briefing. **Appendix A and Table 1 in Appendix B shall be used in making that determination.** Employees and supervisors are to use professional judgment in determining the need for a written HA. The advice of the division/section Senior Safety Officer (SSO) or ES&H Section should be sought if assistance is needed.

3.0 DEFINITIONS

Hazard Analysis – Tool used to assess hazards and plan work accordingly.

HA Form PDF Version - <http://esh-docdb.fnal.gov/cgi-bin/ShowDocument?docid=1209>

HA Form Word Version - <http://esh-docdb.fnal.gov/cgi-bin/ShowDocument?docid=1209>

Job Site Walk Down – A visit to the job site for the purpose of identifying work control and ES&H issues that must be addressed prior to beginning work.

Pre-job Briefing – Dialogue between supervisor and those involved in the work to ensure that all understand the scope of what is to be accomplished, procedural steps, roles and responsibilities, and hazards and controls.

Post-job Review – A review of the work that has been performed to identify any improvements or experiences that should be recorded for future job planning efforts.

Work Planning – Systematic process for determining methods for completing the assigned task safely and efficiently. The process includes defining the work to be performed and the methods for performing the work, identifying the hazards and their controls, hazard analysis (possibly a written one) and a pre-job briefing.



4.0 RESPONSIBILITIES

A responsibilities section is included only if there are any responsibilities which are unusual, i.e., different than those indicated in [FESHM 1030](#).

4.1 Division/Section/Center Heads

Division/Section/Center Heads are responsible for implementing this policy within each division/section.

NOTE: A division/section/center head may choose to impose more stringent requirements than those described in this policy. Additional requirements must be documented by internal procedures.

4.2 Supervisors and Employees

Supervisors and employees are responsible for planning the work and identifying those activities that require a written HA. Table 1 in Appendix B shall be used to assist in determining when a written HA is required. Table 2 in Appendix B defines the need for secondary review and/or notification.

The supervisor is also responsible for:

- Ensuring HAs are developed and reviewed by the employee before work begins.
- Ensuring written HAs are signed by the affected employees.
- Seeking advice from Senior Safety Officer or others, as appropriate.
- Approving written HAs completed by employees in their group.
- If necessary, conducting a job walk-down to analyze the hazards and determine if a HA is required. Conducting a pre-job briefing with employees before work begins.
- Ensuring employees are trained in the process of developing an HA.
- Ensuring employees are trained to work in the area of the job and trained in the tools/equipment to be used in the completion of the job.
- Assuring the work is performed in accordance with the hazard analysis.

4.3 Senior Safety Officers (SSO)

Senior Safety Officers (SSO) or designee, are responsible for providing technical expertise in job planning and preparing written HAs.

4.4 The ESH&Q Section

The ESH&Q Section will provide training support by developing a standard lesson plan for preparing a work plan and writing HAs. The ES&H Section will also provide assistance in preparing and reviewing HAs upon request.

5.0 PROGRAM DESCRIPTION



This section is used for "Program" chapters only. It should be sufficiently detailed to identify clearly those entities responsible for program implementation. The last statement in the program description refers to the availability of a Technical Appendix.

6.0 PROCEDURES

6.1 Work Plan Process

The work plan process consists of six elements: job site walk down, hazard analysis, pre-job briefing, performance of the work, post-job review, and HA record retention.

6.1.1. Job Site Walk Down

In those instances where the job site can be safely accessed, an inspection of the job site should be conducted. Ideally this inspection should be conducted prior to developing the hazard analysis in order to assure all job site hazards and work control issues are identified and addressed. Otherwise, the job site walk down shall be conducted by the workers prior to beginning, as part of the pre-job briefing.

6.1.2. Hazard Analysis Process (illustrated in Appendix A)

1. The supervisor and employees develop the hazard analysis if required by Appendix B, Table 1. ES&H professionals are available within all divisions/sections/centers to assist in the development of an HA. The 2060.1 Hazard Analysis Form contains information to help complete a hazard analysis. You are required to write a Hazard Analysis if:
 - a. The task involves two or more of the low-risk general hazards or one high-risk hazard in Appendix B Table 1. [NOTE: An additional written HA is not required if the work activity is performed under a standard operating procedure or if the work activity involves the use of a permit where all the hazards and their mitigation requirements are identified and addressed. Examples of this could include lockout/tagout procedures, radiation work permits, confined space permits, excavation permits, and electrical hazard analysis/work permits, or the area postings requiring certain PPE. In all cases, job planning and some form of pre-job briefing are required.]
 - b. The task is outside the normal duties and responsibilities for your group and involves one or more hazards from Appendix B Table 1.
 - c. The task involves complex activities of more than one day duration and at least one hazard from Appendix B Table 1.
 - d. If, in your judgment, the task is complicated and would be done more safely using a written Work Plan/Hazard Analysis, then a HA should be completed.
2. Using Appendix B Table 2, determine if the hazards of the job exceed the thresholds indicated and determine the appropriate level of review or notification necessary.
3. If a written HA already exists, it must be reviewed and revised as appropriate for current job site conditions and to incorporate previous work experiences and lessons learned.



4. The preparation of the written HA will include or involve the following aspects:
 - a. Detailed scope of work, including how the person/team intends to complete the work;
 - b. Walk down or inspection of the work area and equipment while planning the work;
 - c. Identification of materials to be used;
 - d. Identification of hazards;
 - e. Identification of work requirements, controls, procedures, instructions and personal protective equipment necessary to perform the work safely (including permits); and
 - f. Involvement of the workers in the preparation of the work plan.
5. The level of detail in the HA should be relative to the complexity of the work and the hazards involved with the activity. For instance, cleaning and painting magnet components on an open worktable would require less detail than the same activity in the Main Injector Tunnel while standing on a ladder.
6. The supervisor will review the HA for completeness and thoroughness and determine whether the hazards for the work activity have been adequately identified and controlled. Permits, Safety Data Sheets (SDS), etc., shall be attached to the written hazard analysis (to the extent possible) to consolidate the work package. The supervisor will then approve the HA.
7. “Generic” HAs may be used and are those that would be routinely used for a specific activity (e.g., asbestos removal). They shall be reviewed by the employees and updated as necessary prior to each specific activity to ensure that all hazards of the work and the job site are addressed. In all cases, some form of pre-job briefing at the job site is required.
8. Emergency repair activities may be required during off-shift hours. If a written procedure or hazard analysis for the work to be performed exists, it shall be reviewed and updated to incorporate field conditions. If a hazard analysis needs to be written, this can be done in the field. Verbal approval from the supervisor is to be sought in lieu of a signature. In all cases, a pre-job briefing is required. Under no circumstances shall an emergency serve as a reason for ignoring established safe work practices.

6.1.3. Pre-Job Briefing

1. The supervisor and employees performing the job shall discuss the work plan to ensure everyone is aware of how the job will proceed. For low-risk tasks the briefing may be a quick exchange between the supervisor and employee(s), or a mental review by the employee. For more complex and higher-risk tasks, a more detailed and formal pre-job briefing is required. The HA form can be used to conduct this briefing. The pre-job briefing shall consist of the following:
 - a. Summarizing the critical steps and materials.



This includes steps where the success depends solely on the individual work, and that serious injury or significant loss of property could result from not following the prescribed safe work procedures.

b. Anticipating what can go wrong or where errors can occur.

This includes distractions, confusing procedures, inexperience and assumptions. Examining what errors have occurred with the activity in the past may be helpful.

c. Foreseeing consequences

What is the worst that could happen? Work plans should incorporate defenses to prevent the incident.

d. Review operating experience.

How has the task gone in the past? Work plans should incorporate defenses to prevent a repeat incident. The SSO is a good informational source in this area.

e. Review of Equipment

Review of PPE, equipment necessary for the job, engineering controls, and equipment controls.

2. All who review the written HA will document the review by signing the form. Only then can the supervisor allow the work to begin.

6.1.4. Performance of Work

1. The work plan/hazard analysis shall be posted in the work area or shall be readily available to those performing the work. Any visitors to the job site must also review and sign the written HA.
2. The work activity must be completed in accordance with the HA. Work activity shall cease immediately if: There is a change in the work scope, work conditions change, new hazards are identified, or the controls prove inadequate or ineffective. If work activity is ceased for any of these reasons, the HA shall be reviewed by the employees and supervisor and revised as necessary. Approval/concurrence must be obtained before the work is continued.

6.1.5. Post Job Review

After the activity has been completed, the HA should be updated to include improvements that were identified while performing the work. This will help assure better planning and a safer work experience the next time the job is performed.

6.1.6. HA Record Retention

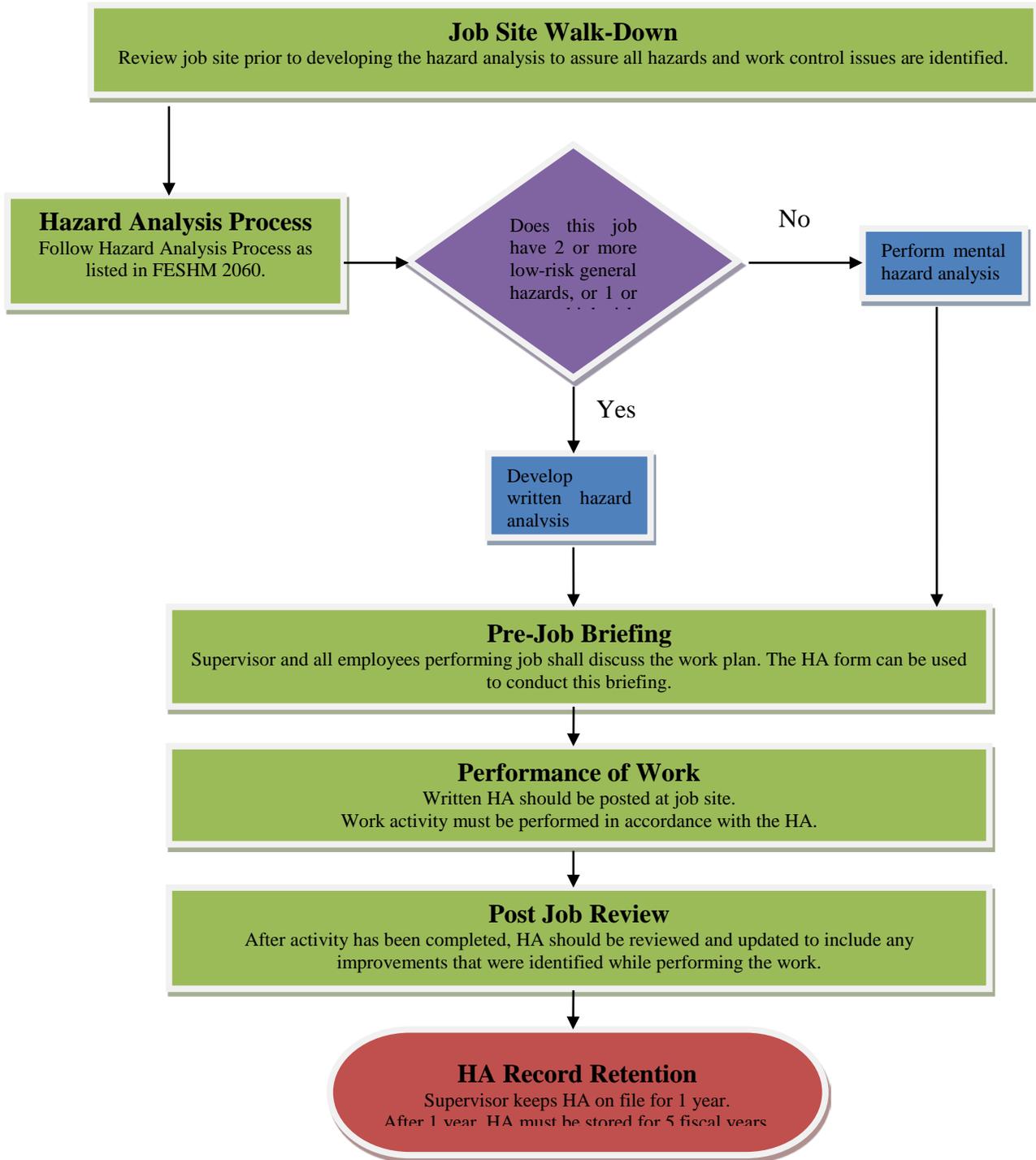
The supervisor will keep a copy of the HA for training employees. These will be made available to the SSO or anyone who requests them, for the purposes of providing oversight, trending, and/or lessons learned.



In general, a written work plan/hazard analysis should be kept on file (readily accessible) for 1 year. HA's must be stored for 5 fiscal years after the year in which the work took place.



Appendix A Planning for Safety – Hazard Analysis Process





7.0 TECHNICAL APPENDICES

7.1 Appendix B

7.2 Table 1 – Low and High Risk Hazards

Low-Risk General Hazard (If your task has TWO 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 Use of chemicals/materials which under a normally controlled work environment do not pose a significant safety or health hazard. (Refer to the MSDS). Contact D/S/C ES&H for guidance in determine the hazard level of chemicals.</p>	<p>Use of chemicals/materials which may pose a significant safety or health hazard. (Refer to the MSDS). Contact D/S/C ES&H for guidance in determine the hazard level of chemicals. (FESHM 5051)</p>
<p>Confined Space Work 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 5063)</p>	<p>Entry into a "Permit Required Confined Space" when not all hazards can be incorporated into the permit (FESHM 5063)</p>
<p>Crane, Hoist, & Forklift Use 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.</p>	<p>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 5021) Load tests at 100% or 125% of rated capacity (FESHM 5021) Lifts involving prototype or in-house lifting devices and fixtures or attachments Planned engineered lift</p>
<p>Cryogenic Equipment or Systems Working with solids, liquids, or gases colder than -150 C, 200 liter or less of cryogenic material.</p>	<p>Working with more than 200 liters of cryogenic material Transporting cryogenic dewar in an elevator (FESHM 5030 series)</p>



<p>Electrical Work 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.</p>	<p>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 5042) 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>
<p>Excavation and Digging Trenching or excavation less than 4 feet in depth (JULIE required at minimum).</p>	<p>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) <i>NOTE: All excavation must be overseen by excavation competent person.</i></p>
<p>Fall Exposure Work from a ladder at 6 feet or more above the floor. Work from a scissors lift or articulating boom lift.</p>	<p>Fall potential is >4 ft. when performing maintenance work, and >6 ft. when performing construction work. HA also requires rescue plan when using fall protection equipment (FESHM 5066) Any use of scaffolding, including erection of the scaffolding. <i>NOTE: Any erection or dismantling of scaffolding must be overseen by scaffolding competent person.</i></p>



<p>"First time use" of new or unfamiliar equipment</p> <p>Potential hazard with any first time use of mechanical or electrical equipment if a significant injury could occur.</p> <p>Consider ergonomic issues. Ergonomic issues are described in the "repetitive motion" box.</p> <p>Activity presenting unfamiliar hazards to employees</p>	<p>First time production work with new equipment designed or modified at Fermilab if a <u>significant</u> injury or property damage potential exists.</p> <p>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>
<p>Flammable Gas Areas</p> <p>Flammable gas areas are classified by fire risk and must be reviewed to determine the risk class (un-reviewed areas are Class 2).</p> <p>Risk Class 0: risk of small local flash fire.</p>	<p>Work in a Flammable Gas Risk Class I: Risk of a local fire, Risk Class II: Risk of a general fire.</p> <p>All un-reviewed Flammable Gas Risk areas are Class 2. (FESHM 6020.3)</p>
<p>Hand Tools</p> <p>Using commercially available tools with a sharp blade or edge (i.e. an Exacto knife).</p> <p>Using homemade tools with a sharp blade or edge.</p> <p>Using a modified tool, a non-commercial tool and/or a tool designed or fabricated at Fermilab.</p>	<p>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.</p> <p>Non-routine work requiring the use of sharp instruments or cutting tools where the worker is exposed to the unguarded cutting surface.</p>
<p>Hydraulic and Pneumatic Systems ("Fluids such as oil, water, air, etc.)</p> <p>Connecting hoses or lines to pressurized oil, water, or air systems.</p> <p>Pressure washing operations or power sprayers.</p>	<p>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).</p> <p>Modifying or reconfiguring hydraulic or pneumatic systems.</p> <p>Operating hydraulic cutters.</p>
<p>Lasers</p> <p>Laser systems can present electrical, chemical, and eye or skin hazards from intense visible light.</p> <p>Lasers are classified on a scale of 1 (safe) to 4 (dangerous). Refer to FESHM 5062.1.</p>	<p>Work with a Class 3b or 4 laser (FESHM 5062.1)</p> <p>Note: Work with a class 3b or 4 laser requires Laser Safety Officer approval, eye examination and training.</p>



Machining and Grinding 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.	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.
Magnetic Fields Magnetic fields as low as 2.5 gauss can cause cardiac pacemakers, metallic implants, and other medical devices to function improperly (FESHM 5062.2).	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 5062.2) 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.
Noise Hazard 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	Two hours of work or more per day in an unposted environment where it is necessary to shout in order to be heard from a distance of 3 feet. (FESHM 5061) Work that exceeds a posted noise hazard limitation. (Typically 8 hrs. @ 85 dbA) (FESHM 5061).
Other Work Environments Nuisance dust from general cleaning, sweeping, or windy conditions. Work in areas of excessive heat or cold.	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 5065)
Radiation 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.	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.



Repetitive Motion or Ergonomically Challenging Tasks 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 5084) Work conducted from awkward positions - stooping, twisting, stretching, etc.	
Respiratory Hazards	Work that requires respirator protection due to a potential overexposure. (FESHM 5103)
Release/Spill Potential	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.
Stored Energy 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.	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.
Waste Generation 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).	Work that will generate a mixed (radioactive + regulated) waste. Work that will generate more than <u>5 gallons</u> of regulated waste.
Welding, flame cutting, brazing, open flame work Welding work in an area where passers-by can see the arc. Work requiring welding, brazing, or open flames (FESHM 6020.2)	



Work in spaces controlled by other D/S's

This includes all Collision Halls. See High Hazard section.

Always considered a high hazard until analyzed to determine if the severity of an incident would have serious impact on operations.

**7.3 Table 2 – Hazards That Require Secondary Review of HA**

Hazards That Require Secondary Review of HA <i>(Who reviews HA)</i>	Notification of Work
Crane, Hoist, & Forklift Use Below-the-hook lifting devices require engineering note and review Lifts involving prototype or homemade lifting devices and fixtures or attachments Planned engineering lift outside rated load capacity <i>(D/S/C Engineering Reviewer)</i>	Notify D/S/C ES&H.
Cryogenic Equipment or Systems Any work with more than 200 liters of cryogenic material. <i>(D/S/C Engineering Reviewer)</i>	
Electrical Work Work on AC electrical power distribution system requires an Electrical Hazard Analysis/Work Permit. <i>(D/S/C Electrical Coordinator)</i>	
Flammable Gas Areas Work in class 1 or 2 flammable areas <i>(D/S/C Department Head)</i>	Notify D/S/C ES&H of work in flammable gas Class I or II areas.
Lasers Any work with a Class 3b or higher laser. <i>(D/S/C ES&H Laser Safety Officer)</i>	
Radiation Work in a High Radiation Area, on or with Class 2-5 objects, with activated liquids, depleted U2, or contaminated objects, requires a Rad Work Permit (RWP). <i>(D/S/C Radiation Safety Officer)</i>	Notify D/S/C ES&H and ES&H Section prior to moving any source to another building.