

MARSHALL PROCEDURES AND GUIDELINES

MPG 1700.1

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MSFC INDUSTRIAL SAFETY PROCEDURES AND GUIDELINES

Responsible Office: CR01/Safety and Mission Assurance Office

NOTE: Certain sections/chapters have been canceled as noted herein.

Preface

P.1 PURPOSE

In order to provide employees a safe and healthful workplace, the Marshall Space Flight Center (MSFC) Safety and Mission Assurance (S&MA) Office, through the implementation of an aggressive safety and health program, has set forth safety and health policies, responsibilities, and procedures in compliance with the latest applicable Federal, National Aeronautics and Space Administration (NASA), and MSFC safety and health regulations, guidelines, and standards.

The purpose of these MSFC Industrial Safety Guidelines and Procedures is to explain how the program will be conducted in compliance with Occupational Safety and Health Administration (OSHA), NASA, and MSFC requirements and policies, and to establish responsibilities and guidelines for employees to prevent injury, illness, and loss or damage to NASA/MSFC property. These procedures and guidelines are applicable to all persons on MSFC property to include contractors involved in MSFC operations.

P.2 APPLICABILITY

This Directive applies to:

- a. All ground-based activities conducted by or at MSFC.
- b. All persons on MSFC property.
- c. All MSFC facilities, systems, equipment, and property.
- d. All contractors involved in MSFC operations.

P.3 AUTHORITY

- a. Public Law 91-596, "Occupational Safety and Health Act of 1970"
- b. Executive Order 12196, "Occupational and Health Programs for Federal Employees"
- c. 28 CFR 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters"
- d. 29 CFR 1910, "Occupational Safety and Health Standards"
- e. 29 CFR 1926, "Safety and Health Regulations for Construction"

f. NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"

g. NHB 2710.1, "Safety and Health Handbook - Occupational Safety and Health Program"

P.4 REQUIREMENTS

All MSFC elements will comply with MPG 1700.1, "MSFC Industrial Safety Procedures and Guidelines", and applicable health instructions.

P.5 CANCELLATION

MM 1700.4 dated December 16, 1983; MMI 1700.1 dated September 20, 1985; MMI 1700.6 dated June 7, 1988, MMI 1700.8 dated March 5, 1991; MMI 1700.10 dated February 26, 1993; MMI 1700.11 dated August 30, 1985; MMI 1700.14 dated December 16, 1985; MMI 1700.16 dated January 6, 1983; MMI 1710.1 dated February 8, 1988; MMI 1710.3 dated March 4, 1985; MMI 1710.4 dated July 18, 1988; MMI 1710.10 dated June 26, 1980; MMI 1711.2 dated August 10, 1989; and MMI 1720.1 dated April 30, 1985

Original signed by

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Director

Distribution:
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CHAPTER 1

PURPOSE, PLANNING, AND ADMINISTRATION

SECTION 1-1

PURPOSE

This document establishes the procedures and guidelines for the MSFC Industrial Safety Program.

SECTION 1-2

SCOPE

- 1-2.1.** This directive is applicable to:
 - 1-2.1.a.** MSFC organizations, elements, entities, and individuals.
 - 1-2.1.a.** MSFC controlled property, equipment, systems, and facilities.
 - 1-2.1.a.** Contractors and industrial partners involved in MSFC operations as required by contracts and agreements.
 - 1-2.1.a.** Persons doing business on MSFC property.

SECTION 1-3

POLICY

1-3.1. MSFC's industrial safety policy is to:

1-3.1.a. Prevent:

- (1) Loss of life or personnel injury.
- (2) Equipment or property damage or loss.
- (3) Mission or test failures.
- (4) Events that could cause adverse public reaction.

1-3.1.b. Use an organized and systematic approach to identify and control hazards from conception to completion of all MSFC activities.

1-3.1.c. Eliminate or control hazards by corrective action with the following priorities:

- (1) Eliminate hazards by design.
- (2) Minimize or negate the effects of hazards by design.
- (3) Install safety devices.
- (4) Install caution and warning devices.
- (5) Develop administrative controls, including special procedures.
- (6) Provide personal protective equipment.

SECTION 1-4

PROTECTION OF THE PUBLIC

- 1-4.1.** MSFC strives to provide protection to the general public from any adverse effects of MSFC controlled operations. If protection can be afforded through exclusion, adequate security measures are imposed to limit public access and exposure. If protection must be afforded by safety restriction, adequate precautions and controls are implemented based on the hazards identified by analysis.
- 1-4.1.** The MSFC Emergency Coordinator establishes cooperative plans with the local community including:
- a)** Ensuring community awareness of the nature and extent of actual and potential hazards arising from MSFC operations and the measures being taken to protect the community.
 - a)** Developing joint disaster evacuation plans.
 - a)** Participating jointly in community safety activities.
- 1-4.1.** Research personnel who are neither contractors nor visitors, yet allowed access to MSFC facilities to conduct individual research under grants or other auspices, shall comply with all the requirements of this handbook, including taking the same safety indoctrination training required for new NASA employees. If their activities are potentially hazardous to personnel or property, they shall submit a written safety plan to the Industrial Safety Office (ISO) for approval prior to starting work. The NASA organization responsible for the work area of these personnel is responsible for assuring compliance.

SECTION 1-5

APPLICABLE DOCUMENTS

1-5.1. PURPOSE

To identify key applicable standards, regulations, and requirements of the MSFC Industrial Safety Program. Other reference documents are listed in Appendix 1.

1-5.1. FUNCTIONS

MSFC complies with all applicable Local, State, Federal, and consensus codes and standards. Where similar requirements exist, MSFC complies with the most stringent.

1-5.1. CODE OF FEDERAL REGULATIONS (CFR)

1-5.1.a. 29 CFR 1910, “Occupational Safety and Health Standards”

1-5.1.b. 29 CFR 1926, “Safety and Health Regulations for Construction”

1-5.1.c. 29 CFR 1960, “Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters”

1-5.1.d. 45 CFR 46, “Protection of Human Subjects”

1-5.1.e. 49 CFR, Subpart B, “Hazardous Materials Transportation and Pipeline Safety”

1-5.1.f. 49 CFR, Subpart C, “Hazardous Materials Regulations”

1-5.1. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

National Fire Codes

1-5.1. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

1-5.1.a. NHB 1700.1(V1), “NASA Safety Policy and Requirements Document”

1-5.1.b. NHB 1700.1(V2), “Guidelines for Mishap Investigation”

1-5.1.c. NHB 1700.6, “Guide for In-service Inspection of Ground-Based Pressure Vessels and Systems”

1-5.1.d. NHB 2710.1, “Safety and Health Handbook - Occupational Safety and Health Program”

1-5.1.e. NASA-STD 8719.1, “Aerospace Pressure Vessel Safety Standard”

1-5.1.f. NASA-STD 8719.4, “Medium Weight Pressure Vessel Safety Standard”

1-5.1.g. NASA-STD 8719.9, “Safety Standard for Lifting Devices and Equipment”

1-5.1.h. NASA-STD 8719.10, “Safety Standard for Underwater Facility and Non-Open Water Operations”

1-5.1.i. NASA-STD 8719.11, “Safety Standard for Fire Protection”

1-5.1.j. NASA-STD 8719.12, “Safety Standard for Explosives, Propellants, and Pyrotechnics”

1-5.1.k. NASA-STD 8719.13, “Software Safety Standard”

1-5.1.l. NASA-STD 8719.15, “Safety Standard for Oxygen and Oxygen Systems”

1-5.1.m. NASA-STD 8719.16, “Safety Standard for Hydrogen and Hydrogen Systems”

1-5.1. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

All Standards as applicable.

SECTION 1-6

DEFINITIONS

For the purpose of this document, the following terms are defined as stated in this section. Additional definitions are listed in specific sections.

Accepted Risk - A hazard whose risk is not eliminated or controlled and that has been accepted by management in accordance with the requirements of this section.

Basic Organizations - The primary directorates, offices, and laboratories at MSFC.

Certified Personnel - Personnel who have completed required training and whose specified knowledge or proficiency in a skill has been demonstrated and documented.

Close Call - A close call is an unexpected occurrence, event, or sequence of events which does not meet the definition of a mishap, but bears reasonable probability to be a mishap in the event of recurrence.

Controlled Hazard - A hazard where the likelihood of occurrence or severity of the associated undesirable event has been reduced to an acceptable level - generally a Priority 3 or 4 as determined by Section 1-13, "Risk Assessment and Acceptance," and approved by the responsible basic organization and the ISO.

Direct Reports - Employees for whom a supervisor, manager, or director is responsible for conducting their performance appraisal.

Eliminated Hazard - A hazard that has been eliminated by completely removing the hazard casual factors.

Hazard - A condition that could cause injury, illness, or death, or that could result in damage to property or loss of equipment, or impact to the environment.

Hazard Assessment - The systematic identification and evaluation of existing and potential hazards and the recommended mitigation for the hazard sources found, based on risk assessment.

Hazard Status - Hazard status is cited as follows:

Open - Corrective action(s) to eliminate or control the hazard has not been completed.

Closed - Corrective action(s) to eliminate or control the hazard has been completed.

Accepted Risk - By definition.

Mishap - A mishap is an unexpected occurrence, event, or sequence of events which results in injury or death to employees or visitors, or damage to NASA equipment or property. See Section 8-1 for the definitions of the mishap classifications.

Potentially Hazardous Operations or Facilities - Any operation, process, facility, or equipment that has a high potential to result in serious injury or death to personnel, or damage and/or destruction of property. These operations may involve explosives, propellants, high energy, high pressure, oxidizers, corrosives, high elevations, cryogenics, hostile atmosphere, flammables, high electrical energy, radiation, noise, hyperbaric or hypobaric environment, toxic material, critical hardware, etc.

Residual Risk - Risk that remains from a hazard after all mitigation and controls have been applied.

Accepted Risk - A hazard whose risk is not eliminated or controlled and that has been accepted by management in accordance with the requirements of this section.

Risk - As applies to safety, exposure to the chance of injury or loss. It is a function of the possible frequency of occurrence of an undesired event, of the potential severity of resulting consequences, and of the uncertainties associated with the frequency and severity.

Risk Assessment - The process of risk categorization or quantitative risk estimation, followed by the evaluation of risk significance.

SECTION 1-7

RESPONSIBILITIES

1-7.1. Each director, manager, and supervisor is responsible for the safety of personnel and property under his/her control, with timely monitoring, surveillance, and support provided by the S&MA Office.

1-7.2. Safety responsibilities are as follows. Additional responsibilities concerning specific activities are listed in the related sections of this document.

1-7.2.a. Director, MSFC:

- (1) Guides and directs the safety program for MSFC.
- (2) Addresses safety issues/concerns to MSFC employees as needed.
- (3) Ensures safety meetings with employees (direct reports) are conducted monthly.
- (4) Conducts walk-through inspections of activity areas.
- (5) Ensures that controls for safety issues and concerns are integrated into the total management system.
- (6) Evaluates the safety performance of employees (direct reports) using the performance appraisal process.

1-7.2.b. Director, Safety & Mission Assurance Office:

- (1) Serves as the Designated Safety Official for MSFC. [NHB 1700.1(V1), paragraph 105]
- (2) Implements the MSFC Industrial Safety Program in compliance with applicable Federal, NASA, and MSFC safety policies, regulations, and standards.
- (3) Provides independent assessment of safety issues and concerns.

1-7.2.c. Directors/Managers of Basic Organizations:

- (1) Apply the safety program to assigned areas of functional responsibility.
- (2) Establish organization's safety goals.
- (3) Communicate with the ISO to resolve safety issues.
- (4) Conduct safety meetings with employees (direct reports) monthly.
- (5) Conduct inspections of potentially hazardous activity areas with area supervision and ISO representatives. [Section 4-3, Safety Inspections and Surveys]
- (6) Support the Safety and Health Committee.
- (7) Evaluate safety performance of employees (direct reports) using the performance appraisal system.
- (8) Ensure reporting and investigation of mishaps.
- (9) Inform employees of the MSFC safety program with emphasis on their rights and responsibilities. [29 CFR 1960.59]
- (10) Ensure all personnel, including visitors, contractors, and researchers working in their area of functional responsibility comply with the requirements of this document.

1-7.2.d. Director, Industrial Safety Office:

- (1) Serves as the designated MSFC Authority Having Jurisdiction (AHJ) for safety. [NASA-STD 8719.11, paragraph 102.6(11)]
- (2) Develops and propagates safety policies, standards, and procedures to implement OSHA and NASA requirements.
- (3) Establishes and maintains files of safety standards, instructions, and guidelines applicable to MSFC operations, and makes them available for employees to review.
- (4) Provides technical assistance to line and staff managers to assist in accomplishing safety-related goals and objectives.

- (5) Measures, analyzes, and maintains records of safety performance; reports performance annually to Manager of Basic Organization.
- (6) Encourages a preventive approach to safety.
- (7) Supports Safety and Health Committee meetings.
- (8) Supports directors, managers, and supervisors safety meetings.
- (9) Consults with employee representatives in the implementation of the MSFC Safety and Health program. [29 CFR 1960.12]
- (10) Maintains records and submits reports to OSHA of occupational injuries and illnesses, and posts annual summaries. [29 CFR 1960, Subpart I]
- (11) Posts Safety and Health Program information. [29 CFR 1960.12]
- (12) Performs annual comprehensive evaluations of MSFC basic organization and contractor safety programs.
- (13) Provides continuous overview and surveillance of Center potentially hazardous activities.
- (14) Receives and resolves reports of unsafe or unhealthful working conditions and maintains a log of these reports. [29 CFR 1960.28]
- (15) Provides and implements a plan for occupational safety and fire prevention training for managers, supervisors, employees, employee representatives, and safety and collateral duty safety personnel.
- (16) Reviews safety plans, hazardous procedures, and other safety sensitive documents and drawings.

1-7.2.e. Management Operations Office (MOO):

- (1) Implements the MSFC Health Program
- (2) Assures compliance with applicable health policies, regulations, and standards.

1-7.2.f. MSFC Occupational Safety and Health Committee (OS&HC):

Provides a forum for discussion and a channel for input to Center management on occupational safety and health matters.

1-7.1.a. Supervisors:

- (1) Promote safety by setting a positive example.
- (2) Ensure personnel are trained to perform in conformance with the requirements of this safety program.
- (3) Ensure procedures are used and approved by the ISO for the conduct of potentially hazardous operations.
- (4) Ensure that safety training is provided through work area safety orientations and job specific training [Section 3-2, Training and Certification].
- (5) Perform job safety evaluation for all new potentially hazardous activities, and review a minimum of one job safety evaluation each quarter per Section 4-2, "Job Safety Evaluations."

Exception 1: Supervisors that have no potentially hazardous activities in their area of responsibility.

Exception 2: Any one job analysis need not be reviewed more than once per year.

- (6) Review a minimum of one potentially hazardous procedure each quarter.

Exception 1: Supervisors who do not have responsibility for potentially hazardous procedures.

Exception 2: Any one procedure need not be reviewed more than once per year.

- (7) Conduct safety inspections of assigned areas of responsibility each month [Section 4-3, Safety Inspections and Surveys].
- (8) As directed, accompany Manager when he/she performs safety inspections of assigned area of responsibility.
- (9) Conduct safety meeting with employees (direct reports) monthly [Section 3-3, Safety Meetings].
- (10) Evaluate employees' safety performance using the performance appraisal system.

- (11) Inform employees of the specific hazards associated with their workplace and duties, location of nearest medical treatment facility, procedure for obtaining treatment, method for reporting occupational injuries or illnesses, and of their responsibilities and rights [29 CFR 1960.59].
- (12) Report and investigate mishaps, including close calls [Chapter 8, Mishaps].
- (13) Take appropriate action to protect employees in imminent danger situations.

1-7.1.b. Safety Monitors:

- (1) Assist supervisor(s) in performing safety inspections.
- (2) Inspect fire extinguishers and fire hose stations monthly.
- (3) Issue permits for portable appliances using MSFC Form 3798 (see Figure 7-1-1) .
- (4) Raise safety concerns to the ISO that cannot be corrected through normal procedures.
- (5) Perform emergency duties specified in MM 1040.3, “MSFC Emergency Plan.” (in revision as MPG 1040.3F)

1-7.1.c. Team Leads:

- (1) Assist supervisors in performing Job Safety Evaluations.
- (2) Conduct pre-operational safety checks for potentially hazardous operations.
- (3) Stop operation if an unsafe act or condition exists and report it to the supervisor or safety monitor.

1-7.1.d. Employees:

- (1) Avoid unsafe acts.
- (2) Become familiar with emergency procedures.
- (3) Report hazards to supervisor [Section 1-8, Reporting Unsafe Conditions].

- (4) Obtain and post a portable appliance permit, MSFC Form 3798, for privately owned, electrically powered appliances with heating elements [Section 7-1, Fire Prevention and Protection].
- (5) Perform tasks in accordance with safety requirements, plans, and procedures.
- (6) Stop operation if an unsafe act or condition exists and report it to the team lead, supervisor, or safety monitor.
- (7) Provide feedback to the team lead or supervisor on needed changes to procedures.
- (8) Attend and participate in safety meetings.

SECTION 1-8

REPORTING UNSAFE CONDITIONS

- 1-8.1.** Each employee has the responsibility to report unsafe or potentially unsafe conditions in the workplace. Report all suspected unsafe conditions in order of preference to:
- 1-8.1.a.** Your team lead or supervisor
 - 1-8.1.b.** MSFC Industrial Safety Office, 544-0046
 - 1-8.1.c.** MSFC's Safety Concerns Reporting System (SCRS), web address:
<http://www.msfc.nasa.gov/safety/>
 - 1-8.1.d.** MSFC Occupational Safety and Health Committee (Committee members are listed in MM 1150.1, Charter 3-19)
 - 1-8.1.e.** The safety designee listed on the "Occupational Safety and Health Protection for NASA Employees" poster.

NOTE: Personnel are required to report unsafe conditions to their supervisor. The other alternates are available if action is not considered adequate or if reprisal is feared.

- 1-8.1.** Employees may also report safety concerns via the NASA Safety Reporting System (NSRS). Forms are available in common areas of buildings at MSFC. The NSRS is a confidential, voluntary, and responsive safety reporting system that provides a direct channel for NASA employees and contractors to notify NASA Headquarters, Safety and Risk Management Division, of safety concerns. It is intended to supplement, not replace, the reporting system in paragraph 1-8.1.
- 1-8.2.** If the condition is not satisfactorily corrected, the employee may file an appeal or grievance (as appropriate) in accordance with NHB 2710.1.
- 1-8.3.** Employees are guaranteed freedom from restraint, interference, coercion, discrimination, or reprisal for exercising their rights.

SECTION 1-9

EMERGENCY PLANNING

- 1-9.1.** MSFC develops and maintains readiness and preparation for emergencies ranging from local mishaps to national emergencies and disasters, in accordance with the requirements of NPD 8710.1, "Emergency Preparedness Program."
- 1-9.2.** Written emergency plans are maintained, discussed with the appropriate personnel, and exercised periodically.
- 1-9.3.** The MSFC emergency plans are provided in MM 1040.3, "MSFC Emergency Plan." (in revision as MPG 1040.3F)

SECTION 1-10

SAFETY PROGRAM REVIEWS

1-10.1. The ISO conducts the following safety reviews:

<u>Description</u>	<u>Frequency</u>
Comprehensive Safety Inspection of Each Facility	Annually*
Laboratory/Office/Project Safety Program Surveys	Annually
On-Site Contractor Safety Program Surveys	Annually
Off-Site Prime Contractor Safety Program Surveys	As Needed
MSFC Industrial Safety Program Self-Assessment	Annually

* More frequent inspections are conducted in workplaces where there is an increased risk of accident, injury, or illness due to nature of the work performed.

1-10.1. The ISO maintains records of program surveys for at least five years. Findings and recommendations are tracked until satisfactorily resolved.

SECTION 1-11

VARIANCES

- 1-11.1.** Variances to the requirements of this document are approved by the Center Director. The ISO reviews proposed variances before submittal.
- 1-11.2.** Variances to safety requirements flowed down from NASA Headquarters' documents are also approved in accordance with the safety variance policy established in NHB 1700.1(V1).
- 1-11.3.** Variances to Federal (e.g., OSHA) and applicable State/local regulations must be approved by the appropriate Federal/State/local agency. The ISO and the NASA Headquarters Safety and Risk Management Division review all proposed variances to Federal/State/local regulations before submittal to OSHA for approval.

SECTION 1-12

OCCUPATIONAL SAFETY AND HEALTH COMMITTEE

1-12.1. AUTHORITY

- 1-12.1.a.** 29 CFR 1960, “Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters”
- 1-12.1.a.** MM 1150.1, Charter Number 3-19, “MSFC Occupational Safety and Health Committee”
- 1-12.1.a.** NHB 1700.1(V1), “NASA Safety Policy and Requirements Document”
- 1-12.1.a.** NHB 2710.1, “Safety and Health Handbook - Occupational Safety and Health Programs”

1-12.1. MEMBERSHIP

Membership is established in MM 1150.1, Charter 3-19, “MSFC Occupational Safety and Health Committee”

1-12.1. OCCUPATIONAL SAFETY AND HEALTH COMMITTEE FUNCTIONS

- 1-12.1.a.** The OS&HC provides for Center-wide management and employee visibility of the status of MSFC’s Safety and Health Program, and serves as a means to dispose of significant safety and health issues. Responsibilities are listed in MM 1150.1.
- 1-12.1.a.** An agenda is prepared in advance of meetings [NHB 2710.1, 5.2], and as a minimum includes:
 - (1)** The ISO report on significant safety issues (i.e., existing or potentially unsafe work conditions, mishap investigations, and hazard abatement plans).
 - (1)** The Environmental Health Office report on significant existing or potentially unhealthful working conditions.
 - (1)** Committee managers’ reports on significant activities related to safety and health within their respective areas of responsibility, safety and health Lessons Learned, and mishap investigations.

(2) A discussion by committee members to resolve safety and health issues including those that cut across organizational boundaries.

- 1-12.1.a.** The committee may assign action to any MSFC element. Each committee member receives a formal response to the disposition of his/her recommendations which are incorporated into the minutes. [NHB 2710.1, 5.2]
- 1-12.1.a.** Meeting minutes are forwarded to the Director of Safety, NASA Headquarters, and the Director, NASA Occupational Health Office. [NHB 2710.1, 5.2]
- 1-12.1.a.** Meetings are scheduled quarterly.

SECTION 1-13

Note: Section 1-13 was canceled by MWI 8715.7 dated December 13, 1999

RISK ASSESSMENT AND ACCEPTANCE

1-13.1. PURPOSE

Establish the guidelines for assessing the safety risks associated with MSFC ground-based activities in order to support risk acceptance by management.

1-13.1. AUTHORITY

NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"

1-13.1. RESPONSIBILITIES

1-13.1.a. Industrial Safety Office:

Assesses the safety risks or hazards associated with current and planned activities.

1-13.1.a. Directors/Managers of Basic Organizations:

Make the decision to accept a hazard with its associated risk, based upon risk assessment with coordination and concurrence by the cognizant safety official and the Program/Project Manager.

1-13.1. FUNCTIONS

1-13.1.a. Risk assessments are performed for hazards associated with current or planned ground-based activities in accordance with the requirements of NHB 1700.1(V1).

1-13.1.b. The following approach and risk assessment code (RAC) determination system is used:

- (1) **RAC** is a measure of relative risks. A RAC is composed of the Severity (I-IV) and Probability (A-E) (e.g., IA, IIA...IVC, etc.).

- (2) **Severity** is the classification of the worst credible effect that could result from a hazard. Severity levels are based on hazardous effects, and are independent of the probability of occurrence. Severity levels are defined in Table 1-13-1.

Example: An electrical hazard/shock may occur several times but may not cause death in every instance. However, if there is reasonable chance of death from this electrical source, the severity would be catastrophic, no matter how remote the likelihood of death.

- (3) **Probability** is likelihood that, given exposure to the hazard, an undesired event will occur, irrespective of how severe the consequences. The probability is assessed over the operating life of the system or program. Probability levels are defined in Table 1-13-2.

Example: Using the same example in (2) above, an electrical shock may occur several times but may not cause death in every instance. The probability would be the likelihood of getting shocked at any time.

- (4) **Corrective Action Priorities** for implementing hazard controls are assigned to each identified hazard. Priorities are based on a combination of *severity* and *probability* as determined from Table 1-13-3. The priorities presented in the table are weighted toward hazard severity. Actions for each priority are as follows:

- (a) **PRIORITY 1.** Hazards with a Priority 1 code are corrected prior to start-up or continuation of a process or operation. Corrective actions are in the form of engineering or design controls. Procedural controls for these hazards are not used as the primary control. Industrial Safety Office's concurrence, or verification that controls or an alternate means are in place, is obtained prior to start-up or restart of the operation. In those cases where management proposes an alternate means to obtain the **SAME LEVEL OF SAFETY**, an engineering justification is submitted to the ISO for approval.
- (b) **PRIORITY 2.** Hazards with a Priority 2 code are corrected, but a phased implementation of controls is allowed. Corrective actions in this category are in the form of engineering and design controls, safety devices, or other physical controls. Procedural controls are not used.

- (c) **PRIORITY 3.** Hazards with a Priority 3 code are corrected within 30 days. Engineering and design controls are the corrective action of choice; however, safety devices, personal protective equipment (PPE), and procedures are used with Industrial Safety Office's approval.
- (d) **PRIORITY 4.** Hazards with a Priority 4 code are normally considered controlled hazards. Formal response is not submitted; however, these hazards are corrected during routine repair or refurbishment operations.

Table 1-13-1 SEVERITY LEVEL CLASSIFICATION

Severity	Severity Level	Description
Catastrophic	I	This hazardous condition may cause a permanent disabling or fatal injury to personnel, and/or loss of facilities, major systems, or associated hardware.
Critical	II	This hazardous condition may cause severe injury or occupational illness, and/or major damage to facilities, systems, or flight hardware.
Moderate	III	This hazardous condition may cause minor injury or occupational illness, and/or marginal damage to facilities, systems, or equipment.
Negligible	IV	This hazardous condition may cause first aid injuries or occupational illness, and/or minimal damage to facilities, systems, or equipment.

Table 1-13-2 PROBABILITY LEVEL CLASSIFICATION

Probability	Level	Description
Imminent	A	This hazardous condition is likely to occur immediately.
Frequent	B	This hazardous condition is expected to occur several times during the life cycle of the system.
Probable	C	This hazardous condition is expected to occur during the life cycle of the system.
Remote	D	This hazardous condition is unlikely to occur during the life cycle of the system, but may occur in time.
Improbable	E	This hazardous condition is extremely remote and is not expected to occur during the life cycle of the system.

Table 1-13-3 CORRECTIVE ACTION PRIORITY CODE MATRIX

		Probability Level				
		A	B	C	D	E
Severity Level	I					
	II					
	III					
	IV					

CHAPTER 2 CONTRACTING AND PURCHASING

SECTION 2-1

CONTRACTING

2-1.1. APPLICABILITY

Applies to work performed under an MSFC contract.

Exception: Facility construction contract requirements are provided in Section 2-2, “Construction Contracting.”

2-1.1. AUTHORITY

2-1.1.a. NHB 1700.1(V1), “NASA Safety Policy and Requirements Document”

2-1.1.b. Federal Acquisition Regulations (FAR)

2-1.1.c. NASA Federal Acquisition Regulations Supplement (NFS)

2-1.1. RESPONSIBILITIES

2-1.1.a. Basic Organizations:

Coordinate with the S&MA Office in establishing the contract’s industrial safety requirements.

2-1.1.a. Contracting Officer’s Technical Representative (COTR):

(1) Ensures the contractor complies with contract safety requirements.

(2) Includes safety in the contractor’s periodic performance reviews.

2-1.1.b. Industrial Safety Office:

(1) Advises basic organization in establishing contract industrial safety requirements.

- (2) Reviews and approves the contractor's safety plan and other safety related submittals.
- (3) Assists the appropriate COTR in assuring contractors comply with the safety requirements of contract.
- (4) Serves on the Mishap Abatement Review Board (MARB).
- (5) As requested, evaluates contractor's industrial safety performance.

2-1.1.c. Procurement Office:

- (1) Incorporates the safety and health clause in accordance with the FAR.
- (2) Obtains advice, assistance, recommendations, and applicable requirements from the ISO in accordance with the NASA FAR Supplement.

2-1.1. FUNCTIONS

2-1.1.a. General

- (1) MSFC solicitations contain the safety requirements of the FAR and the NASA FAR Supplement.
- (2) The requirements for specific projects are based on the potential of:
 - (a) Personnel injury or death
 - (b) Property loss
 - (c) Mission or test failure
 - (d) Adverse NASA public reaction
- (3) MSFC solicitations require contractors to comply with the Industrial Safety Program established in this document and NHB 1700.1(V1).

Exception: Solicitations for contractors working at facilities that are not controlled by MSFC. Their industrial safety programs, as a minimum, are required to embody equivalent features.

- (1) Contractors flow down contract safety requirements to subcontractors.

2-1.1.a. Safety Plan

- (1) When required, contractors submit a safety plan detailing how they will implement and comply with the contract's industrial safety requirements throughout all phases of the contract.
- (2) Contractors are required to use the Safety Program Plan provided in NHB 1700.1(V1) as a guide in preparing their safety plan.
- (3) Contractors submit safety plans through the Contracting Officer (CO) to the ISO as soon after award of the contract as directed by the CO. The ISO approves safety plans before the contractor begins any potentially hazardous activities.
- (4) Contractors maintain the safety plan and submit changes through the CO to the ISO for approval.

2-1.1.b. Mishaps

- (1) Contractors report and investigate mishaps in accordance with Sections 8-1, "Mishap Reporting and Investigation," 8-2, "Mishap Abatement and Recordkeeping," of this document, and NHB 1700.1(V1).
- (2) Contractors support MARB's in accordance with Section 8-2, "Mishap Abatement and Recordkeeping."
- (3) Contractors working on MSFC property submit monthly summary reports to the ISO, identifying number of employees on contract and number of man-hours worked.

SECTION 2-2

CONSTRUCTION CONTRACTING

2-2.1. APPLICABILITY

Applies to construction work performed under an MSFC contract.

2-2.1. AUTHORITY

2-2.1.a. 29 CFR 1910, “Occupational Safety and Health Standards”

2-2.1.a. 29 CFR 1926, “Safety and Health Regulations for Construction”

2-2.1.a. Federal Acquisition Regulations (FAR)

2-2.1.a. NASA Federal Acquisition Regulations Supplement (NFS)

2-2.1. RESPONSIBILITIES

2-2.1.a. Facilities Office:

- (1) Coordinates the review of contractors’ safety and health plans.
- (1) Ensures contractors comply with contract safety requirements.
- (1) Ensures designs and work orders that affect fire safety are reviewed by the ISO before work is initiated.

2-2.1.a. Industrial Safety Office:

- (1) Conducts site visits to ensure contractors comply with contract industrial safety requirements.
- (1) Reviews and approves the contractors’ safety and health plans and other safety-related submittals.
- (1) Issues Hot Work Permits.
- (1) Assists Environmental Health in issuing Confined Space Entry Permits.

2-2.1. FUNCTIONS

2-2.1.a. General

- (1) Contracts comply with NASA safety requirements, including the FAR and NFS.
- (1) Contractors comply with the Industrial Safety Program established in this document.

NOTE: The Facilities Office maintains a typical “Safety and Health Plan” that contractors may use as a guide in developing their own specific plan.

- (1) Contractors use the FAR and NFS in preparing their safety plans.
- (1) The contractors’ safety and health plans are approved before they are allowed to begin potentially hazardous activities.
- (1) Contractors flow down contract safety requirements to subcontractors.
- (1) ISO presents MSFC safety issues at the preconstruction conference arranged by the Facilities Office.
- (1) MSFC ISO has stop work authority at construction sites. This authority is limited to specific construction activities which may endanger life or property. Upon exercising this authority, ISO immediately notifies the contracting officer of the reason for work stoppage and the corrective action necessary to resume work.

SECTION 2-3

PURCHASING

2-3.1. AUTHORITY

2-3.1.a. 29 CFR 1910, “Occupational Safety and Health Standards”

2-3.1.a. Federal Acquisition Regulations (FAR)

2-3.1.a. NASA Federal Acquisition Regulations Supplement (NFS)

2-3.1.a. MM 4000.1, “Property Management Manual”

2-3.1. RESPONSIBILITIES

2-3.1.a. Supervisors:

Ensure purchases of safety critical items (e.g., PPE, lifting equipment, fire extinguishers, etc.) and potentially hazardous items (e.g., hazardous materials, lasers, etc.) comply with applicable MSFC standards and instructions.

2-3.1.a. Procurement Office:

Procures items designated as safety critical by the requiring activity in accordance with applicable MSFC and NASA policies.

2-3.1.a. Industrial Safety Office:

- (1) Reviews and approves explosives and fire protection equipment procurements.
- (1) Provides consultation and assistance to MSFC organizations in matters concerning purchase of potentially hazardous equipment and supplies.

2-3.1. FUNCTIONS

2-3.1.a. General

- (1) All purchased items meet or exceed safety requirements listed in applicable federal and industry standards (e.g., OSHA, ANSI, NFPA, and Underwriters’ Laboratory).

- (2) Training/certification requirements for operation of new, potentially hazardous, equipment are coordinated with the ISO.

2-3.1.a. Personal Protective Equipment (PPE)

PPE meets or exceeds applicable ANSI standards. Reference section 4-11, "Personal Protective Equipment."

2-3.1.a. Lifting and Handling Devices and Equipment

- (1) New lifting equipment and devices meet NASA-STD 8719.9 requirements.
- (1) Manufacturers supply a certificate of conformance (NASA-STD 8719.9).
- (1) Receiving inspections are performed and conformance packages prepared by the responsible maintenance organization (e.g., Facilities Office, Transportation Management Office, or their contractors) in accordance with NASA-STD 8719.9.

2-3.1.a. Hazardous Materials

- (1) Hazardous material purchases comply with requirements of MMI 1845.1. Government credit card purchases of hazardous material are coordinated with Environmental Health.
- (1) Purchases of explosives are coordinated with the ISO.

2-3.1.a. Lockout/Tagout

- (1) When major replacement, repair, renovation, or modification of existing equipment is performed, energy isolating devices for such equipment are designed to accept a lockout device.
- (1) Lockout capabilities are specified for new equipment.

2-3.1.a. Fire Protection Equipment

Purchases of fire protection equipment (e.g., fire extinguishers, detectors, etc.) are reviewed and approved by the ISO.

CHAPTER 3 TRAINING, CERTIFICATION, AND MOTIVATION

SECTION 3-1

BASIC AWARENESS AND MOTIVATION

3-1.1. PURPOSE

Establish guidelines for developing positive attitudes for safe behavior and for stimulating active participation in mishap prevention.

3-1.1. AUTHORITY

NHB 1700.1(V1), “NASA Safety Policy and Requirements Document”

3-1.1. RESPONSIBILITIES

3-1.1.a. Managers and Supervisors:

- (1) Set a personal example in safe attitude for employees to follow in understanding and participating in safety program elements.
- (2) Lead employees in understanding and participating in safety program elements.
- (3) Utilize incentives and awards to recognize and reinforce safe behavior and mishap prevention.
- (4) Exercise appropriate controls to promptly correct unsafe behavior.
- (5) Show concern for employee safety.

3-1.1.b. Industrial Safety Office:

- (1) Sustains a site-wide program of education and awareness using multiple channels of communication.
- (2) Administers safety incentives and awards program.

3-1.1.c. Employee:

- (1) Maintains awareness of hazards in the work area.
- (2) Actively seeks to understand how to perform safely.
- (3) Consciously avoids unsafe acts.

3-1.1. FUNCTIONS:

3-1.1.a. Methods used in communicating safety awareness include:

- (1) Safety posters
- (2) Safety publications and pamphlets
- (3) Industrial Safety Office Bulletins
- (4) Safety videos
- (5) Special safety displays and demonstrations
- (6) Off-the-job safety activities
- (7) Safety contests and safety talks
- (8) Photos and stories in the Marshall Star
- (9) Daily Planet articles

3-1.1.b. Types of Safety Awards and Incentives used include:

- (1) Monetary
- (2) Letters of Appreciation
- (3) Plaques
- (4) Prizes

SECTION 3-2

TRAINING AND CERTIFICATION

3-2.1. AUTHORITY

- 3-2.1.a.** 29 CFR 1910, “Occupational Safety and Health Standards”
- 3-2.1.b.** 29 CFR Part 1960, “Basic Program Elements For Federal Employee Occupational Safety and Health Programs and Related Matters”
- 3-2.1.c.** NHB 1700.1(V1), “NASA Safety Policy and Requirements Document”
- 3-2.1.d.** NHB 2710.1, “Safety and Health Handbook,” Chapter 7

3-2.1. RESPONSIBILITIES

3-2.1.a. Supervisor:

- (1) Ensures that employees receive appropriate training and certification per Tables 3-2-1 and 3-2-2.
- (2) Maintains a current listing of specialized training with status of employees’ training.

3-2.1.b. Human Resources and Administrative Support Office:

- (1) Arranges appropriate training sources and facilities.
- (2) Maintains safety training records for MSFC employees.

3-2.1.c. Industrial Safety Office:

- (1) Reviews and approves MSFC training and certification programs.
- (2) Reviews and approves employee certifications.
- (3) Ensures personnel are trained and certified.

3-2.1. FUNCTIONS

3-2.1.a. Safety Training

- (1) The ISO establishes training requirements and certifies personnel who have successfully completed the training requirements.
- (2) A common guide for specialty training is provided in Table 3-2-1. Employees should receive appropriate training at the time of initial job assignment and periodically as needed. Additional training may be necessary for employees who are reassigned, or whenever new equipment, procedures, or chemicals are introduced, or to improve current employee work habits.
- (3) The Training Branch maintains training records which should include name, social security number, name and date of class, and employee's signature.
- (4) The Training Branch surveys all organizations to determine safety training needs.
- (5) The ISO assists MSFC organizations in developing safety training and certification requirements.

3-2.1.b. Certification

- (1) Supervisors nominate for certification only those employees whose job descriptions and skills ensure a level of proficiency that will result in safe operations.
- (2) Special certification programs are established for potentially hazardous tasks not listed in Table 3-2-2.
- (3) Special certification programs are approved by ISO.
- (4) Employees performing functions listed in Table 3-2-2 are certified prior to performing these potentially hazardous tasks.
- (5) The Director, ISO, approves employee safety certifications.
- (6) ISO maintains certification records for all MSFC employees and for contractor personnel performing Program Critical Hardware moves.

TABLE 3-2.1 TRAINING SPECIALTIES

Training Specialty	Requirements	Re-training Period
1. New Employees [CFR 1960]	• New Employee Training (ISO)	
2. New Supervisors [CFR 1960]	• MSFC Supervisor Safety Course (NSTC 005)	
3. New SES Managers [CFR 1960]	• MSFC Manager Safety Course (NSTC 827)	
1. Safety Monitor Training [CFR 1960] (Fire Marshalls)	• Safety Monitor Course (ISO)	
1. MSFC Safety & Health Committee [CFR 1960]	• MSFC Safety & Health Committee Course (ISO)	
2. Test Area Access	• Contact ISO	
3. Compressed Gas Cylinder Safety	• <i>Safe Handling and Storage of Compressed Gases</i> (ISO)	
4. Hazard Communications Orientation	• Hazard Communications (CN01-M)	
5. Hearing Conservation	• Hearing Conservation (CN01-M)	• 1 Yr (Physical)
6. Ionizing Radiation [1910.96]	• Ionizing Radiation (CN01-M)	• 1 Yr (Physical)
7. Laboratory Safety [1910.1450]	• Laboratory Safety (NSTC 224)	
8. Lockout/Tagout Affected/Other Employees [1910.147]	• <i>Lockout/Tagout</i> (NSTC 814)	
9. Machine Shop Personnel	• <i>Machine Shop Safety</i> (NSTC 204)	
10. Open Surface Tanks [1910.94]	• Contact ISO	
11. Personal Protective Equipment (PPE) [1910.132]	• <i>Personal Protective Equipment</i> (ISO)	
1. Robotics Safety [ANSI/RIA R15.15.06]	• Contact ISO	
1. Scaffolds [1910.28]	• Contact ISO	
2. Woodworking Machines [1910.213]	• Contact ISO	

TABLE 3-2.2 CERTIFICATION SPECIALTIES

Certification Specialty	Requirements	Cert. Period	Re-Cert. Requirements
1. Asbestos Abatement [1910.1001]	<ul style="list-style-type: none"> • State Accredited Training [State Registration - Safe State (1-800-452-5928)] • Physical 	1 Yr	<ul style="list-style-type: none"> • State Accredited Refresher Course • Physical
2. Aerial Lift Operator [1910.67]	<ul style="list-style-type: none"> • Aerial Work Platform Training (NSTC 030) or Manufacturer's Course • Written & Proficiency Tests • Physical 	4 Yrs	<ul style="list-style-type: none"> • Refresher Course • Physical
3. Confined Space Entry [1910.146 and MMI 1845.3]	<ul style="list-style-type: none"> • Confined Space Entry Training (CN01-M) • Written Test • Physical 	1 Yr	<ul style="list-style-type: none"> • Refresher Course • Physical
4. Overhead Crane & Hoist Operators and Flagman [1910.179 and NASA-STD 8719.9]	<ul style="list-style-type: none"> • <i>Overhead Cranes & Materials Handling</i> (NSTC 205) • Written & Proficiency Tests • OJT (As determined by supervisor) • Physical 	4 Yrs	<ul style="list-style-type: none"> • Refresher Course • Physical
1. Lift Riggers [1910.179 and NASA-STD 8719.9]	<ul style="list-style-type: none"> • <i>Overhead Cranes & Materials Handling</i> (NSTC 205) • Written & Proficiency Tests • 4-Years OJT • Physical 	4 Yrs	<ul style="list-style-type: none"> • Refresher Course • Physical
1. Cryogen Handlers	<ul style="list-style-type: none"> • Cryogenic Safety (NSTC 313) 	4 Yrs	<ul style="list-style-type: none"> • Refresher Course
2. Flight Deck Crew	<ul style="list-style-type: none"> • Appropriate FAA license and certification 		<ul style="list-style-type: none"> • FAA Requirements
3. Forklift Operators [1910.178]	<ul style="list-style-type: none"> • <i>Forklift Safety</i> (NSTC 209) • Written & Proficiency Tests • 4-Years OJT • Physical 	4 Yrs	<ul style="list-style-type: none"> • Refresher Course • Physical
4. Hazardous Materials Handlers [1910.120]	<ul style="list-style-type: none"> • 40 Hour HAZWOPER Class • 16 Hour Incident Commander Training • Physical 	1 Yr	<ul style="list-style-type: none"> • HAZWOPER Refresher • Incident Refresher • Physical
5. Heavy equipment Operators (>3/4 ton)	<ul style="list-style-type: none"> • State Driver's License • Commercial Driver's License (As Required) 		
1. High Pressure Systems (> 150 psig)	<ul style="list-style-type: none"> • Contact ISO 		
1. Hydraset Operator	<ul style="list-style-type: none"> • Manufacturer's Course • Proficiency Test 	4 Yrs	<ul style="list-style-type: none"> • Proficiency Test
2. Hyperbaric Chamber	<ul style="list-style-type: none"> • Hyperbaric Chamber Operations Course • Written Test & Proficiency Test • First Aid (Red Cross) • CPR (Red Cross) • Physical 	3 Yrs	<ul style="list-style-type: none"> • Refresher Course • Physical
1. Laser Operators (\geq Class 3A) [ANSI Z136.1]	<ul style="list-style-type: none"> • Laser Safety Course (CN01-M) • Written Test • CPR (Red Cross) • Physical 	4 Yrs	<ul style="list-style-type: none"> • Refresher Course • Physical

Certification Specialty	Requirements	Cert. Period	• Re-Cert. Requirements
15.Laser Maintenance Personnel [ANSI Z136.1]	<ul style="list-style-type: none"> • Laser Safety Course • <i>Lockout/Tagout</i> (NSTC 814) • CPR 	4 Yrs	<ul style="list-style-type: none"> • Refresher Course
16.Lockout Tagout, Authorized Employee [1910.147]	<ul style="list-style-type: none"> • <i>Lockout/Tagout</i> (NSTC 814) • Written Test 	4 Yrs	<ul style="list-style-type: none"> • Refresher Course
17.Mobile Crane Operator [1910.178 and NASA-STD 8719.9]	<ul style="list-style-type: none"> • Mobile Crane Operator Course • Written & Proficiency Tests • 4-Years OJT • Physical 	2 Yrs	<ul style="list-style-type: none"> • Refresher Course • Physical
18.Critical Hardware (CH) [MMI 6400.2] Lifting & Handling	<ul style="list-style-type: none"> • <i>PCH Training</i> (CN71) • Physical 	2 Yrs	<ul style="list-style-type: none"> • Re-application
18.Propellant & Explosive Handler [1910.109 and NASA-STD 8719.12]	<ul style="list-style-type: none"> • <i>Explosive Handler's Course</i> (NSTC 009) • Written Test • OJT(As determined by supervisor) • Physical 	2 Yrs	<ul style="list-style-type: none"> • Refresher Course • Physical
18.Propellant & Explosive User [1910.109 and NASA-STD 8719.12]	<ul style="list-style-type: none"> • <i>Explosive Handler's Course</i> (NSTC 009) • <i>Explosives Safety Program Management</i> (NSTC 010) (Supervisors Only) • Written & Proficiency Tests • OJT (As determined by supervisor) • Physical 	2 Yrs	<ul style="list-style-type: none"> • Refresher Course • Physical
19.Respirators (Non- SCUBA) [1910.134 and 1810.3]	<ul style="list-style-type: none"> • Respirator Training (CN01-M) • Written & Proficiency Tests • Physical 	1 Yr	<ul style="list-style-type: none"> • Refresher Course • Physical
18.Rigging Equipment/Sling Inspector [1910.184 and NASA-STD 8719.9]	<ul style="list-style-type: none"> • <i>Overhead Cranes & Materials Handling</i> (NSTC 205) • Written & Proficiency Tests • OJT (As determined by supervisor) 	4 Yrs	<ul style="list-style-type: none"> • Refresher Course
18.Rescue Personnel [MMI 1845.3]	<ul style="list-style-type: none"> • First Aid, (Red Cross) • CPR, (Red Cross) • Bloodborne Pathogens, (CN01-M) • Certification for specific operation supported (e.g., Confined Space Entry) • Physical 	1 Yr	<ul style="list-style-type: none"> • Refresher Course(s) • Physical
18.Self-Contained Breathing Apparatus (SCBA) [MMI 1810.3]	<ul style="list-style-type: none"> • SCBA Training (CN01-M) • Written & Proficiency Training • Physical 	1 Yr	<ul style="list-style-type: none"> • Refresher Course • Physical
18.Wind Tunnel Operators	<ul style="list-style-type: none"> • Contact ISO 		

SECTION 3-3

SAFETY MEETINGS

3-3.1 PURPOSE

3-3.1.a. Safety meetings develop positive employee attitudes and demonstrate management's commitment to safe operations.

3-3.1.b. Safety meetings are used to:

- (1) Enhance safety awareness.
- (2) Emphasize safety rules and procedures.
- (3) Raise personnel motivation toward safety.
- (4) Relate recent mishaps to employee's activities.
- (5) Obtain safety-related feedback from employees.

3-3.1 AUTHORITY

NHB 1700.1 (V1), "NASA Safety Policy and Requirements Document"

3-3.1 RESPONSIBILITIES

3-3.1.a. Directors/Managers:

Ensure monthly safety meetings are conducted with employees (direct reports).

3-3.1.b. Supervisors:

Ensure monthly safety meetings are conducted with employees (direct reports).

3-3.1 FUNCTIONS

3-3.1.a. Directors, managers, and supervisors ensure monthly safety meetings are conducted with their respective employees (direct reports). This function may be incorporated into regular organization staff meetings.

3-3.1.b. Safety meeting content includes:

- (1) Discussion of results of safety inspection findings and necessary corrective actions.
- (2) Discussion of recent mishaps, including close calls and corrective actions.
- (3) Discussion of current safety issues and concerns, including subjects identified at other levels of the organization.
- (4) Presentation of safety topics relevant to the organization work environment.
- (5) Discussion of the following topics at least once each year:

Slips, trips, and falls

Emergency Preparedness (e.g. , severe weather, fire, medical)

Hazards Communication

Housekeeping

- (6) Discussion of the following topics at least once each year (if applicable):

Personal Protective Equipment

Lockout/Tagout

Confined Space Entry

Safety Permits

3-3.1.c. All employees attend safety meetings.

3-3.1.d. Attendees' signatures and meeting minutes are recorded and kept on file for at least two years.

3-3.4.e. The ISO provides guidance and training material in support of safety meetings as requested.

CHAPTER 4 SAFETY ASSURANCE

SECTION 4-1

SAFETY MONITORS

4-1.1. PURPOSE

To establish a collateral duty safety monitor program at MSFC.

4-1.1. AUTHORITY

29 CFR 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters"

4-1.1. RESPONSIBILITIES

4-1.1.a. Directors/Managers of Basic Organizations:

Appoint safety monitors for all areas of responsibility.

4-1.1.a. Safety Monitors:

- (1) Perform auxiliary actions to assist supervisors in maintaining a safe work place.
- (2) Perform planned actions to protect fellow employees in case of emergency.

4-1.1. FUNCTIONS

4-1.1.a. The director/manager of the basic organization notifies the ISO when a safety monitor is appointed or changed, and provides name, organization, building, and phone number.

4-1.1.b. The ISO maintains a current listing of all safety monitors.

4-1.1.c. The ISO provides training for new safety monitors, and safety consultation as requested.

4-1.1.d. The name of the safety monitor is conspicuously posted in the assigned area using MSFC Form 35.

4-1.1.e. Safety monitors:

- (1) Assist supervisor(s) in performing safety inspections.
- (2) Inspect fire extinguishers and fire hose stations monthly; initial fire extinguisher tags; document inspection on MSFC Form 542 (available on the Centerwide Forms application) or equivalent spreadsheet and maintain this record for at least 2 years.
- (3) Issue permits for portable appliances using MSFC Form 3798 (see Figure 7-1-1) .
- (4) Raise safety concerns to the ISO that cannot be corrected through normal procedures.
- (5) Perform emergency duties specified in MM 1040.3, “MSFC Emergency Plan.” (in revision as MPG 1040.3F)

SECTION 4-2

JOB SAFETY EVALUATIONS

Note: Section 4-2 was canceled by MWI 8715.15 dated February 14, 2000

4-2.1. AUTHORITY

- 4-2.1.a. 29 CFR 1910, "Occupational Safety and Health Standards"
- 4-2.1.b. 29 CFR 1960, "Basic Program Elements for Federal Occupational Safety and Health Programs and Related Matters"

4-2.1. DEFINITIONS

- 4-2.1.a. **Job Safety Evaluation (JSE)** - An important mishap prevention tool which identifies, eliminates, or minimizes job hazards.
- 4-2.1.b. **Potentially hazardous** - Any operation involving material or equipment that has a high potential to result in serious injury or death to personnel or damage and/or destruction of property. These operations may involve explosives, propellants, high energy, high pressure, oxidizers, corrosives, high elevations, cryogenics, hostile atmosphere, flammable liquids, high electrical energy, radiation, noise, hyperbaric or hypobaric environment, toxic material, critical hardware, etc.

4-2.1. RESPONSIBILITIES

- 4-2.1.a. **Supervisors**
 - (1) Identify potentially hazardous jobs within their area of responsibility.
 - (2) Ensure conduct of and maintain JSE's on all potentially hazardous jobs within their area of responsibility.

4-2.1. FUNCTIONS

- 4-2.1.a. JSE's are performed before starting a first time potentially hazardous job and reviewed annually.

4-2.1.b. A typical JSE includes the following elements:

- (1) Identify each step required to perform the job by reviewing the procedures, discussing the operations with the operator, and observing the operations; addressing non-routine and emergency situations as well as normal operations.
- (2) Identify the hazards associated with each step.
- (3) Identify actions necessary to eliminate or minimize the hazards.

SECTION 4-3

SAFETY INSPECTIONS AND SURVEYS

4-3.1. AUTHORITY

- 4-3.1.a. NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"
- 4-3.1.a. NHB 2710.1, "Safety and Health Handbook - Occupational Safety and Health Programs"
- 4-3.1.a. 29 CFR 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters"
- 4-3.1.a. NASA-STD 8719.11, "NASA Safety Standard for Fire Protection"

4-3.1. RESPONSIBILITIES

4-3.1.a. Supervisors:

- (1) Ensure safety inspections are conducted for assigned work areas.
- (1) Participate in planned safety inspection with Director/Manager and ISO representative.

4-3.1.a. Directors/Managers of Basic Organizations:

- (1) Support ISO inspections by providing points-of-contact and access to work areas.
- (1) Correct unsafe and unhealthy working conditions and safety findings which are the responsibility of the organization.
- (1) Request resources from higher authority when a hazard cannot be abated within their authority [NHB 2710.1, paragraph 4.7.5].
- (1) Conduct announced inspections of potentially hazardous activity areas with area supervisor and ISO representative.
- (1) Conduct unannounced inspections of potentially hazardous activity areas.

4-3.1.a. Industrial Safety Office:

- (1) Inspects all MSFC facilities.
- (1) Surveys MSFC basic organization and contractor safety programs.
- (1) Surveys potentially hazardous MSFC operations.
- (1) Reviews and approves hazard abatement plans.

4-3.1.a. Facilities Office:

Supports basic organizations to correct facilities and collateral equipment safety findings.

4-3.1.a. Human Resources and Administrative Support Office:

Supports ISO surveys with respect to health standards.

4-3.1. FUNCTIONS

4-3.1.a. Supervisor Inspections

- (1) Supervisors ensure that a minimum of one safety inspection is performed for assigned work area(s) each month using MSFC Form 4286 as a guide.
- (1) As directed, supervisors participate in planned quarterly safety inspection with Director/Manager and ISO representative.
- (1) Supervisors ensure that inspections are documented and records are retained for three years.
- (1) Supervisors correct findings or submit hazard abatement plans in accordance with section 4-3.3.d.
- (1) When a hazard poses imminent danger and cannot be immediately corrected, the supervisor secures the area and notifies the ISO.

4-3.1.a. Manager Inspections

- (1) Managers conduct quarterly announced inspections of potentially hazardous activity areas with area supervisor and ISO representative.

- (1) Managers conduct unannounced inspections of potentially hazardous activity areas.
- (1) Managers retain records for three years.
- (1) Supervisors correct findings or submit hazard abatement plans in accordance with section 4-3.3.d.
- (1) When a hazard poses imminent danger and cannot be immediately corrected, the area is secured and the ISO is notified.

4-3.1.a. Industrial Safety Office Inspections and Surveys

- (1) ISO conducts inspections of MSFC facilities in accordance with NHB 2710.1.
- (1) ISO conducts surveys which address all aspects of its safety programs in accordance with NHB 1700.1(V1).
- (1) Hazardous operation surveys emphasize compliance with NASA hazardous operation program requirements (e.g., hazard identification and control, and operating procedures).
- (1) ISO notifies managers, contracting officers, and employee representatives before formal inspection of facility or survey of safety program.
- (1) ISO conducts informal inspections without notification.
- (1) ISO conducts informal spot-checks to ensure safety violations are corrected.
- (1) Within 15 working days after completion of the inspection or survey, ISO sends:
 - (a) Facility inspection reports to basic organization points-of-contact.
 - (a) Contractor safety survey reports to the contracting officer.
 - (a) Potentially hazardous operation reports to basic organization managers.
- (1) Inspections are documented and records retained for 5 years [29 CFR 1960.26(c)(4)].

4-3.1.b. Closure of Inspections and Surveys Findings

- (1)** Managers of basic organizations with findings:
 - (a)** Correct findings or submit Hazard Abatement Plan to ISO for findings that cannot be corrected within 30 days [NHB 2710.1, paragraph 4.7.7].
 - (a)** Establish interim actions to mitigate hazards until permanent measures are implemented [NHB 2710.1, paragraph 4.7.7].
 - (a)** Post each facility finding in the work area for a minimum of 3 working days or until the finding is corrected (whichever is longer) [OSHA 1960.26(c)(4)].
 - (a)** Notify the ISO of corrective actions.

APPENDIX 4-3

SUPERVISOR SAFETY INSPECTION CHECKLIST		
Name/Office Code:	Month of inspection:	Location:
Check applicable column. Mark N/A in "Yes" column if not applicable. Explain "NO" answers in remarks.		
GENERAL	YES	NO
1. Walking surfaces safe (No slip, trip, or fall hazards such as elect. wires, wet areas, etc.)		
2. Work areas clean, sanitary, orderly, and adequately illuminated.		
3. Paths to egress and exits maintained clear.		
4. All exits clearly marked.		
5. Appliances (heaters, coffee pots, etc.) have, and are in compliance with permits.		
6. Emergency phone numbers posted.		
7. Fire alarm pull stations visible and accessible.		
8. Fire Evacuation Plans posted and current.		
9. Emergency lights functional (Test if possible).		
10. Fire doors left in closed position (unless automatic releasing type).		
11. Doors that could be mistaken as exits are marked appropriately (storage, not an exit, etc.).		
12. Electrical power strips/extension cords not connected in series.		
13. Work supplies/materials stored in cabinets or in shelves.		
14. Materials/equipment stored so that sharp objects are not a hazard.		
15. Fire extinguisher inspection tag up-to-date.		
16. Material Safety Data Sheets (MSDS)'s available for area chemicals.		
COMPUTER ROOMS		
17. Paper, recording media and other combustibles minimum essential for efficient operation.		
18. Floor pullers mounted on brackets and location identified.		
19. Trash receptacles are self extinguishing type.		
LABORATORY/SHOP AREAS		
20. Tools and equipment in good repair.		
21. Machine guards in place and properly adjusted.		
22. Compressed air for cleaning under 30 psi.		
23. Combustible scrap, debris, and waste stored and removed properly.		
24. PPE equipment in good condition.		
25. Personnel protected from existing or potential falling objects.		
26. Work positions, pits, holes, machines, and other hazards appropriately guarded.		
27. Machines firmly anchored to prevent moving/tipping.		
28. Vent and exhaust systems in proper working order.		
29. Compressed gas cylinders stored and restrained properly.		
30. Chemical/Flammable storage cabinets good operating condition.		
31. Chemicals clearly labeled for easy identification.		
32. Flammable liquid drums properly grounded and bonded.		
33. Eyewash and safety showers inspected monthly.		

34. Confined spaces clearly marked.		
35. Lockout/Tagout procedures implemented properly.		
36. Access working space maintained about electrical equipment.		
37. Flex hoses, tubing and piping properly restrained.		
38. Tubing, piping and tanks properly labeled for contents and pressure.		
MATERIAL HANDLING (WAREHOUSE AREAS)		
39. Floor load capacity signs posted in storage areas.		
40. Industrial trucks equipped with horn, overhead guard and capacity.		
41. Batteries charged in designated area with proper ventilation.		
REMARKS: (List all findings and action taken for each.)		
Supervisor Signature:		Date:

SECTION 4-4

HAZARD ASSESSMENT

Note: Section 4-4 was canceled by MWI 8715.7 dated December 13, 1999

4-4.1. AUTHORITY

- 4-4.1.a. NPD 8710.2, "NASA Safety and Health Program Policy"
- 4-4.1.b. NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"
- 4-4.1.c. OSHA 29 CFR Parts 1910, and 1926

4-4.1. DEFINITIONS

- 4-4.1.a. **Accepted Risk** - A hazard whose risk is not eliminated or controlled and that has been accepted by management in accordance with the requirements of this section.
- 4-4.1.b. **Controlled Hazard** - A hazard where the likelihood of occurrence or severity of the associated undesirable event has been reduced to an acceptable level - generally a Priority 3 or 4 as determined by Section 1-13, "Risk Assessment and Acceptance," and approved by the responsible basic organization and the ISO.
- 4-4.1.c. **Eliminated Hazard** - A hazard that has been eliminated by completely removing the hazard causal factors.
- 4-4.1.d. **Hazard Assessment** - The systematic identification and evaluation of existing and potential hazards and the recommended mitigation for the hazard sources found, based on risk assessment.
- 4-4.1.e. **Hazard Status** - Hazard status is cited as follows:
 - (1) Open - Corrective action(s) to eliminate or control the hazard has not been completed.
 - (2) Closed - Corrective action(s) to eliminate or control the hazard has been completed.

4-4.1.a. Potentially Hazardous Operations or Facilities - Any operation, process, facility, or equipment that has a high potential to result in serious injury or death to personnel, or damage and/or destruction of property. These operations may involve explosives, propellants, high energy, high pressure, oxidizers, corrosives, high elevations, cryogenics, hostile atmosphere, flammables, high electrical energy, radiation, noise, hyperbaric or hypobaric environment, toxic material, critical hardware, etc.

4-4.1.b. Residual Risk - Risk that remains from a hazard after all mitigation and controls have been applied.

(1) Accepted Risk - By definition

4-4.1. RESPONSIBILITIES

4-4.1.a. Basic Organizations:

- (1) Identify potentially hazardous facilities and operations requiring hazard assessment.
- (2) Ensure hazard assessments are performed for potentially hazardous facilities and operations.
- (3) Eliminate or control hazards using the priorities provided in Section 1-3, "Policy."

4-4.1.b. Industrial Safety Office:

- (1) Performs hazard assessments upon request.
- (2) Tracks hazards to closure.

4-4.1. FUNCTIONS

4-4.1.a. Hazard assessments are performed and updated for changes in accordance with the authority documents, this directive, and guidelines from ISO.

4-4.1.b. The responsible basic organization develops and submits to the ISO closure rationale for identified hazards. Rationale is based on risk per Section 1-12, "Risk Assessment and Acceptance."

4-4.1.c. ISO reviews and approves the closure rationale.

- 4-4.1.d.** The responsible basic organization ensures any required closure actions or controls are implemented.
- 4-4.1.e.** The ISO tracks hazard status and verifies action implementation. Hazard status is either open, closed, or accepted risk. Open hazards are not closed until the approved corrective action(s) to eliminate or control the hazard is completed.
- 4-4.1.f.** For accepted risk, the manager/director of the responsible basic organization documents acceptance based upon risk assessment with coordination and concurrence by the ISO and the program/project manager, if applicable.

SECTION 4-5

MSFC OPERATIONAL READINESS PROGRAM

Note: Section 4-5 was canceled by MWI 8715.8 dated February 24, 2000

4-5.1. PURPOSE

To establish guidance for the MSFC Operational Readiness Program to ensure initial and continued safe operation of facilities and equipment.

4-5.1. AUTHORITY

- 4-5.1.a. NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"
- 4-5.1.a. OSHA 29 CFR 1910.119, "Process Safety Management"
- 4-5.1.a. SPD 1700.4, "SSC Operational Readiness Program"

4-5.1. DEFINITIONS

- 4-5.1.a. **Operational Readiness Inspection Committee (ORIC):** An ORIC is established to review new or significantly altered equipment, facilities, or test activity/operation where there is a significant degree of risk of accident or misoperation which might cause personal injury or death, or where there is a high risk of serious damage to equipment, test articles, buildings, or adjoining areas.

Membership: The ORIC will consist of a chairperson, a recorder, and a minimum of five other members to assess all functional areas of the assigned operation. Chairpersons and members of the ORIC or Safety Review Team (SRT) are selected, to the extent possible, from organizations without a vested interest in the activity for which the review is being conducted. Members are qualified to provide competent review by technical experience in areas related to the subject of the ORI. ORIC composition will normally include individuals from: responsible program/project office, Facilities Office, Management Operations Office, appropriate laboratory, operating, or staff elements, and an ISO representative, to serve as a consultant to the ORIC to ensure a complete and thorough review.

4-5.1.a. Safety Review Team (SRT): An SRT is established to review and inspect equipment, facilities, or test activities/operations of a less hazardous nature, to review and inspect facility additions or modifications that result in incremental change in existing hazard levels that have been previously reviewed by an ORIC, or to ensure that all hazards are identified and either eliminated, controlled, or acceptance of risk recommended. An assessment concerning the readiness for safe operations of the equipment, facilities, or test activities/operation is completed and presented to the Director, S&MA Office, and cognizant laboratory director, for approval prior to initiation of operations.

Membership: Same as for the ORIC.

4-5.1.a. ORI Management Review Board (MRB): An ORI MRB chaired by the Director, Science and Engineering, is established to review and evaluate the adequacy of the ORIC efforts, and make recommendations concerning the readiness of equipment, facilities, or test activities/operations. These recommendations, including any restrictions or limitations, are presented to the Center Director for final decision and approval.

Membership: Membership is in accordance with MM 1150.1, Charter 3-15, "Operational Readiness Inspection Management Review Board." _

4-5.1.a. Institutional Review Board (IRB) for Human Research Tests: An IRB is established to review human research activities with the primary responsibility for the safety of human research subjects (reference section 5-4, "Ergonomics," for further information).

Membership: Membership is in accordance with MM 1150.1, Charter 3-26, "Institutional Review Board for Human Research Tests."

4-5.1. RESPONSIBILITIES

4-5.1.a. Safety & Mission Assurance Office: _

- (1) Coordinates with managers of basic organizations to determine the need for establishing ORIC's or SRT's.
- (1) For operations or facilities related to propulsion testing, coordinates with Stennis Space Center, the lead NASA center for propulsion testing.

- (1) Determines whether an ORIC or SRT will be formed based on the recommendation of the director/manager responsible for the facility/equipment, the physical size of the facility/equipment, and the expected hazards.
- (1) Establishes ORIC's as required. The ORIC is established concurrent with construction start.
- (1) Participates in ORIC and ORI Management Review Board activities.
- (1) Participates in and evaluates results of SRT activities.
- (1) Provides followup review as required.

4-5.1.a. Directors/Managers of Basic Organizations:

- (1) Implement safety requirements in design and operation of equipment, facilities, and test activities;
- (1) Identify candidate equipment, facilities, or test operations for ORI's or safety reviews (SR's) and provide necessary resources to support these reviews.

4-5.1.a. The ORIC:

- (1) Conducts the review and inspection of assigned equipment, facilities, test activities/operations and associated procedures to ensure that all hazards are identified, evaluated, and either eliminated, controlled, or recommended risk is accepted.
- (1) Provides recommendations to the ORI Management Review Board concerning the readiness for safe operation of the equipment, facilities, or test activity/operation.
- (1) Maintains records of all proceedings and prepares a final report.
- (1) Supplies original records to the ISO for permanent file.

4-5.1.a. The SRT:

- (1) Conducts the review and inspection of assigned equipment, facilities, test activities/operations and associated procedures to ensure that all hazards are identified and either eliminated, controlled, or acceptance of risk recommended.

- (1) Recommends to the Director, S&MA Office and cognizant laboratory director operational readiness of the equipment, test, or facility.
- (1) Maintains records of all proceedings and prepares a final report.
- (1) Supplies original records to the ISO for permanent file.

4-5.1.a. The ORI Management Review Board:

Responsible for evaluating and assuring adequacy of ORIC efforts, and for recommending to the Center Director concurrence to proceed with the readiness of equipment, facilities, or test activities/operations, together with any restrictions or limitations.

4-5.1. FUNCTIONS

4-5.1.a. S&MA Office:

- (1) Assists managers and directors in the identification of facilities or equipment that would require an ORI or SR.
- (1) Selects an ORIC chairperson in concert with the appropriate director/manager and chairperson of the ORI Management Review Board; establishes functional membership and consultants in coordination with the ORIC Chairperson; and prepares a Management Announcement for the Center Director's approval, accompanied by rationale for, and recommendation of, any chairperson or members with a vested interest in the facility or operation under review.
- (1) Assists directors/managers in preparing an announcement for SRT's, as required, and concurs in the announcement. The announcement specifies the scope of the review and activation milestone event approval authority granted to the SRT and the SRT reports required to be presented at the completion of the evaluation.
- (1) Provides an ISO representative to serve as a consultant to the ORIC.
- (1) Reviews ORIC and SRT final reports for completeness, maintains permanent files of reports and associated material, and retires files to holding areas as appropriate.
- (1) Approves the SRT report, in conjunction with the responsible director/manager.

4-5.1.a. Directors/Managers of Basic Organizations:

- (1) Identify existing or proposed equipment, facilities, or operations under their control or jurisdiction requiring an ORI or SR.
- (1) Propose an ORI or SR for facilities, equipment, or operations identified to the S&MA Office so the assessment can be completed prior to facility activation, and an ORI, if required, can be conducted without undue interference with scheduled use or operation.
- (1) Provide chairpersons, members, recorders, and consultants (recorder will be provided by organization responsible for the facility/equipment/operation or process under review). Identify to the Director, S&MA, any of these individuals with a vested interest in the facility or operation under review, and provide rationale for their selection.
- (1) Appoint SRT's in coordination with Director, S&MA Office; and issue the announcement establishing the SRT. The announcement requires the concurrence of the Director, S&MA Office.
- (1) Approve, in conjunction with the Director, S&MA Office, results of the SRT report.
- (1) Ensure that appropriate analyses are accomplished when facility, procedure, and equipment modifications are made. Changes or modifications that may create new hazards are to be reported to the S&MA Office.
- (1) Provide a review plan to the ORIC or SRT that identifies the requirements the facility or operation must meet, documentation that will satisfy the general requirements of this instruction, and a schedule for submittal of the documentation to the ORIC or SRT.

4-5.1.a. Operational Readiness Inspection Committee:

The primary function of the ORIC is to ensure that all hazards are identified and either eliminated, controlled, or acceptance of risk recommended and to ensure safe operations relative to personnel and property. This will include reviewing data or performing tasks in the following areas:

(1) Design Data

- (a) Interfaces - ensure compatibility of test article to test facility/equipment (physical, functional, materials).
- (a) Materials - ensure compatibility of medium to system, system to system.
- (a) Hazards - review facility and system designs to identify hazards. Ensure elimination or control of identified hazards. Identify and review systems and devices for warning and control, such as fire detection and suppression systems, leak detection systems, air contamination monitors, blast and shock protection, and lightning protection systems.
- (a) Safety Factors - ensure appropriate safety factors exist for all structural systems (e.g., fluid piping systems, pressure vessels, and thrust structures).
- (a) Hazard Analysis and Failure Modes and Effects Analysis (FMEA) - review planned/accomplished hazard analyses and FMEA's for adequacy and identify additional reliability or safety analyses if deemed necessary. Ensure proper retention rationale and controls are implemented for all failure modes and hazards.
- (a) Specifications - ensure proper application of controlling specifications and standards for all critical systems and operations (e.g., welding, cleaning, hazardous and toxic materials, etc.).
- (a) Performance - ensure that the facility affords the ability to control and monitor the test or operation in a safe mode.
- (a) Support Services - ensure that support services, such as electrical power, are adequate for safe conduct of the planned tests or operations.

(1) Construction and Installation

- (a) Configuration - ascertain that all new or modified facilities conform to approved design documentation and deviations are properly documented and dispositioned. Ascertain that the configuration of the facility is established and adequate configuration controls will be maintained.

- (b) Quality Control/Inspection - review quality controls and inspections that were exercised during the procurement, receiving, in-process inspection of the construction, installation, and checkout phases, including adequacy and maintenance of inspection records, disposition of nonconformances, log books, etc.
- (a) Facility Inspection - as a minimum, conduct a facility inspection at 75 percent completion and at 100 percent completion of new facilities construction or existing facilities modifications.
- (a) Personnel Qualification - ascertain that fabrication and assembly personnel, such as welders, are qualified.

(1) Activation and Operation

- (a) Plans and Procedures - review all plans and procedures for activation, checkout, and tests or operations. Plans shall be reviewed to ensure that appropriate tests are planned that will result in a high level of confidence in the integrity of the facilities and systems prior to initiation of testing or operations.
- (a) Personnel Qualifications and Training - evaluate the adequacy of the experience and training of the operating personnel. If additional training is required, the ORIC will assist the director/manager in establishing the training requirements and retain completion of training as a constraint to activation as appropriate.
- (a) Change Control - ensure that a system exists to control changes to the facility, ground support equipment (GSE), technical systems, and procedures so the safety of personnel and operations will not be compromised.
- (a) Work Control - review the adequacy of procedures for controlling all work on the facility, GSE, and test article. Shift change procedures shall also be reviewed.
- (a) Safety and Health - ensure compliance with OSHA regulations and applicable federal, state, and local regulations pertaining to safety and health.

(1) Other

Other areas, tasks, data, etc., as deemed necessary by the ORIC.

4-5.1.a. Safety Review Team:

The primary function of the SRT is to ensure that all hazards are identified and either eliminated or controlled, and to ensure safe operations relative to personnel and property. This will include reviewing data or performing tasks in the following areas:

- (1)** Perform a safety review within the requirements established in the announcement issued by the affected director/manager.
- (1)** Utilize the functions identified for the ORIC as guidelines for performing a review and evaluation. The formality and depth of the review should be consistent with the concern for the probability of a mishap and the possible seriousness of the mishap.
- (1)** Prepare reports required by the announcement, list all discrepancies and recommendations noted by the SRT, and have the report approved by the affected director/manager and Director, S&MA Office.
- (1)** Present to appropriate management, including the affected director/manager and Director, S&MA Office, the results of the safety review, and obtain the approval of the affected director/manager and Director, S&MA Office, to proceed with the operation.

4-5.1.a. ORI Management Review Board:

- (1)** Performs status reviews and evaluation of the activities of ORIC's as they are assigned and provides recommendations for additional activities as determined necessary.
- (1)** Specifies the degree of approval authority granted to the ORIC for activation milestone events.
- (1)** Conducts a final review to evaluate and ensures adequacy of the total ORIC effort; includes appropriate documentation.
- (1)** Reports the readiness of the facility/operation to the Center Director; provides the data required to support restrictions and limitations to be imposed.

4-5.1.a. REPORTING REQUIREMENTS

(1) Discrepancies and Recommendations

- (a)** The ORIC notes discrepancies and recommendations in writing. The recorder assigns a control number to each discrepancy/recommendation for future disposition. Recommendations are deliberated in a meeting of the full committee.
- (a)** The ORIC reviews proposed recommendations with appropriate operational personnel to ensure that recommendations are understood and that the ORIC has not acted on the basis of inaccurate or incomplete information. The ORIC establishes time or event deadlines associated with each recommendation or discrepancy.

(1) Final Written Report

- (a)** The ORIC maintains records of all proceedings and prepares a report. Original material is supplied to the ISO. ISO maintains records for life of facility/operation plus five years.
- (a)** The report is prepared in two parts as follows:
 - (1)** Part I - Executive Summary. Includes a copy of the Management Announcement establishing the ORIC, a brief summary of the activities (number of meetings, presentations to the ORI Management Review Board), identification of the number of action items and status by ORIC and Board, residual risks, conclusions, recommendations, and signature page for the ORIC members. Distribution includes Center Director, Board, ORIC members, and affected program managers and laboratory directors.
 - (1)** Part II - Supporting Data and Information. Includes minutes of meetings, presentation charts, directly related correspondence, and other information judged to be appropriate to support any future investigation or review. Part II is retained by the ISO and is not normally reproduced or distributed.

SECTION 4-6 FACILITIES

Note: Section 4-6 was canceled by MWI 8715.7 dated December 13, 1999

4-6.1. APPLICABILITY

This section applies to all facilities owned, controlled, or operated by MSFC.

4-6.1. AUTHORITY

4-6.1.a. Occupational Safety and Health Administration (OSHA)

- (1) 29 CFR 1910, "Occupational Safety and Health Standards"
- (2) 29 CFR 1926, "Safety and Health Regulations for Construction"

4-6.1.b. National Fire Protection Association (NFPA)

National Fire Codes (NFC)

4-6.1.a. Local Building Codes

Standard Building Code (SBCCI)

4-6.1.a. National Aeronautics and Space Administration (NASA)

- (1) NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"
- (2) NPG 8820.2, "Facility Project Implementation Handbook"
- (3) NHB 8831.2, "Facilities Maintenance Handbook and Energy Management Handbook"

4-6.1. RESPONSIBILITIES

4-6.1.a. Facility User Organization (Occupants):

- (1) Informs the Facilities Office of all facility procurements, changes, and changes of facility use.
- (2) Identifies the need for an operational readiness review as described in Section 4-5, "MSFC Operational Readiness Program."

- (3) Uses facilities within the intended design.
- (4) Ensures facility's safety integrity is not compromised by unqualified user personnel performing facility additions or modifications.

4-6.1.b. Facilities Office:

- (1) Designs, constructs, operates, and maintains facilities in accordance with the authority codes and standards, and the requirements of this document.
- (2) Approves all facility procurements, changes, and changes of facility use.
- (3) When the Facilities Office deems appropriate, develops and maintains facility Safety Management Plans (SMP) for major facility acquisitions in accordance with requirements of NHB 1700.1(V1).
- (4) Arranges for ISO participation in all phases of facility construction and modification.
- (5) Provides documentation for new facilities and modifications of existing facilities to the ISO for timely review and approval at each design phase.

4-6.1.c. Industrial Safety Office:

- (1) Reviews and approves all phases of facility design, construction, and operation.
- (2) Provides requirements for safety management plans and contractor safety plans.
- (3) Reviews and concurs with safety plans.
- (4) Monitors construction and operation of facilities to ensure compliance with safety plans, standards, and requirements.

4-6.1.d. Contracting Officer:

- (1) Ensures that facility contracts contain the safety and health clause required by NASA/FAR procurement regulations.
- (2) Unless otherwise approved by the ISO, ensures facility contracts require submittal of a safety and health plan to the MSFC for approval prior to start of work.

4-6.2. FUNCTIONS

- 4-6.2.a.** Facilities are constructed, operated, and maintained in accordance with the authority documents, national standards, including ANSI, and international standards as applicable. Where conflicting requirements exist, the most stringent is used.

- 4-6.2.b.** Safety tasks are performed at each phase of the facility life cycle, including concept development, design, procurement, construction, activation, operation, and disposal. Typical safety tasks are listed in Appendix J, NHB 1700.1(V1). These tasks are tailored to the size, complexity, and associated risk of the facility project.

- 4-6.2.c.** Construction work is performed in accordance with the OSHA 29 CFR 1926 and this directive.

SECTION 4-7

HAZARDOUS OPERATIONS

Note: Section 4-7 was canceled by MWI 8715.6 dated February 2, 2000

4-7.1. AUTHORITY

4-7.1.a. Occupational Safety and Health Administration

- (1) 29 CFR 1910, "Occupational Safety and Health Standards"
- (2) 29 CFR 1926, "Safety and Health Regulations for Construction"

4-7.1.b. National Aeronautics and Space Administration

- (1) NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"
- (2) NHB 2710.1, "Safety and Health Handbook - Occupational Safety and Health Programs"

4-7.1. DEFINITIONS

4-7.1.a. Potentially Hazardous Operation - Any operation involving material or equipment that has a high potential to result in serious injury or death to personnel, or damage and/or destruction of property. These operations may involve explosives, propellants, high energy, high pressure, oxidizers, corrosives, high elevations, cryogenics, hostile atmosphere, flammables, high electrical energy, radiation, noise, hyperbaric or hypobaric environment, toxic material, critical hardware, etc.

4-7.1.b. Note - Provides additional information to assist in conducting procedure.

4-7.1.c. Caution - Highlights a portion of the procedure which, if not strictly adhered to, could cause some damage to equipment, system, or minor injury to personnel.

4-7.1.d. Warning - Highlights a portion of the procedure which, if not strictly adhered to, could cause severe personnel injury, loss of life, or major equipment damage.

4-7.2. RESPONSIBILITIES

4-7.2.a. Supervisors:

- (1) Identify potentially hazardous activities.

- (2) Ensure preparation and utilization of procedures, work instructions, plans, detail drawings, and other documentation to safely control potentially hazardous activities.
- (3) Provide documentation for potentially hazardous operations to the ISO for timely review and approval.
- (4) Conduct internal reviews to ensure all hazardous operations are being conducted according to approved procedure(s) and that any changes, safety problems, or incidents/mishaps have been reported to the ISO.

4-7.2.b. Industrial Safety Office:

- (1) Reviews and approves potentially hazardous operation documentation.
- (2) Monitors hazardous operations to ensure compliance with safety plans, standards, and requirements.

4-7.1. FUNCTIONS

- 4-7.1.a.** Safety requirements for a potentially hazardous operation are identified for each stage of study, design, construction, and test.
- 4-7.1.b.** Hazard assessments are performed for all potentially hazardous operations in accordance with Section 4-4, "Hazard Assessment."
- 4-7.1.c.** Operational readiness reviews are conducted for a potentially hazardous facility or test program in accordance with Section 4-5, "Operational Readiness Program."
- 4-7.1.d.** Test Readiness Reviews (TRR) are conducted for potentially hazardous test programs in accordance with S&E 1156.1, "Test Readiness Review Program."
- 4-7.1.e.** Configuration and documentation of potentially hazardous facilities and operations are kept current.
- 4-7.1.f.** Procedures are utilized during the conduct of operations considered potentially hazardous and procedures include:
 - (1) A cover sheet identifying the operation as hazardous (e.g., MSFC Cover 2)
 - (2) Activity description
 - (3) Reference documents

- (4) Definitions and acronyms
 - (5) Responsibilities
 - (6) Safety section
 - (a) List of potential hazards and controls
 - (b) Pretest requirements (i.e., weather restrictions)
 - (c) Emergency telephone numbers
 - (7) Detailed operating sequences include:
 - (a) Status of switches, valves, etc., before fluid flow or energizing circuit
 - (b) Test sequences
 - (c) Secure sequences
 - (d) Safety mandatory inspection points
 - (8) Hazardous area access control
 - (9) List of required equipment
 - (10) Notes, cautions, and warnings prior to sequences that could injure personnel or damage property.
 - (11) Emergency procedures for securing facility and test operation when an anomaly occurs (i.e., equipment failure, personal injuries, and fire/explosion)
 - (12) Schematics, drawings, test setup diagrams, etc.
 - (13) Signature sheet
- 4-7.1.g.** A responsible person is identified for each potentially hazardous operation.
- 4-7.1.h.** Working in pairs (buddy system) is considered during the performance of a potentially hazardous operation. Personnel work in pairs where a serious degree of risk dictates.
- 4-7.1.i.** Material Safety Data Sheets (MSDS) are provided for potentially hazardous materials in accordance to MMI 1845.1, "Hazard Communication Program."

- 4-7.1.j.** Personnel performing a potentially hazardous operation are trained and certified for the job or task in accordance with Section 3-2, “Training and Certification.”
- 4-7.1.k.** Pretest briefings and/or dry runs are conducted before the start of a potentially hazardous operation.
- 4-7.1.l.** Potentially hazardous operation lessons learned are documented and discussed with personnel.

SECTION 4-8

HOT WORK PERMIT

4-8.1. APPLICABILITY

Safety permits are required for welding, burning, or similar spark or heat-producing operations, except in approved and designated areas.

4-8.1. AUTHORITY

4-8.1.a. 29 CFR 1910, “Occupational Safety and Health Standards”

4-8.1.a. 29 CFR 1926, “Safety and Health Regulations for Construction”

4-8.1. RESPONSIBILITIES

4-8.1.a. Supervisors:

- (1) Obtain work site inspection and safety permit as far in advance as possible to avoid unnecessary delays.
- (1) Post the permit in a conspicuous location or keep it readily available for reference at the job site.
- (1) Ensure the work is being performed in accordance with the provisions of the permit.

4-8.1.a. Industrial Safety Office:

Inspects work sites and issues permits for applicable operations.

4-8.1. FUNCTIONS

4-8.1.a. ISO uses MSFC Form 1155, “MSFC Safety Permit for Heat, Flame, or Spark-Producing Operations” (Figure 4-8-1).

4-8.1.a. The “Burn Permit Checklist” on back of MSFC Form 1155 is completed prior to issue of permit.

**MSFC
SAFETY PERMIT
FOR HEAT, FLAME OR SPARK-PRODUCING OPERATIONS**

THIS PERMIT MUST BE DISPLAYED AT THE SCENE OF THE OPERATION

Issue Date: _____
Expiration Date: _____
(Duration Not to Exceed 30 Days)

1. _____ has approval to perform the operation described in paragraph 2 at the
location, _____ Organization _____ between the hours _____ and _____

2. Work to be done: _____

3. Special precautions: _____

4. Fire Watch Yes No

5. The undersigned have personally inspected the location and agree on conditions. (See checklist on other side.)

Industrial Safety Office Representative _____ Charge of Operation _____ Supervisor _____
FINAL CHECK-UP

Work area and all adjacent areas to which sparks and heat might spread (including floors above and below and on opposite sides of walls) were inspected 30 minutes after each hot work activity was completed and found fire-safe.

SUPERVISOR OR FIRE WATCH _____

Figure 4-8-1
Safety Permit for Heat, Flame, or Spark-Producing Operations
MSFC Form 1155

BURNING PERMIT CHECKLIST

1. Coordinate planned activity with concerned departments.
2. Consult Environmental Health and Industrial Safety representatives as appropriate.
3. Contact Fire Protection Specialist before welding or cutting on tanks, drums, or containers where flammable materials have been stored.
4. Fire extinguishers will be at worksite during welding operations and prior to issuance of permit.
5. When possible, welding and cutting will be performed in an area designated for such work.
6. Fire Department standby as appropriate for work in hazardous area.
7. Protect all flammable materials within at least 35 feet by moving or covering with flame-proof blankets or material. Wind should be considered for exterior work. (See Note 1 below.)
8. Shields will be used around areas to protect other personnel from bright flashes of light.
9. Provide access to all enclosed areas where sparks may fall.
10. If required by Industrial Safety Office, maintain fire watch during and for at least 30 minutes after welding/burning is completed.
11. Welders will check area thoroughly for sparks or hot metal after welding is completed.
12. Insure provision of personal protective equipment. (See Note 2 below.)
13. Protect running cables/hose. (See Note 1 below.)
14. Gas/liquid lines are not pressurized and are purged as needed.
15. Insure appropriate support provisions for elevated activities are adequate, including scaffolds, belts, lifting devices, etc.
16. Insure arc welding equipment is grounded to material being welded.
17. Post caution/warning signs as required.
18. Disable fire detectors in area before starting operations and reactivate after operations are complete. Call 544-3919.
19. Fuel and oxygen cylinders will be secured on special trucks when used for welding and cutting.
20. Welding and cutting shall not be done in or near rooms containing flammable vapors or liquids.
21. Oil, grease, and heat will be kept away from welding equipment.
22. Hands or gloves shall be free of oil or grease when handling welding equipment.
23. Cylinder valves shall be provided with fixed hand wheels.
24. Compressed gas cylinders shall not be used for supports at any time.
25. Cylinder valves shall be closed when left unattended.
26. Cylinders will be placed as far away from work area as possible.

Note 1:

Flameproof blankets must pass following test:
Material placed 8 inches under the cutting of
½-inch thick metal with a standard no. 60 tip
torch at a rate of 15 inches per minute. Material
must not show holes as a result of slag burning
or heat stress.

Note 2:

Supervision is responsible for ensuring safety of
operations, personnel, and facilities. Reference
MPG 1700.1 (Fire Protection Standard), OSHA 1910.252
(Welding, Cutting, and Blazing), OSHA 1926.353
(Ventilation and Protection in Welding, Cutting, and
Heating).

Note: Section 4-9 was canceled by MWI 8715.2 dated December 13, 1999

SECTION 4-9

LOCKOUT/TAGOUT

4-9.1. SCOPE

4-9.1.a. The requirements set forth in this standard apply to the control of energy during servicing or maintenance of "affected equipment" in all operations and facilities at MSFC. Exceptions are:

- (1) Normal production operations, unless servicing and maintaining requires an employee to remove or bypass a guard or safety device, or to place any part of his/her body in a point of operation.
- (1) Cord and plug connected equipment if equipment is unplugged and under the control of the employee during service or maintenance work.

4-9.1. AUTHORITY

4-9.1.a. 29 CFR 1910.147, "The Control of Hazardous Energy (Lockout/Tagout)"

4-9.1.a. NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"

4-9.1. DEFINITIONS

4-9.1.a. Affected Employee - employee who operates "affected equipment" to be locked or tagged out during service or maintenance work, or any person who works in an area where such service or maintenance work is being performed.

4-9.1.a. Affected Equipment - all machinery, tooling, equipment, process, or any device which can contain or produce kinetic or potential energy.

4-9.1.a. Authorized Employee - employee who locks or tags out the "affected equipment" and performs the service or maintenance on "affected equipment."

4-9.1.a. Energy Control Program - a comprehensive plan which describes how an organization or contractor implements the MSFC Standard for Lockout/Tagout.

- 4-9.1.a. Energy Control Procedure** - a procedure developed, documented, and utilized for each unique service or maintenance job.
- 4-9.1.a. Lockout** - the placement of a positive lock on a specific energy isolating device, in accordance with an established procedure, which precludes the operation of equipment and the energy isolating device. At MSFC the equipment must be locked out and tagged.
- 4-9.1.a. Lockout Devices** - lockout devices are used to control energy and are not used for any other purpose.
- 4-9.1.a. Other Employee** - other (than the authorized and affected) employees who may be in the area where energy control procedures are used.
- 4-9.1.a. Tagout** - the placement of a "tagout device" on the energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and equipment being controlled may not be operated.

4-9.1. RESPONSIBILITIES

- 4-9.1.a. Equipment maintenance or repair organization (employer of "authorized employee" as mandated by 29 CFR 1910.147):**
 - (1) Develops an Energy Control Program.
 - (1) Develops Energy Control Procedures.
 - (1) Performs periodic reviews of Energy Control Procedures.
 - (1) Provides for training and certification of employees.
 - (1) Ensures employees comply with an outside employer's energy control program.
 - (1) Procures or specifies new equipment designed to accept a lockout device when major replacement, repair, renovation, or modification of existing equipment is performed.
- 4-9.1.a. Industrial Safety Office:**
 - (1) Ensures lockout/tagout program is implemented.

4-9.1. FUNCTIONS

- 4-9.1.a. Lockout/tagout is performed in accordance with 29 CFR 1910.147 and the additional provisions of this document
- 4-9.1.a. The equipment repair/maintenance organization completes a detailed survey of machinery, equipment, or processes to identify equipment to be designated "affected equipment." This survey is used to develop the Energy Control Procedures.
- 4-9.1.a. A written Energy Control Procedure is developed for each service or maintenance job where personnel may be exposed to the unexpected energization or startup of the machine and/or equipment or the release of hazardous energy. An example format is provided in Appendix 4-9-A (MSFC Form 4287). Minimum requirements are listed in 29 CFR 1910.147, Appendix A.
- 4-9.1.a. Energy Control Procedures are reviewed annually to ensure use and to evaluate effectiveness. This review is performed by an authorized employee (but not the one who uses the Energy Control Procedure) and documented for ISO review.
- 4-9.1.a. The person who placed the lock or tag personally removes the lock or tag.

Exception: Occasionally, a situation arises where the person who placed the lock or tag is unavailable and the locked or tagged equipment must be placed in operation. This exception is not allowed if the person who placed the lockout/tagout device is on the MSFC site. If that person is at MSFC, he/she is to remove the lock or tag. Three possible scenarios are described below:

- (1) **Employer Removes Lock** - the device may be removed by the authorized employee's employer provided all the following requirements are met:
 - (a) Specific procedures and training for such removal have been developed, documented, and incorporated into the employer's energy control program.
 - (a) Employer verifies the authorized employee who applied the device is not on site.
 - (a) Employer verifies that the authorized employee is notified of the removal prior to the authorized employee resuming work at the facility.

(1) **Another Organization Removes the Lock In an Emergency Situation When Pre-Approved Procedures Do Not Exist** - In cases where pre-approved plans for lockout/tagout removal by anyone other than the authorized employee who installed the device do not exist, or where those plans are not immediately available, the following steps must be followed:

- (a) Every effort is made to get verbal clearance from the authorized employee who placed the lock or tag before proceeding to step 2.
- (a) MSFC Security is notified (544-4357).
- (a) The organization removing the lock uses the Lockout/ Tagout Procedure (MSFC Form 4287 or equivalent) to remove the lock or tag after a thorough check has been made to ensure the equipment is in safe operating condition and all employees are clear of the equipment.
- (a) The authorized employee who placed the lock or tag is notified that his or her lockout/tagout device was removed before the employee resumes work at the facility.
- (a) The ISO is notified.

**4-9.1.a. EQUIPMENT EQUIPMENT EQUIPMENT EQUIPMENT DEFINITIONS
DEFINITIONS DEFINITIONS DEFINITIONS Safety Locks**

(1) Distinctive identified locks are used for securing energy sources. All locks used at MSFC are identifiable by individual, user organization name, or outside contractor name. The typical lockout device used at MSFC is a nickel-plated case-hardened steel shackle, laminated cadmium steel case, and four-pin tumbler locking mechanism with a 1½-inch (3.8 cm) body width and a 3-inch (7.6 cm) vertical shackle clearance. Lockout devices are color coded to specialty skills.

(a) <u>Specialty Skill</u>	<u>Color</u>
(b) Electrical	Red
(c) Laborers	White
(d) Millwright	Blue
(e) Pipefitters/HVAC	Black
(f) Sheet Metal	Yellow
(g) Other	Green

- (1) Multiple lockout devices are used to facilitate more than one safety lock on an energy-isolating device.
- (2) Exception: Tags alone are permissible only when it is not possible to use lockout devices. It must be demonstrated that a level of safety is achieved in the tagout which is equivalent to lockout.

4-9.1.a. DEFINITIONS DEFINITIONS DEFINITIONS DEFINITIONS Lockout Tags

- (1) Every lockout is tagged. The tag, when used alone, is securely fastened to the energy-isolating device in accordance with an established energy control procedure. The tag, when used in conjunction with the lockout device, is attached through the locking shackle. The lockout tag (Figure 4-9-1):
 - (a) Is not used for any other purpose.
 - (a) Includes a means of attachment durable enough to prevent accidental removal (minimum unlocking strength of no less than 50 pounds).
 - (a) Indicates the date applied, the identity of the employee applying the device, and a brief statement about the work being performed.



Figure 4-9-1

4-9.1.a. Group Lockout

- (1)** Group lockout occurs when more than one crew, department, or contractor is involved. Group lockout or tagout devices are used in accordance with established procedures, including:
 - (a)** All authorized employees for every crew, department, and/or contractor affix a personal lockout or tagout device to the group lockout device, or comparable mechanism, when they begin work.
 - (a)** When an authorized employee stops working on "affected equipment," each authorized employee personally removes the lockout or tagout devices.
 - (a)** Overall job-associated lockout or tagout control responsibility can be vested in a single authorized employee from each crew, department, or contractor. This authorized employee coordinates with the affected work force to ensure continuity and protection.

4-9.1.a. Training

TRAINING AND RECORD KEEPINGTRAINING AND RECORD KEEPING
TRAINING AND RECORD KEEPINGTRAINING AND RECORD KEEPING
TRAINING AND RECORD KEEPINGThere are three types of training: authorized employee, affected employee, and other employee. See Section 3-2, "Training and Certification," for detailed requirements.

MSFC LOCKOUT / TAGOUT PROCEDURE

PURPOSE

This procedure establishes the minimum requirements for the Lockout or Tagout of this hazardous energy or material contained in the Equipment/System listed above when ever servicing or maintenance is performed. It is used to ensure that the Equipment/System is stopped, isolated from all potential hazards, and locked and/or tagged out before servicing or maintenance is performed where unexpected start-up could cause injury.

REQUIREMENTS

All employees shall comply with the restrictions imposed during lockout/tagout of equipment/systems. Authorized employees will perform the lockout/tagout in accordance with this procedure and the safety requirements in MMI 1700. 1 (Section 6-5). No employees shall attempt to restart or use equipment/systems that have been locked or tagged out. Noncompliance with these requirements can result in reprimand, suspension, or employee termination.

Equipment/System:	Location (Building/Room):
-------------------	---------------------------

Authorized Employee/Organization:
(List additional authorized employees in block 10)

PROCEDURE

1. Notification: Notify all affected (equipment/system operators) personnel of the servicing or maintenance and the lockout/tagout to be performed.

a. Employees notified (names)/Organization	b. Method notified (PA System, telephone, direct, etc.)

2. Hazard recognition and identification: Refer to organization documentation (e.g. factory manuals, FOP's, etc.) to understand and control hazards of the equipment/systems.

a. Identify Hazard Type, (Pneumatic, Hydraulic, Toxic, Flammable, Electrical, etc.):	
b. Identify Hazard Magnitude (PSI, Qty of Material, Voltage, etc.)	c. Method of Control (Valve or Switch Closure, etc.)

3. Shut down equipment/system (if operating). Use the following control component(s):

a. Type	b. Location

4. Deactivate the energy-isolating device (the component selected to lockout/tagout).

a. Type	b. Location

5. Lockout/Tagout one or more of the energy-isolating devices listed under step 4, above.

--

6. Release stored energy or material necessary to render the equipment/system safe for conducting the servicing or maintenance. List the type of energy or material released (flywheel, capacitor, pressure, springs, etc.) and the method used (reposition, ground, block, bleed down, etc.).		
a. Type		b. Location
7. Ensure that the equipment/system is isolated or disconnected from the source by: (a) First verifying no personnel are exposed to a potential hazard, and (b) Attempting to turn on or restart the equipment/system, or testing for energy or material.		
Method of Verification		
8. Proceed with servicing or maintenance.		
9. Upon completion of servicing or maintenance and if equipment/system is ready to return to normal operation, proceed to the following steps:		
(a) Ensure that non-essential items are removed from the immediate area around the machine and that the equipment/system components are operationally intact.		
(b) Ensure all personnel are removed from the area or positioned safely prior to restart.		
(c) Verify all controls are in neutral or correct positions.		
(d) Remove the lockout/tagout device(s).		
(e) Notify the affected employees (equipment/system operators) that the servicing or maintenance is complete and the equipment/system is ready for use.		
Procedure prepared by, (legible signature):		
Date:		
Servicing or maintenance performed by, (legible signature):		
Date:		
10. Additional Authorized Employees (Service/Maintenance):		
a. Name	b. Organization	c. Signature/Date (following removal of lockout/tagout device)

SECTION 4-10

Note: Section 4-10 was canceled by MWI 8715.3 dated December 13, 1999

HAZARD WARNING (Signs, Tags, and Barricades)

Note:

**CHAPTER 6: STANDARD FOR HAZARD WARNING TAGS, SAFETY PERMITS,
AND EMERGENCY SHOWER AND EYEWASH TEST RECORD
TAGS**
**CHAPTER 6: STANDARD FOR HAZARD WARNING TAGS, SAFETY
PERMITS, AND EMERGENCY SHOWER AND EYEWASH TEST RECORD
TAGS**
**CHAPTER 6: STANDARD FOR HAZARD WARNING TAGS, SAFETY
PERMITS, AND EMERGENCY SHOWER AND EYEWASH TEST RECORD
TAGS**
**CHAPTER 6: STANDARD FOR HAZARD WARNING TAGS, SAFETY
PERMITS,
AND EMERGENCY SHOWER AND EYEWASH TEST RECORD TAGS**

4-10.1. AUTHORITY

4-10.1.a. 29 CFR 1910.145, "Specifications for Accident Prevention Signs and Tags"

4-10.1.a. 29 CFR 1926.200, "Accident Prevention Signs and Tags"

4-10.1.a. 29 CFR 1926.202, "Barricades"

4-10.1. RESPONSIBILITIES

4-10.1.a. Employees:

(1) Tag defective tools or equipment using the procedures in this section.

(1) Barricade unsafe areas to prevent or limit employee access.

4-10.1.a. Supervisors:

(1) Ensure unsafe conditions are tagged or barricaded and corrected.

(1) Issue biological hazard tags in accordance with procedures approved by the Industrial Safety and Environmental Health Offices.

4-10.1.a. Management Operations Office:

Issues caution, danger, and warning tags.

4-10.1.a. Security Office:

Places barriers at accident scenes and limits access to authorized personnel.

4-10.1. FUNCTIONS

4-10.1.a. General

- (1) MSFC employees (including Industrial Safety and Quality Assurance Offices) use caution, danger, and warning tags as a temporary means of warning personnel of a hazardous condition, defective equipment, or other potentially hazardous operation involving tools, equipment, materials, and processes which are considered unsafe.
- (1) Tags are not considered as a complete warning method.
- (1) Supervisors notify affected employees of the hazard and take additional steps to secure the scene or resolve the hazard.
- (1) Barricades are used to prevent or limit employee access to work hazardous areas, including:
 - (a) Accident scenes
 - (a) Evacuation sites
 - (a) Uninsulated energized circuits
 - (a) Open wells, pits, or shafts
 - (a) Traffic hazards
 - (a) Areas to which objects could fall

4-10.1.a. Types of Tags

- (1) **Caution Tags** are used only in minor hazard situations where the potential hazard or unsafe practice presents a lesser threat of employee injury. See Figure 4-10-1.



Figure 4-10-1

- (1) **Warning Tags** are used to identify hazardous situations where a non-immediate or potential hazard or unsafe practice presents a lesser threat of employee injury (hazard level between Caution and Danger). Also, use warning tags to identify equipment, tools, or articles involved in mishaps.
- (1) **Danger Tags** are used only in major hazard situations where an immediate hazard presents a threat of death or serious injury to employees.
- (1) **Biological Hazard Tags** are used to identify the presence of a biological hazard and equipment, containers, rooms, experiment animals, or combinations thereof, that contain, or are contaminated with, hazardous biological agents.
- (1) **Lockout/Tagout Tags** (See Section 4-9, “Lockout/Tagout”).

4-10.1.a. Procedure for Tagging

- (1) **Initiator:**
 - (a) Affixes tag as close as possible to the hazard in a means which prevents loss or unintentional removal of the tag.
 - (a) Prints a concise reason for attaching the tag on the reverse side.
 - (a) Signs and dates the tag.
 - (a) Notifies the supervisor.

(1) Supervisor:

- (a)** Informs affected employees and advises them of special precautions.
- (a)** Takes steps to correct the defect or unsafe practice.

4-10.1.a. Procedure for Removing Tags

The tag is removed by the initiator.

Exception: Only the ISO removes warning tags affixed to articles involved in mishaps.

SECTION 4-11

PERSONAL PROTECTIVE EQUIPMENT

Note: Section 4-11 was canceled by MWI 8715.4 dated December 20, 1999

4-11.1. PURPOSE

To establish guidance for the selection and maintenance of personal protective clothing and equipment. This includes safety goggles and safety prescription spectacles, welding helmets and shields, safety shoes, aprons, suits, gloves, protective headgear, face shields, and fall protection equipment. Inclement weather clothing, such as rain coats, parkas, and boots, are not considered protective safety clothing. This standard does not address selection of eye and face protection related to radiation, lasers and masers (see Section 5-7, "Lasers"), recreational activities, or respiratory equipment.

4-11.1. AUTHORITY

4-11.1.a. NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"

4-11.1.a. CFR 1910 Subpart I, "Personal Protective Equipment"

4-11.1.a. CFR 1926 Subpart E, "Personal Protective and Life Saving Equipment"

4-11.1. RESPONSIBILITIES

4-11.1.a. Supervisors:

- (1) Assess the workplace for hazards which require the use of PPE (see Appendix 4-11-A).
- (1) Select proper PPE for the identified hazards using OSHA, ANSI standards, and Material Safety Data Sheets.
- (1) Procure PPE where necessary for the protection of visitors and MSFC employees (see Section 2-3, "Purchasing").
- (1) Provide PPE use and maintenance training to employees.
- (1) Ensure employees and visitors use and properly maintain PPE.

4-11.1.a. Employees:

Wear and maintain PPE.

4-11.1.a. Industrial Safety Office:

- (1) Assists supervisors in the selection of PPE.
- (1) Assures proper use and maintenance of PPE.

4-11.1. FUNCTIONS

4-11.1.a. PPE meets or exceeds applicable recognized performance standards (ANSI Z41.1, ANSI Z49.1, ANSI Z87.1, ANSI Z89.1, OSHA 29 CFR 1910 Subpart I, and 29 CFR 1926 Subpart E).

4-11.1.b. Supervisors use the PPE Safety Survey Form (Appendix 4-11-A) to determine PPE needs. A copy of the results is provided to the ISO.

4-11.1.a. Training Guidelines

As a minimum, training includes the following:

- (1) When PPE is necessary
- (2) What PPE is necessary
- (3) How to properly doff, don, adjust, and wear PPE
- (4) Limitation of PPE
- (5) Proper care, maintenance, useful life, and disposal of PPE.

4-11.1.a. The supervisor documents training, including the name of each employee trained and date(s) training took place (Figure 4-11-1).

4-11.1.a. Supervisor forwards training records to the Training Branch for inclusion in MSFC employee training records.

4-11.1. Additional PPE Requirements at MSFC:

4-11.1.a. Signs are posted in areas where eye protection is required.

4-11.1.a. Floors are painted in large shops to designate eye hazard areas. Eye protection is worn entering the designated area.

4-11.1.a. Personnel wear eye protection with side shields in areas where machines or operations produce flying object hazards (particles, chips, or sparks), glare, liquids, injurious radiation, dangerous chemicals (poured, brushed, or handled), or a combination of these hazards.

- 4-11.1.a.** Signs are posted where welding operations are performed warning personnel not to watch arc.
- 4-11.1.b.** Hard hat chin straps are used in elevated areas, e.g., test stands.
- 4-11.1.c.** PPE is maintained in a clean, sanitary, serviceable condition.
- 4-11.1.d.** PPE is never modified without express written authorization from the manufacturer or ISO.

Name (First, Last)	Type of Training	Date of Training	Mail Code	SSN

Figure 4-11-1 Example Training Record for PPE Course

APPENDIX 4-11-A

This document has been written to satisfy the hazard assessment requirements in 29 CFR 1910.132(d).

Survey Performed By: _____ **Office Symbol:** _____ **Date:** _____
(Print Name then sign above it)

Hazardous Operation(s): _____

Location: _____
(Building Number and Room Number)

Head Protection (1910.135) [Ref.: ANSI Z89.1]

Survey Questions	NO	YES	Suggested Corrective Actions	Corrective Actions Taken
Risk of falling objects? Note: Chin straps required for overhead work.			Hard hat required (Types A or B). Stock No. 8415005856531	
Possible contact with electrical conductors?			Hard hat required Type A up to 2,200 V, Type B up to 20,000 V. Stock No. 8415005856531	

Eye & Face Protection (1910.133) [Ref.: ANSI Z87.1]

Survey Questions	NO	YES	Suggested Corrective Actions	Corrective Actions Taken
Flying particles?			Safety glasses with side guards. Stock No.'s 4240012615497, 4240011400282, or 4240011715178	
Molten metals?			Face shield and goggles. Stock No.'s 4240005422048 and 4240000523776	
Liquid chemicals?			Chemical goggles. Stock No. 4240010635996	
Acids/Caustic Liquids?				
Chemical gases or vapors?			Contact Environmental Health CN01-M (544-2390)	
Potentially injurious light radiation?				

NOTE: Prescription safety glasses can be procured, but the employee is responsible for the eye examination.

Foot Protection (1910.136) [Ref.: ANSI Z41.1]

Survey Questions	NO	YES	Suggested Corrective Actions	Corrective Actions Taken
Danger of foot injury due to falling or rolling objects?			Order safety shoes	
Danger of objects piercing the sole?				
Danger of exposure to electrical hazards?			Electrical hazard footwear is intended to provide protection against open circuits of up to 600 volts under dry conditions. Note: Electrical hazard shoes are NOT intended for use in explosive or hazardous locations where conductive footwear is required.	
Danger of buildup of static electricity? Note: A conductive shoe tester should be provided in ESD Sensitive areas.			Conductive safety shoes are designed to protect against hazard of buildup of static electricity. Note: Conductive shoes are to be used only in areas designated as ESD Sensitive areas.	
Oil or chemical hazards?			Use oil and chemical resistant safety shoes/boots.	

Note: The Safety Shoe Van is at Building 4471 the second Wednesday of each month.

Hand Protection (1910.138)

Survey Questions	NO	YES	Suggested Corrective Actions	Corrective Actions Taken
Skin absorption of harmful substances?			Use glove recommended in MSDS or contact Environmental Health CN01-M (544-2390). Neoprene 8415011892672/3 0.019 thick 8415013291657 0.015 thick 8415011200539 Nitrile rubber 8415010318985 Vinyl 8415010706263	
Severe cuts, punctures, or abrasions?			Use protective gloves/gauntlets. Stock No.'s 8415002688350, 84150009537354, 8415009533749, 8415002688330, 8415010923910, Or 8415006345026	
Chemical burns?			Use glove recommended in MSDS or contact Environmental Health CN01-M (544-2390).	
Thermal burns/harmful temperature extremes?			Use protective gloves/gauntlets. Welders gloves: 841501290545 or 8415002687859	
Blood or other biological hazards?			Contact Environmental Health CN01-M (544-2390).	
Hyperbaric (O ₂ > 25%) atmospheres?				

Protective Clothing

Survey Questions	NO	YES	Suggested Corrective Actions	Corrective Actions Taken
Fire?			Use fire resistant clothing: flame retardant jump suit, lab jacket, and welder's jacket. Contact the Property Management Division/CN41.	
Abrasion?			Use abrasion resistant clothing.	
Exposure to particulate contaminants?			Contact Environmental Health CN01-M (544-2390). Clean room disposable coveralls Stock No. 8415011158404	
Static electricity shock hazards?			Electrostatic wrist strap Stock No. 5920013010424	
Hazardous chemicals?			Contact Environmental Health CN01-M (544-2390).	
Cryogenics?			Use clothing approved for cryogenic work; contact the ISO (544-0057).	
Radiological hazards?			Contact Environmental Health CN01-M (544-2390).	
Biological hazards?				
Hyperbaric (O ₂ > 25%) atmospheres?			Use approved fire resistant clothing.	

Respirators (1910.134) [Ref.: MMI 1810.3]

Survey Questions	NO	YES	Suggested Corrective Actions	Corrective Actions Taken
Harmful Dust?			Contact Environmental Health CN01-M (544-2390) or Respiratory Services (544-4483).	
Harmful fogs?				
Harmful fumes?				
Harmful mists?				
Harmful gases?				
Harmful smoke?				

Hearing Protection (1910.95)

Survey Questions	NO	YES	Suggested Corrective Actions	Corrective Actions Taken
Is there a reason to believe workers are exposed to a Time Weighted Average (TWA) of 85 dBA for 8 hours or 115 dBA for any time period?			Contact Environmental Health CN01-M (544-2390). Ear plugs 6515013620300 Ear muffs 8415011473599	

SECTION 4-12

ACCESS TO THE EAST AND WEST TEST AREAS

4-12.1. PURPOSE

To authorize and control entry into the East and West Test Areas.

4-12.1. RESPONSIBILITIES

4-12.1.a. Planners of Authorized Escorted Tours of Test Areas by Distinguished Visitors:

Notify the Chief, Propulsion Test Division, immediately upon initiating plans for tours of the East and West Test Areas by distinguished visitors without temporary safety badges.

4-12.1.a. Supervisors:

Notify the Chief of the Propulsion Test Division and ISO of personnel requiring access to the East and West Test Areas.

4-12.1.a. Propulsion Laboratory:

- (1) Authorizes personnel access to the East and West Test Area.
- (1) Directs Security to revoke access privileges upon indication that individuals are in noncompliance with the terms of their access privilege.

4-12.1.a. Facilities Office:

Authorizes construction personnel access to the East and West Test Area and notifies the Propulsion Test Division of authorizations and their purpose and duration.

4-12.1.a. Industrial Safety Office:

Provides safety orientation for personnel requiring access to the East and West Test Areas.

4-12.1.a. Security:

- (1) Issues backdrop badges or key cards to personnel requiring access to the East and West Test Areas.
- (1) Revokes and reclaims custody of backdrop badges or key cards as directed by the Propulsion Laboratory.

4-12.1.a. Authorized Personnel:

- (1) Comply with movement restrictions indicated by warning signals as described in 4-12.3.h.
- (1) Enter active test facilities only with the consent of the designated responsible test engineer.
- (1) Comply with verbal instructions of the responsible Propulsion Laboratory test engineers to evacuate an area.

4-12.1. FUNCTIONS

4-12.1.a. Supervisors:

Notify Propulsion Laboratory and the ISO (in writing) of personnel requiring access to the East and West Test Areas.

4-12.1.a. Facilities Office:

Notifies the ISO and Propulsion Test Division of construction personnel requiring access to the East and West Test Areas.

4-12.1.a. Propulsion Test Division:

- (1) Permits permanent or temporary access into the East and West Test Areas by authorizing appropriate test area backdrop badges and key cards to personnel who possess NASA civil service or MSFC contractor picture badges.
- (1) On scheduled visits, authorizes escorted tours and distinguished visitors to enter the East and West Test Areas without issuance of temporary safety badges or key cards.
- (1) Informs the Security Division of any changes in the method of controlling the entry into the East and West Test Areas.

- (2) Provides names of personnel authorized to request open/close East and West Test Area gates to support work conducted during off-normal working hours.
- (1) Informs the Security Division to open/close East and West Test Area gates as necessary to support work conducted after normal duty hours.

4-12.1.a. Other Than Propulsion Laboratory Who Desire Access of East and West Test Area During Off-Normal Duty Hours

Others who desire access to either test area after normal duty hours, request access in advance, during normal duty hours, from the Propulsion Test Division. In case of NASA contractors desiring access, the respective NASA contracting officer's technical representative makes the advance request for access.

4-12.1.a. Facilities Office:

Authorizes construction personnel who have an MSFC contractor badge to receive backdrop badges and key cards to work in the East and West Test Areas. Temporary construction backdrop badges will include an expiration date.

4-12.1.a. Industrial Safety Office:

- (1) Provides safety orientation training to personnel requiring access to test areas. This is a prerequisite to the issuance of a test area backdrop badge and key card.
- (1) Provides notification to Security when a person completes the safety orientation.

4-12.1.a. Security Office:

- (1) Issues permanent and temporary backdrop badges and key cards for entrance into the East and West Test Areas, as approved by Propulsion Laboratory and concurred by the ISO.
- (1) Assures that personnel who have been authorized access backdrop badges and key cards for entry into the East and West Test Areas have valid NASA civil service or contractor picture badges.
- (1) Closes the East and West Test Area gates upon request by Propulsion Laboratory.
- (1) Controls access within the test area upon request of Propulsion Laboratory.

- (1) Approves all locally developed temporary-type devices (backdrop badges) used in conjunction with the security badge card.
- (1) Permits escorted visitors to enter the test area without issuance of backdrop badges. Tours can be authorized by the following:
 - (a) MSFC Director, Deputy Director, and Associate Director
 - (a) S&E Director and Deputy
 - (a) Propulsion Laboratory Director and Deputy
 - (a) Propulsion Test Division, Chief, Deputy, and Branch Chiefs
 - (a) Public Affairs Office, Director

NOTE: Security guards and emergency service personnel (firemen, medical, etc.) are permitted test area access without temporary or backdrop badges.

4-12.1.a. Warning Signals:

- (1) All personnel authorized to enter the East and West Test Areas must comply with the following general visual warning signals:
 - (a) GREEN: Area Safe.
 - (a) AMBER: Area semihazardous, only authorized personnel may enter.
 - (a) AMBER (with Chime): Propellant Transfer - No smoking or other flame anywhere at transfer location.
 - (a) RED: Area hazardous do not enter, only personnel authorized by Test Engineer may remain.
 - (a) FLASHING AMBER: Area in danger due to another location. No one authorized.
 - (a) FLASHING RED: Extremely hazardous area, evacuate immediately.

CHAPTER 5

APPLICATION STANDARDS AND GUIDELINES

SECTION 5-1

GENERAL SAFETY

5-1.1. HOUSEKEEPING

- 5-1.1.a.** Loose objects or other tripping hazards are removed from floor immediately.
- 5-1.1.b.** Spills are cleaned from floor immediately.
- 5-1.1.c.** Trash and other unnecessary combustibles are removed from area.
- 5-1.1.d.** Fire exits, means of egress, and hallways remain free of boxes, file cabinets, and excess furniture.

5-1.1. SAFE PRACTICES

5-1.1.a. Employees:

- (1)** Wear appropriate personal protective equipment.
- (2)** Do not read or otherwise be distracted while walking; be alert at corners or when stepping into aisles. When crossing aisles, passageways, or roadways, walk with care, and keep to the right, especially at intersections.
- (3)** Close desk and file cabinet drawers when not in use. Do not open more than one drawer of a file cabinet at a time.
- (4)** Use handrails when provided.
- (5)** Do not climb on chairs, boxes, or objects other than approved ladders, scaffolds, or step-stands.
- (6)** Avoid lifting heavy objects, and contact appropriate personnel who have been trained in proper lifting techniques.
- (7)** Avoid leaning too far backward or forward in chairs.

- (8) Do not run in buildings (except in exercise areas).
- (9) Use knives, razor blades, scissors, shears, etc., with care. Place sharp-edged instruments in sheath when not in use. Store all such items in desk drawers or other secure places when not being used. Paper cutters are equipped with a safety lock. Fasten the blade in the closed position when not in use and set the spring tension so the blade cannot fall due to its own weight.
- (10) When leaving at the end of the workday, disconnect or ensure the power is removed from all heat-producing portable appliances (electric coffee pots, electric ovens, hot plates, grills, etc.).

Exception: Industrial grade appliances having safety interlocks to prevent overheating.

- (1) Maintain electric cords for typewriters, desk lamps, and other office machinery in a safe condition. Remove cords from sockets by using the plug. See Section 7-1, "Fire Prevention and Protection" for other electrical safety requirements.
- (2) Arrange desks, tables, etc., so that electrical and telephone floor outlets do not present a tripping hazard.
- (3) Do not remove, cut off, or bend the third prong (ground), or otherwise alter the plug in any manner to make it compatible with two-aperture outlets.
- (4) Securely fasten shelves, cabinets, lockers, etc., to floors or walls if a possibility of overturning exists.
- (5) Do not place or store material, trays, boxes, etc., on top of lockers and cabinets.

SECTION 5-2

TRANSPORTATION SAFETY

5-2.1. AUTHORITY

5-2.1.a. NPD 6000.1, “Transportation Management”

5-2.1.a. 49 CFR, Subpart B, “Hazardous Materials Transportation and Pipeline Safety”

5-2.1. APPLICABILITY

Detailed instructions for shipping and receiving are provided in MM 4000.1. This section lists safety requirements for MSFC transportation operations.

5-2.1. RESPONSIBILITIES

5-2.1.a. Directors/Managers of Basic Organization:

- (1) Initiate transportation requests (e.g., shipping, receipt, issue, and turn-in) in accordance with MM 4000.1.
- (1) Ensure receipt of explosives or radioactive materials is restricted to certified personnel.

5-2.1.a. Property Management Division:

Controls receipt, issue, turn-in, storage, and disposal of quality sensitive property, hazardous materials, explosives, and radioactive sources in accordance with MM 4000.1, Department of Transportation (DOT) regulations, and this section.

5-2.1.a. Transportation Management Division:

Coordinates transportation of Program Critical Hardware (PCH) in accordance with MSFC-P15.1-C01, “Packaging, Handling, and Moving Program Critical Hardware,” and NASA-STD 8719.9, “Safety Standard for Lifting Devices and Equipment.”

5-2.1.a. Industrial Safety Office:

- (1) Reviews and approves plans and procedures for transportation of explosives and PCH.
- (1) Performs periodic audits to ensure compliance with safety requirements for transportation of hazardous materials, including explosives.
- (1) Provides consultation and assistance to MSFC laboratories and offices in matters concerning explosives safety.

5-2.1.a. Quality Assurance Office:

Assists MSFC laboratories and offices in ensuring compliance with established safety procedures pertaining to transportation of quality sensitive equipment and explosives.

5-2.1. FUNCTIONS

5-2.1.a. General

- (1) The size and weight of equipment to be handcarried is limited in accordance with the NIOSH Manual PB94-176930LJM.
- (1) Program Critical Hardware is transported in accordance with procedures outlined in MSFC-P15.1-C01.
- (1) Hazardous materials defined in 49 CFR 171.8 are not transported in NASA administrative aircraft.

5-2.1.a. Explosives

- (1) Handling, transporting, and disposal of explosive devices and materials are in accordance with the applicable portions of MM 4000.1, "MSFC Property Management Manual," AMCR 385-100, "U.S. Army Missile Command Safety Manual," and NASA-STD 8719.12, "NASA Safety Standard for Explosives, Propellants, and Pyrotechnics."
- (1) Written procedures are prepared for handling, transporting, and disposal of explosives. Procedures are reviewed and approved in accordance with Section 6-2, "Explosive Devices and Materials."

- (1) Receipt, issue, turn-in, disposal, and shipment of explosives are performed by certified personnel at all times.
- (1) Requesting laboratories and offices turn in explosives in accordance with MM 4000.1.

5-2.1.b. Radioactive Materials

- (1) All radioactive materials received by, or shipped from, the Center, or transported within the Center, are properly packed, shielded, and labeled to minimize the radiation hazard. The Radiation Protection Officer (RPO) provides guidance in the receipt, shipment, or disposal of radioactive material contained in, or as a part of, equipment.
- (1) Proper identification, shielding, and containment are maintained on all materials to be transported within MSFC.
- (2) Certified users notify the RPO when radioactive material is shipped.
- (3) The RPO ensures outgoing shipments are adequately shielded, contained, and identified.

SECTION 5-3

LIFTING AND HANDLING

5-3.1. AUTHORITY

5-3.1.a. NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"

5-3.1.a. NASA-STD 8719.9, "Safety Standards for Lifting Devices and Equipment"

5-3.1. DEFINITIONS

5-3.1.a. **Critical Lifting Operation** - Lifting and lowering operations involving major programmatic or institutional hardware that is irreplaceable, or will cause serious program or mission delays if damaged, or is hazardous to personnel if dropped or uncontrolled, or will require special budgetary actions to repair damages suffered from lifting malfunctions. A lifting operation is determined critical if:

- (1) The Program/Project Office identifies the equipment to be lifted as program critical.
- (1) The lifting equipment owner identifies the lifting equipment critical to the performance of his/her operations.
- (1) The ISO determines there are special personnel or equipment safety concerns beyond normal lifting hazards (e.g., lifts involving multiple cranes, lifting personnel with cranes, tight work quarters, or hazardous materials).

5-3.1.a. **Non-Critical Lifting Operation** - Non-Critical Lifts involve routine minimal hazard lifting operations and are governed by standard industry rules and practices except as supplemented with unique NASA/MSFC testing, operations, maintenance, inspection, and personnel licensing requirements.

5-3.1. RESPONSIBILITIES

5-3.1.a. **Organization Responsible for Lifted Object(s):**

- (1) Identifies critical hardware and critical operations [Reference MSFC-P15.1-C01 for PCH, and NASA-STD 8719.9 for Owner Designated Critical and Safety Critical Lifts].

- (2) Prepares specific critical lift procedures and general non-critical lifts standard operating procedures.

5-3.1.a. Facilities Office:

- (1) Inspects, tests, and maintains lifting devices, equipment, and associated accessories in accordance with OSHA, NASA, and ANSI standards.
- (1) Performs lifting operations (critical and non-critical) when requested.
- (1) Lift crew (e.g., Center Operations Support Services Contractor lift crew foreman and safety representative) reviews lift procedures.
- (1) Provides lifting device data packages to the ISO for deviations/waivers and certifications.
- (1) Maintains a crane record database [NASA-STD 8719.9, Section 102].

5-3.1.a. Transportation Management Division:

Assists Facilities Office in inspecting, testing, and maintaining forklifts, mobile cranes, manlifts, associated lifting devices, and other equipment in accordance with OSHA, NASA, and ANSI standards.

5-3.1.a. Supervisors of Equipment Operators:

- (1) Ensure operators, riggers, and flagmen (signalmen) are certified, see Section 3-2, "Training and Certification."
- (1) Ensure operators inspect cranes, forklifts, and slings prior to first use each day in accordance with OSHA, NASA, and ANSI standards.

5-3.1.a. Industrial Safety Office:

- (1) Ensures compliance with NASA-STD 8719.9.
- (1) Issues certification cards to lifting and handling equipment operators.
- (1) Certifies critical lifting devices and equipment.

- (1) Ensures an operational hazard analysis is conducted for critical lifts.
- (1) Reviews and approves lift procedures (critical and non-critical), load test programs, and procedures.
- (1) Monitors critical lift operations.

Exception: Cross-trained Quality Assurance representative may monitor operations for Industrial Safety.

5-3.1.a. Quality Assurance Office:

- (1) Reviews critical lift procedures.
- (1) Monitors critical lift operations and verifies the “record copy” of the procedure.

Exception: Cross-trained ISO representative may monitor operations for Quality Assurance.

- (1) Maintains an archive of “record copy” critical lift procedures.
- (1) Reviews load test programs and procedures.

5-3.1.a. Employees:

- (1) Use safe practices and caution when performing lifting and handling operations.
- (1) Follow written procedures when applicable.
- (1) Stop operation if an unsafe condition is noted.

5-3.1. FUNCTIONS

5-3.1.a. General

- (1) Lifting and handling devices, equipment, and accessories meet NASA-STD 8719.9 design and maintenance criteria.
- (1) Lifting and handling operations are performed in accordance with NASA-STD 8719.9.

- (1) The size and weight of the equipment to be manually lifted is limited in accordance with NIOSH Manual PB94-176930LJM.
- (1) Cranes used to load test items such as slings, platforms, or lifting fixtures are specifically identified and have safety analyses approved by the ISO and the responsible engineering and operations/maintenance organizations [NASA-STD 8719.9, 206a(5)].
- (1) The Director, ISO, reviews and approves deviations/waivers to NASA-STD 8719.9 [8719.9, 104].

5-3.1.a. Critical Lifts

- (1) Written procedures are used for each critical lift.
- (1) Operational hazard analyses are prepared for critical lift operations.

5-3.1.a. Non-Critical Lifts

Standard Operating Procedures (SOP's) or generic procedures are used for non-critical lifts.

5-3.1.a. Tests and Inspections

- (1) Load and operational tests and inspections are performed by qualified personnel using technical operating procedures approved by MSFC and/or contractor safety representatives.
- (1) Load tests are conducted in accordance with MSFC-P15.1-C01 and NASA-STD 8719.9. When there is a conflict, the stricter of the two requirements is used.

5-3.4.e. Suspended Load Operations

Personnel do not work under a suspended or moving load.

Exception: Operations performed in accordance with NSS 8719.9, Appendix B, "NASA Alternate Safety Standard for Suspended Load Operations."

SECTION 5-4

ERGONOMICS

5-4.1. APPLICATION

OSHA has proposed a new “Ergonomic Protection Standard.” The draft addresses prevention of work-related musculoskeletal disorders, such as tendinitis, low back pain, and carpal tunnel syndrome, by controlling employee exposure to the workplace risk factors that can cause or aggravate them. Until this Standard is adopted, the ISO is taking the lead in industrial human factors safety applications, especially as they apply to mishap prevention.

5-4.1. AUTHORITY

NMI 7100.8, “Protection of Human Research Subjects”

5-4.1. FUNCTIONS

5-4.1.a. General

- (1) ISO ensures that MSFC programs consider human factors in their designs.
- (1) Use hazard analyses to evaluate the human factor and to make corrective action recommendations to responsible organizations.

5-4.1.a. Human Test Subjects

NMI 7100.8 and MM 1150.1, Charter 3-26, “Institutional Review Board for Human Research Tests,” are applied whenever human test subjects participate in tests.

SECTION 5-5

CONFINED SPACES

5-5.1. AUTHORITY

5-5.1. a. OSHA 29 CFR 1910, “Permit-required Confined Spaces”

5-5.1. a. MM 1845.3, “Confined Space Entry Program”

5-5.1. FUNCTIONS

5-5.1. a. General

No individual enters a confined space until an assessment of that space is made and specific authorization by entry permit or specific written operating procedure is obtained. Provisions are as described in MM 1845.3.

5-5.1. a. Training TRAINING TRAINING TRAINING TRAINING

See Section 3-2, “Training and Certification,” for detailed requirements.

SECTION 5-6

HAZARDOUS LAMPS

5-6.1. APPLICABILITY

This Section provides safety requirements and procedures for handling, operation, and disposal of potentially hazardous lamps at MSFC. Potentially hazardous lamps include: carbon, mercury, and high pressure arc lamps (i.e., xenon arc lamps).

5-6.1. RESPONSIBILITIES

5-6.1.a. Supervisors:

- (1) Store, operate, and maintain hazardous lamps in accordance with national standards (e.g., ANSI A11.1) and manufacturers' recommendations.
- (1) Ensure training is provided to all employees using hazardous lamps.
- (1) Dispose of hazardous lamps in accordance with Federal and State regulations.

5-6.1. FUNCTIONS

5-6.1.a. Hazards

Hazards associated with high pressure arc lamps include ultraviolet and infrared radiation, explosion (high velocity fragments and release of toxic gas), hot surfaces, and ozone gas. Excessive amounts of radiation may result in permanent damage to the eyes. In addition, absorption of excessive amounts of ultraviolet radiation by any part of the body will result in "sunburn" and other effects. The maximum allowable intensity of direct and reflected ultraviolet radiation is established by the American Conference of Governmental Industrial Hygienists (ACGIH), "Threshold Limit Values for Chemical Substances, Physical Agents, and Biological Exposure Indices" (TLV Pamphlet).

5-6.1.a. PrecautionsREQUIREMENTSREQUIREMENTSREQUIREMENTSREQUIREMENTSREQUIREMENTS

- (1) Supervisors furnish employees who handle or work around unprotected lamps:

- (a) Hoods to protect head and neck.
- (a) Heavy coveralls to protect the body (including arms and legs).
- (a) Safety glasses with side shields capable of filtering ultraviolet and infrared radiation to be worn throughout exposure period.
- (a) Heavy gloves.

Note: When the lamp is protected by a suitable enclosure, only item (c) is required.

- (1) Supervisors verify employees are not exposed to radiation beyond the safe Threshold Limit Values (TLV's) listed in ACGIH, TLV Pamphlet.
- (1) Employees place a portable shield between themselves and lamps when possible.
- (1) Employees shut off power when adjusting or repairing lamps.
- (1) Supervisors direct employees exposed to ultraviolet radiation, which results in "sunburn" (erythema), to seek medical treatment by a physician.
- (1) Employees ventilate the area during lamp operation to prevent accumulation of ozone.
- (1) Supervisors control access to lamp operation areas.

5-6.1.a. Storage OPERATIONOPERATIONOPERATIONOPERATION

- (1) Lamps are stored in protective cases until installed.
- (1) Lamps are separated to prevent chain reaction explosions.
- (1) Storage areas are marked, *Danger - High Pressure Arc Lamps - Authorized Personnel Only.*

5-6.1.a. DisposalWASTE DISPOSALWASTE DISPOSALWASTE DISPOSALWASTE DISPOSAL

Hazardous lamps are disposed of by the Hazardous Waste Branch (544-4787).

5-6.1.a. Training

- (1) Supervisors instruct employees on the hazards associated with exposure to, working with, and disposal of hazardous lamps.
- (1) Section 3-2, "Training and Certification," addresses PPE training.

SECTION 5-7

LASERS

5-7.1. PURPOSE

To provide safety guidelines to be used with MMI 1860.3, "Control of Hazards from Laser Operations," to ensure safe operation of all lasers and laser systems operated at MSFC.

5-7.1. TRAINING TRAINING TRAINING TRAINING AUTHORITY

29 CFR 1926.102, "Laser Protection"

5-7.1. FUNCTIONS

5-7.1.a. General Requirements DEFINITIONS DEFINITIONS DEFINITIONS DEFINITIONS Requirements

- (1) All lasers are registered with the Environmental Health Office.
- (1) Lasers or laser systems are under the direct supervision of individuals knowledgeable in laser safety.
- (2) Laser operators are certified; see Section 3-2, "Training and Certification," for detailed requirements.
- (1) Operating procedures for each laser device or system are approved by the Medical Center, Laser Safety Officer, and the ISO.
- (1) Eye and face protection is used in accordance with the requirements of ANSI Z136.1.

5-7.1.a. Requirements for Class II and IIIa Lasers

- (1) Include all of the above requirements.
- (1) "Caution" signs are posted where Class II and Class IIIa lasers are operated [ANSI Z136.1].

5-7.1.a. Requirements for Class IIIb Lasers

- (1) Include all of the above requirements.
- (1) "Danger" signs are posted in areas where Class IIIb or Class IV and some Class IIIa lasers are operated [ANSI Z136.1].
- (2) When engineering controls do not eliminate potential exposure, operators are issued proper PPE (e.g., eye wear, protective clothing, respiratory protection, and hearing protection).
- (1) An audible alarm, a warning light (visible through protective eye wear), or a verbal countdown command precedes lasers or laser systems activation.
- (1) Potentially hazardous beams are terminated by noncombustible, nonreflective beam stops.
- (1) Reflective materials are not used in or near the beam path unless approved by authorized personnel for test applications.
- (1) Lasers are stored or disabled when not in use.
- (1) Temporary laser controlled areas are established for all maintenance or service operations.

5-7.1.a. Requirements for Class IV Lasers

- (1) Requirements for a Class IV laser or laser systems include all of the requirements listed above for Class IIIb lasers.
- (1) Non-defeatable (non-override) area entryway safety controls are used to deactivate or reduce the laser output to a permissible level.
- (1) When safety latches or interlocks are not feasible, a door, blocking barrier, or curtain is used to block or attenuate laser radiation. This must be used in conjunction with a visible or audible signal indicating laser operations are under way.

SECTION 5-8

PRESSURE SYSTEMS

5-8.1. AUTHORITY

- 5-8.1.a. 29 CFR Part 1910, "Occupational Safety and Health Standards,"
- 5-8.1.a. 49 CFR, "Transportation"
- 5-8.1.a. NHB 1700.6, "Guide for Inservice Inspection of Ground-Based Pressure Vessels and Systems"
- 5-8.1.a. NMI 1710.3, "Safety Program for Pressure Vessels and Pressurized Systems"

5-8.1. DEFINITIONS

- 5-8.1.a. **PV/S** - Any pressure vessel or system as defined below.
- 5-8.1.a. **Pressure Vessel** - Any vessel which is used for the storage or handling of gas or liquid under positive pressure (or under vacuum for vacuum vessels).
- 5-8.1.a. **Pressure System** - An assembly of components under pressure (or vacuum) including vessels, piping, pumps, valves, relief devices, expansion joints, gages, and other related components.
- 5-8.1.a. **Class I PV/S** - Pressure vessels or systems used for test and research investigations, or high risk, low cost systems. These systems do not meet any national consensus standards, or NASA/MSFC specifications/ standards. They can be used only if located in an isolated area, buried, or barricaded to preclude injury to personnel or damage to a facility or equipment.

- 5-8.1.a. **Class II PV/S** -

- (1) Flight-weight pressure vessels or systems which are used in human space flight hardware systems. They are designed, developed, certified, and recertified in accordance with a fracture mechanics control plan. The plan shall be in accordance with NASA space vehicle design criteria and NASA SP-8040, "Fracture Control of Metallic Pressure Vessels."
- (1) Associated Aerospace Ground Support Equipment - any pressure vessel or system that is supplied to a user which has been certified or recertified to operate in the service for which it is intended by the responsible flight systems or ground support equipment design organization. These vessels and systems shall normally meet the same consensus standards for ground-based systems except where weight is a factor.
- (1) Flight-weight pressure vessels or systems which are used in unmanned space flight hardware systems or used in ground testing to demonstrate technology for flight systems.

5-8.1.a. Class III PV/S - Pressure vessels or systems which are primarily ground-based systems for technology applications beyond established detailed national consensus standards. These vessels or systems are designed, developed, and built according to NASA, MSFC, or other Government agency standards and specifications. They incorporate more analysis and inspection, including hazards analyses, than normally required by national consensus standards.

5-8.1.a. Class IV PV/S - Industrial pressure vessels and systems which are all ground based, unfired pressure vessels, or systems not covered by Class III. These vessels and systems are designed, developed, and built according to applicable national consensus standards.

5-8.1.a. Class V PV/S - Pressure vessels and systems which are used in aircraft systems. These vessels and systems must meet the requirements of FAA Airworthiness Standard, Part 23.1435, for normal utility and acrobatic aircraft and Part 25.1435 for transport aircraft.

5-8.1.a. Class VI PV/S - Pressure vessels and systems which are used for portable or over-the-road type service.

5-8.1.a. Class VII PV/S - Pressure vessels and systems which are used for fire protection services. These vessels and systems are designed and built to meet applicable NFPA requirements.

5-8.1.a. Class VIII PV/S - Utility pressure vessels and systems containing air or water meeting the following conditions:

(1) Pressure vessels in which pressures are not greater than 863 kPa (125 psig), temperatures are between ambient and 54.4°C (130 °F), and pressure times volume is not greater than 981 kPa x m³ (5,000 psi x ft.³).

(1) Piping and components in which pressures are not greater than 863 kPa (125 psig), temperatures are between ambient and 54.4 °C (130°F), and pressure times diameter squared is not greater than 1,422 MPa x cm² (32,000 psi x in.²).

(1) Water tanks with hydrostatic pressure only, located so as to preclude threat to personnel in event of failure.

(1) Vacuum vessels and systems less than 2.83 m³ (100 ft.³).

5-8.1.a. Certification - The documented status (including cognizant organizational approval signatures) that qualifies a pressure vessel or system to operate in the service for which it is intended.

5-8.1.a. Maximum allowable working pressure (MAWP) - The MAWP for a vessel is the maximum pressure permissible at the top of the vessel in its normal operating position at the operating temperature specified for that pressure.

5-8.1.a. High Pressure - Pressure exceeding 150 psi.

5-8.1. RESPONSIBILITIES

5-8.1.a. Institutional & Program Support (I&PS) Office:

Assures all pressure vessels and systems are designed, fabricated, installed, inspected, tested, certified, operated, and maintained in accordance with NMI 1710.3 and this section.

5-8.1.a. Industrial Safety Office:

- (1) Ensures MSFC policy, responsibilities, and requirements for pressure vessels and pressurized systems are established and are in compliance with NMI 1710.3.
- (1) Reviews and concurs in deviations and waivers.

5-8.1.a. Users of PV/S:

- (1) Designate a responsible engineer for each system.
- (1) Correct any certification deficiencies.
- (1) Establish and maintain a configuration management system for each system.
- (1) Concur in the determination of interfaces.
- (1) Ensure that any alterations, modifications, or repairs to PV/S are in accordance with this document.
- (1) Ensure that any temporary vessels brought onto MSFC comply with the requirements of this document and that the ISO is notified.
- (1) Mark and tag all system components properly.

5-8.1.a. I&PS Office Pressure Systems Manager:

- (1) Approves deviations or waivers of technical requirements as specified in codes and standards with the concurrence of the S&MA Office.
- (1) Serves as chairman of Pressure Systems Committee.
- (1) Maintains a current inventory and certification status of all ground-based pressure vessels and systems.
- (1) Ensures that PV/S that are transferred from or to MSFC are properly documented as to the CERT status.
- (1) Provides and submits the annual NASA RECERT Status Report to NASA Headquarters.

- (2) Ensures that all MSFC offsite facilities, such as Michoud Assembly Facility (MAF), Assembly and Refurbishment Facility (ARF), and Santa Susanna Field Laboratory (SSFL)/Canoga Park, are in compliance with this directive.

5-8.1.a. Science and Engineering Directorate:

- (1) Ground-Based PV/S:
 - (a) Provides technical and engineering support, as required, to all user or operators of ground-based PV/S.
 - (a) Provides assistance in accomplishing special analyses, material evaluations, and design verifications. This includes review of proposed waivers and deviations from codes, standards, and guides.
- (1) Flight-Weight PV/S and Associated GSE:
 - (a) Provides technical review of design, testing, inspection, certification, and recertification of flight-weight pressure vessels and systems and associated GSE.
 - (a) Ensures that design drawings and related documentation, including inspection and test reports, and certification reports, are maintained and updated to reflect current hardware configuration.
 - (a) Approves and ensures that alterations, modifications, or repairs to existing and proposed flight-weight pressurized systems shall be designed, constructed, inspected, tested, and certified in accordance with applicable codes, standards, and guides.
 - (a) Provides plans and schedules to certify and to recertify flight-weight pressure vessels and systems and associated GSE in accordance with this section.

5-8.1.a. Program Offices/Managers:

- (1) Ground-Based PV/S:

Assure this document is made a contractual requirement where deemed necessary, and ensure compliance.

- (1) Flight-Weight PV/S and Associated GSE:
 - (a) Assure that both new and existing pressure vessels and systems, for which their organization has responsibility, are designed and certified in accordance with this document.
 - (a) Assure that the design and development of flight-weight pressure vessels and systems under their cognizance meet all flight safety and operational requirements and that proposed waivers or deviation are properly evaluated and approved.
 - (a) Assure that sufficient design data, operating procedures, system characteristics and constraints, etc., are provided to permit safe conduct of ground test operations without compromising safety of personnel or equipment.

5-8.1. FUNCTIONS

5-8.1.a. General

- (1) The initial design of pressure systems and any subsequent modifications are described by detailed engineering documentation approved by the user, the designer, the ISO, Materials and Processes Laboratory, Structures and Dynamics Laboratory, and the Pressure Systems Manager.
- (1) Personnel engaged in operating pressure systems are qualified by training and experience in accordance with Section 3-2, "Training and Certification."
- (1) Personnel are not exposed to pressure systems that are not operated and certified in accordance with this section.
- (1) Determination of personnel access restrictions shall be requested from the ISO on a case-by-case basis for all other pressure systems.

- (1) Activity involving pressure systems with safety factors less than 4:1, or systems that are not certified according to criteria for Class III, IV, VII, or VIII, are subject to personnel access restrictions as stated above, and are conducted remotely in areas designed for pressure testing to minimize the risk to personnel, property, and equipment.
- (1) Determination of siting restrictions for such systems shall be requested from the ISO on a case-by-case basis.
- (1) Personnel access, siting restrictions, or other protective features are based on quantitative and qualitative analysis which:
 - (a) Assumes failure of the system at a worst-case maximum pressure/temperature condition.
 - (a) Estimates fragmentation and over pressure effects (catastrophic or leak-before-burst failure mode shall be determined).
 - (a) Assesses the potential for secondary effects such as fire, explosion, motion of failed components and piping, high velocity gas streams, noise, and asphyxiant gas release.
- (1) Any deviations from the requirements of this standard are reviewed and approved by the ISO. Approval is based on the demonstrated presence of compensating features which provide equivalent safety of personnel and property.

5-8.1.a. I&PS Office:

- (1) Appoints a Center **Pressure Systems Manager** to direct technical efforts and act as the primary point-of-contact for all technical recertification activities.
- (1) Institutes, in conjunction with the Science and Engineering Directorate and the ISO, the formation of a **Pressure Systems Committee**. This committee consists of the Pressure Systems Manager and designated representatives of the ISO, the Structures and Dynamics Laboratory, the Materials and Processes Laboratory, and the respective user(s), where appropriate.

5-8.1.a. Pressure Systems Committee:

- (1) Reviews recommended requirements and procedures.
- (1) Maintains an overview of pressure system technology.
- (1) Participates in recertification activities.
- (1) Provides guidance on pressure system safety to the Pressure Systems Manager and other appropriate officials.

5-8.1.a. S&MA Office:

- (1) Establishes a training and certification program for operators of pressure systems capable of operation above 1,034 kPa (150 psig) (Section 3-2, “Training and Certification”).
- (1) Establishes a pressure vessel and systems safety awareness program that periodically alerts all MSFC personnel to the proper procedures for working with and around pressure systems.

5-8.1. DESIGN AND INSTALLATION AND INSTALLATION AND INSTALLATION AND INSTALLATION AND INSTALLATION

5-8.1.a. Pressure systems are to conform to ASME B31.1, ASME B31.3, or the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 or 2, as applicable, except as noted under criteria for class III vessels. When one of the codes is chosen, the requirement shall be met in its entirety.

5-8.1.a. Overpressure protection devices are to be installed downstream of pressure regulators unless the downstream system is designed for the maximum pressure upstream of the regulator. Downstream overpressure protection shall be sized on the assumption the upstream regulator is flowing at its maximum opening with an inlet pressure equal to the set pressure of the regulator's upstream relief device. Downstream relief devices shall be installed as close to the outlet of the regulator as possible.

5-8.1.a. Downstream relief features built into pressure regulators may be used in lieu of separate relief devices only if it can be demonstrated that the relief features comply with all other requirements of this directive.

- 5-8.1.a.** Relief device outlets are designed and installed in such a manner as to prevent accumulation of water and subsequent freezing or corrosion, and to prevent blockage by insect nests.
- 5-8.1.b.** Discharges from relief devices, vent valve, and gauge blowout ports are located or directed away from personnel and equipment.
- 5-8.1.a.** Flammable, toxic, and asphyxiant fluids are piped out of buildings to include the discharge of internally relieving regulators.
- 5-8.1.a.** Pressure systems are protected from accidental damage by personnel and equipment.
- 5-8.1.a.** All systems are designed and assembled in such a manner that external pressurization sources and internal fluid sources can be isolated quickly and positively in an emergency.
- 5-8.1.a.** Each component of a pressure system is legibly marked, to the extent practical, to indicate the part number, manufacturer, and maximum working pressure and temperature.
- 5-8.1.a.** Pressure system piping is legibly marked identifying contents, temperature, pressure, and flow direction in accordance with ANSI A13.1.
- 5-8.1.a.** Provisions are made for depressurizing all elements of pressure systems to 0 psig by use of appropriate vent valving. Small components, such as gauges, requiring periodic removal or isolation from the system for calibration or service, are provided with valving to isolate and vent the component without the necessity of venting the entire system.
- 5-8.1.a.** To facilitate effective cleaning, low-point drains are provided in systems when cleaning is required during installation or after repair.
- 5-8.1.a.** Systems are provided with adequate pressure-measuring devices. As a minimum, pressure-measuring devices are installed downstream of all pressure-reducing valves (regulators) and at the system interface with its source pressure. The normal operating ranges of pressure gauges are between 25 and 75 percent of full-gauge scale so that the normal working pressure falls within the middle half of the scale. All gauges have a redline marking at the level where safe operating limits are exceeded. Pressure-measuring devices are calibrated in accordance with MSFC-P11.1.

Exception: Gauges used in systems with varying safe operating limits and under specific procedural control need not have redline.

- 5-8.1.a.** Pneumatic panels are designed, fabricated, and installed in accordance with drawings and specifications approved by the Facilities Engineering Division.
- 5-8.1.a.** Adequate clearance around pressure vessels is provided for maintenance and inspection. Clearance between the vessel and floor is provided to minimize corrosion from moisture.
- 5-8.1.a.** All inspection plugs, pressure gauges, temperature gauges, and safety relief valves are accessible at all times.

5-8.1. FLEXIBLE METAL HOSE METAL HOSE METAL HOSE METAL HOSE METAL HOSE

- 5-8.1.a.** Protection is provided for flexible metal hoses in areas where the hoses are subjected to damage from personnel traffic or movable equipment.
- 5-8.1.a.** Flexible metal hoses are positively restrained by clamps, brackets, steel cables, fabric webbing, steel chains, or other effective devices in areas where failure of the hose could injure personnel or damage equipment. Ineffective means, such as sand bags, are not permitted. All flexible hoses pressurized to 150.0 psig or greater are contained or restrained. Hose restraint is accomplished using a chain or cable anchored to a substantial object and to the hose assembly at the hose end connector, each union or hose splice, and intervals not to exceed 1.83 meters (6 feet).
- 5-8.1.a.** Flexible metal hoses are inspected before use and weekly for flat areas in excess of 3 inches in length, kinks, sharp ends, twists, leaking or damaged fittings, overdue pressure tests, and excessive corrosion or deterioration. If any of the above is found, use of the hose is prohibited.
- 5-8.1.a.** Flexible metal hoses are marked to indicate maximum working pressure and date of last pressure test. Flexible metal hoses for which the MAWP is unknown or cannot be established are destroyed.
- 5-8.1.a.** Flexible metal hoses are hydrostatically tested prior to initial use to 150 percent of the maximum working pressure and annually thereafter to the same level.

Exception: Flexible metal hoses installed for vibration isolation or thermal expansion/contraction that are infrequently disconnected are excluded from the annual testing requirement.

- 5-8.1.a.** Disconnected metal hoses are sealed to prevent contamination.
- 5-8.1.a.** Flexible metal hoses are not subjected to pressure greater than the maximum working pressure for which they were designed.
- 5-8.1.a.** Use of flexible hoses, including temporary installations, are prohibited in any application where the use of rigid piping or tubing is practical.
- 5-8.1.a.** The safety factor for flexible metal hose is a minimum of 4:1 based on burst pressure except as provided in ASME B31.3. The safety factor is increased in applications where the flexible metal hoses are likely to encounter abuse.
- 5-8.1.b.** The I&PS Office certifies and maintains a database for all flexible metal hoses based on input from all users.
- 5-8.1.a.** Users ensure that flexible hoses are in the I&PS database.

5-8.1. TEST AND INSPECTIONAND INSPECTIONAND INSPECTIONAND INSPECTIONAND INSPECTION

- 5-8.1.a.** Pressure systems are inspected and tested in accordance with the applicable code(s).
- 5-8.1.a.** Components which have not been pressure tested by the manufacturer are tested prior to operation.
- 5-8.1.a.** Systems or components that are modified, repaired, relocated, or damaged are hydrostatically tested in accordance with the governing code prior to operation.
- 5-8.1.a.** Open-end systems, such as vent lines, are exempt from the above pressure test requirements unless any of the following is true:
 - (1)** The maximum pressure in the line under flowing conditions can exceed 50 percent of MAWP.
 - (1)** The fluid in the line is flammable, explosive, or toxic.
 - (1)** The line is subject to significant dynamic load.

5-8.1.a. Personnel are cleared from the area while performing pressure tests above MAWP and measures are taken to prevent non-essential personnel from entering the area.

5-8.1.a. Adequate venting is provided at high points of vessels to prevent collapsing during draining of liquids.

5-8.1. CERTIFICATION

5-8.1.a. Certification Instructions

- (1) Identify the pressure vessel or system (PV/S) to be certified.
- (1) Determine appropriate class category as defined below.
- (1) Determine the certification criteria specified for that respective class.
- (2) Determine the “as-built” design and fabrication requirements for the particular PV/S.
- (1) Conduct an analysis or evaluation comparing the “as-built” requirements with the appropriate criteria specified in this document. This analysis or evaluation shall consider the usage history of the PV/S being certified.
- (1) Perform a physical inspection of the PV/S considering how it functions in the system. Determine its general condition and verify that its usage is within the original design intent.
- (1) Identify and disposition any hazards or potential risks involved with the PV/S.
- (1) Determine any modification, repair, testing, or other work that must be accomplished prior to, or as a condition of, certification. Document and track this effort to ensure accomplishment.
- (1) Develop safe operating rationale based upon the above steps considering the status of any modification, repair, or tests required.

- (1) Generate a Certification Data Package that documents the results of all of the above. Contents of a typical Certification Data Package are shown in Paragraph 5-8.8.c. Maintain a record copy of the Certification Data Package and a working file copy in a central location.

- (1) Generate a certificate similar to that shown in Paragraph 5-8.8.b. and submit this certificate along with the Data Package to the ISO and the Facilities Office for approval. Prior to submittal, certificates for all pressure vessels and systems categorized as Classes I and III are reviewed and bear the concurrence signatures of the Pressure Systems Committee. All certificates are signed by the respective user prior to submittal for approval.

- (1) Establish recertification procedures for all pressure vessels and systems based upon these instructions.

5-8.1.a. Certification Form

PRESSURE VESSEL OR SYSTEM CERTIFICATION

PRESSURE VESSEL/SYSTEM:	DATE OF REQUEST:
DESIGN PRESSURE:	
NOMINAL OPERATING PRESSURE:	
COMMENTS:	
DATA PACKAGE FILE LOCATION:	
RECOMMENDED/SUBMITTED BY:	
RESPONSIBLE USER:	DATE:
PRESSURE SYSTEM COMMITTEE CONCURRENCE	
USER REPRESENTATIVE:	DATE:
MATERIALS LAB REPRESENTATIVE:	DATE:
STRESS LAB REPRESENTATIVE:	DATE:
INDUSTRIAL SAFETY OFFICE REPRESENTATIVE:	DATE:
CHAIRPERSON (PRESSURE SYSTEMS MANAGER):	DATE:
APPROVAL	
FACILITIES OFFICE DIRECTOR:	DATE:
INDUSTRIAL SAFETY OFFICE DIRECTOR:	DATE:

5.8.8.c. Data Package Index

(Typical)

Data Package Index
Multilayer Pressure Vessel
15,000 PSIG - 100 FT³
C.B.&I. Co. Contract 9-1968
Vessel No. M208

Responsible Engineer/Organization: _____

I MANUFACTURERS' DATA

1. Manufacturer Data Report
2. Fabrication Drawings, 9-1968
3. Name Plate Facsimile
4. Hydrostatic Test
5. Certification of Cleanliness
6. Pressure Certification
7. Analysis Report

II. HISTORY

1. Narrative
2. Hydrostatic test specification, pages 15C-9, 10, Division 15, Section 15C, MSFC Spec. No. F&D-544, Project 6236, Construction Specification for Addition to GSE Test Facility (attachment).
3. Hydrostatic Test Specification, Par 5.a.5, page 15G-2, Section 15G, MSFC No. DAC 87-73-B-9003, Specification for Modification of Acoustic Model Engine Test Facility at MSFC (attachment).
4. Installation Drawings.
 - a. Addition to GSE Facility High Pressure Fluid Test Cell, F&D-A-S4648 M1, M4, M7.
 - b. Piping and Elevation, GH₂ Storage Bottles Test Stand 116, FAC-A-4540 M 24.
 - c. Photographs of 10,000 psi GH₂ Storage Vessel Installation.
5. Cycle History
6. Proximity Data

5.8.8.d Certification Criteria:

- (1) **Class I:** These vessels and systems are analyzed on a case-by-case basis by Stress and Materials disciplines to verify the safety factor considering all aspects of their design usage, extenuating operational factors, and degree of isolation. These vessels must pass an Operational Readiness Inspection or special Safety Review as required by Section 4-5, “Operational Readiness Program,” or a waiver of this requirement must be approved by the Pressure Systems Manager with the concurrence of the Director, ISO.
- (1) **Class II:** These pressure vessels and systems are analyzed by Stress and Materials disciplines. Criteria for certification of these vessels and systems and associated aerospace GSE is developed for the respective project commensurate with all flight and ground safety and operational requirements. Proof testing is in accordance with MSFC-HDBK-670. These criteria and subsequent certification efforts are applied through the respective program or project channels and are excluded from further reporting requirements of this directive. Certifications and waivers or deviations for these systems are approved by the Program or Project Manager with the concurrence of the Director, ISO.
- (1) **Class III:** Pressure vessels of this class have appropriate stress and material analyses to ensure that safety factors equal or exceed the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 or Division 2. Allowable stresses are governed by the appropriate tables or appendices of either Division 1 or Division 2 of the Code. If the vessel evaluation is based on Division 2, a fatigue analysis may be required. Certification of other system components (piping, valves, fittings, etc.) is based on meeting the intent of the ASME Codes for Pressure Piping, B31.1 or B31.3, as determined by engineering evaluations and appropriate engineering rationale.
- (1) **Class IV:** Certification of these pressure vessels and systems is based upon the fact that they are code stamped to ASME standards and the code status has not been nullified by vessel modification or repair. Certification of the remainder of the system (piping, valves, regulators, fittings, etc.) is based upon evidence of compliance with ASME and ANSI standards.
- (1) **Class V:** Certification of these pressure vessels and systems is controlled by FAA and is excluded from further requirements and reporting specified by this instruction.

- (1) **Class VI:** Certification of these pressure vessels and systems is controlled by DOT requirements as specified in CFR, Title 49. When utilized for over-the-road hauling on public highways, these pressure vessels and systems are excluded from further requirements and reporting specified by this instruction. When they are used exclusively for local (on-post) hauling or portable storage, these vessels and systems may be certified as specified for Class III or IV above, including appropriate stress and material analysis.
- (1) **Class VII:** These vessels and systems are to be certified as specified by the NFPA requirements and are excluded from further requirements and reporting specified by this instruction.
- (1) **Class VIII:** These vessels and systems are excluded from the scope of this instruction.

5-8.9. OPERATION

- 5-8.9.a.** Repairs or modifications are performed on high pressure fluid systems or components with approved work orders.
- 5-8.9.a.** Personnel are protected from energy sources when performing maintenance and repairs by implementing lockout/tagout procedures. See Section 4-9, "Lockout/Tagout."
- 5-8.9.a.** Pressure vessels and lines are considered potentially hazardous unless it is established that the system is at ambient pressure. Prior to disconnecting any portion of a pressure system, personnel are to ensure the system is depressurized to 0 psig. Pressurized lines are not depressurized by loosening a fitting.
- 5-8.9.a.** All entrances to work areas where high pressure operations are performed or areas of high pressure gas storage are posted with warning signs indicating the fluid and the maximum system pressure. All work areas where high pressure operations are performed are strictly controlled. Entrance to high pressure operation areas is restricted to authorized personnel only.
- 5-8.9.a.** Test and storage areas where leakage can present a hazard to personnel or equipment are equipped with leak detectors with audible alarms.
- 5-8.9.a.** Personnel operating pressure systems are to wear face shields, goggles, or safety glasses with side shields. Additional personal protective equipment may be required depending on other hazards present.

- 5-8.9.a.** Pressure system operations are conducted using written procedures conforming to Section 4-7, "Hazardous Operations" and are reviewed and approved by the ISO.

- 5-8.9.a.** All operating personnel and adjacent equipment of uncertified or Class I or II certified pressurized systems are protected by a barrier (distance, wall, etc.). This barrier is capable of protecting personnel and equipment in the event of a system rupture or leak.

SECTION 5-9

USE, HANDLING, AND STORAGE OF COMPRESSED GAS CYLINDERS

5-9.1. AUTHORITY

5-9.1.a. 29 CFR 1910, “Occupational Safety and Health Standards”

5-9.1.a. 49 CFR, “Transportation”

5-9.1. FUNCTIONS

5-9.1.a. General

- (1) Cylinders are filled by the authorized vendor unless otherwise approved by the ISO.
- (1) Cylinders are only filled with the gas for which they are marked.
- (1) Cylinders are labeled and marked in accordance with Compressed Gas Association (CGA) Pamphlet C-4.
- (1) If a cylinder leaks and the leak cannot be remedied by tightening a valve gland or packing nut, the cylinder is moved to an outdoor location away from personnel and sources of ignition. The valve is cracked open, permitting the gas to escape slowly. If the contents are toxic or flammable, Security (544-4357) is immediately notified. **DO NOT EXPEL CONTENTS INTO THE ATMOSPHERE.**
- (1) Cylinders are protected from heat, impact, cuts, abrasions, and extreme low temperatures.
- (1) Cylinders (whether full or empty) are not used for rollers, supports, or for any purpose not specified by the manufacturer.
- (1) Valves are closed and protective caps replaced when not in use.

5-9.1.a. STORAGE

- (1) All cylinders are stored in an upright position, with the exception of anhydrous ammonia, in tube-type containers. When in use or stored in an upright position, cylinders are secured to prevent them from being accidentally tipped over. Acetylene, chlorine, and sulphur dioxide are always utilized in an upright position.
- (1) Cylinders containing the same gas are stored in a segregated group. Empty cylinders are stored in the same manner.
- (1) The valve wrench or wheel is in the operating position when the cylinder is utilized.
- (1) Areas storing cylinders containing toxic gas are appropriately placarded.
- (1) In storage areas, oxygen and fuel cylinders are separated by at least 6.1 m (20 feet), unless a fire-resistive partition, with a fire resistance rating of at least one-half hour and at least 1.5 m (5 feet) high, is provided between cylinders and approved by the ISO.
- (1) Suitable cradles are used for lifting or lowering cylinders. Ordinary rope slings or electromagnets are not used.
- (1) Cylinders stored outside are:

 - (a) Not exposed to direct sunlight or temperatures in excess of 125° F (52° C).
 - (a) Protected from ice and snow during the winter.
 - (a) Protected from the elements with a noncombustible or fire retardant cover with a space of 45.7 cm (18 inches) between the cylinders and the cover to provide ventilation in case of gas leakage.
- (1) Cylinders are hydrostatically tested in accordance with CGA Pamphlet C-1.
- (1) Cylinders are never stored:

 - (a) Near highly flammable substances such as oil, gasoline, or waste.

- (a) Where there is a possibility of mechanical damage to them.
- (a) Where they are exposed to continuous dampness, salt, corrosive fumes, or other chemicals.
- (a) Near live wires or ground wires from electrical equipment.
- (1) Empty cylinders are labeled “EMPTY.” The valve is always closed and the cap in place. Full and empty cylinders are always separated and grouped by type.
- (1) Smoking is prohibited within 15.2 m (50 feet) of compressed gas storage. “No Smoking” signs are posted at the storage area.

5-9.1.a. Handling

- (1) If valve caps become frozen, allow caps to thaw out in a warm room. Steam or flame is never used to thaw out valve caps.
- (1) Valve caps are in place when cylinders are transported.
- (1) Because of their shape, smooth surface, and weight, cylinders are difficult to carry by hand and should be transported by two-wheel cylinder carts or a two-man carrying device. Cylinders moved over very short distances may be rolled on the bottom edge, but never dragged.

SECTION 5-10

COMPRESSED AIR FOR HUMAN RESPIRATION

5-10.1. APPLICABILITY

5-10.1.a. This Standard is intended for:

- (1) Self-contained or hose-line-supplied breathing equipment used in test or industrial operations, confined space entries, rescue, and underwater breathing operations.
- (1) Purging systems used to provide a breathable atmosphere prior to entry.

5-10.1. AUTHORITY

5-10.1.a. 29 CFR 1910, “Occupational Safety and Health Standards”

5-10.1.a. 29 CFR 1926, “Safety and Health Regulations for Construction”

5-10.1.a. 49 CFR, “Transportation”

5-10.1. RESPONSIBILITIES

5-10.1.a. Breathing Air Equipment/Systems Users:

- (1) Obtain ISO and MOO approval prior to first use or reactivation (when not used in past year) of any breathing air equipment/system.
- (1) Ensure proper maintenance, calibration, and air quality tests are performed.

5-10.1.a. Facilities Office:

- (1) Maintains configuration control of breathing air systems which use gases provided by the Facilities Office.
- (1) Notifies users whenever supplied air is contaminated or suspected of being contaminated.

5-10.1.a. Materials and Processes Laboratory:

- (1) Tests breathing air prior to first use and regularly (weekly) thereafter.
- (1) Reviews and approves materials used in breathing air equipment and systems.

5-10.1.a. Management Operations Office:

Reviews and approves breathing air equipment, systems, and their operating procedures.

5-10.1.a. Industrial Safety Office:

- (1) Reviews and approves breathing air equipment, systems, and their operating procedures.
- (1) Assures equipment, systems, and operations comply with Government and industry standards.

5-10.1. FUNCTIONS

5-10.1.a. General

- (1) Compressed air conforms to Type I, Grade "E," as specified in the Compressed Gas Association (CGA), C-7.1, Table I.
- (1) Compressed air containers meet CGA G-7.1 and 49 CFR 178, Subpart C, requirements.
- (1) Quality verification, sampling, and analytical procedures conform to applicable standards.

5-10.1.a. Use of MSFC High Pressure Air System for Breathing Air

- (1) At the point of connection to the central system, the following are provided:
 - (a) Breathing air filters capable of filtering 1.00 micron particulate.
 - (a) Continuous Oxygen (O₂) and Carbon Monoxide (CO) monitors.

- (2) Air quality is tested weekly by the Materials and Processes Laboratory.

5-10.1.a. Self-Contained Breathing Apparatus (SCBA)SELF-CONTAINED BREATHING APPARATUS (SCBA)SELF-CONTAINED BREATHING APPARATUS (SCBA)SELF-CONTAINED BREATHING APPARATUS (SCBA)SELF-CONTAINED BREATHING APPARATUS (SCBA)

- (1) When transporting cylinders, care is taken to ensure the valve mechanism is protected.
- (1) SCBA cylinders are stored in the vertical position in a cool place with a slight positive pressure.
- (1) At least once each year, SCBA cylinders are visually inspected internally and externally in accordance with CGA Pamphlet C-6 by a competent inspector.
- (1) SCBA cylinders are hydrostatically pressure tested every 5 years by a qualified inspector, following the rules and procedures of the Department of Transportation Hazardous Materials Regulations, Section 173.34(a) and CGA Pamphlet C-1.

SECTION 5-11

INDUSTRIAL MACHINE SHOPS

5-11.1. AUTHORITY

29 CFR 1910, "Occupational Safety and Health Standards"

5-11.1. RESPONSIBILITIES

5-11.1.a. Supervisors:

- (1) Comply with applicable OSHA and ANSI standards for machines, shop equipment, and operations.
- (1) Ensure machines and equipment are in safe working condition.
- (1) Ensure machine or equipment operators are trained and experienced (and certified when quality-sensitive hardware is involved).

5-11.1.a. Employees:

- (1) Operate machines in accordance with applicable OSHA and ANSI standards and manufacturer's recommended practices.
- (1) Tagout defective machines and equipment in accordance with Section 4-10, "Hazard Warning."

5-11.1.a. Industrial Safety Office:

Surveys machine shops to ensure compliance with all OSHA and ANSI standards.

5-11.1. FUNCTIONS

5-11.1.a. Requirements

- (1) Machines are located to enhance routine operations and prevent interference with nearby operations. Machines are firmly affixed to the working surface or floor. Adequate lighting which prevents glare or shadows is provided.
- (1) Machines meet the requirements in 29 CFR 1910, Subpart O, “Machinery and Machine Guarding.”
- (1) Machine guards are provided in accordance with 29 CFR 1910, Subpart O, “Machinery and Machine Guarding.” Special guards are fabricated when standard guards are not available. Equipment is locked or tagged whenever guards are removed, Section 4-9, “Lockout/Tagout.”
- (1) Equipment controls are conveniently located for the operator and remain accessible at all times.
- (1) Machines are color coded to increase contrast and improve visibility.
- (1) If compressed air is used for cleaning, pressure is reduced to less than 30 psi, and then effective chip guarding and personal protective equipment is provided [29 CFR 1910.242 (b)].

SECTION 5-12

LABORATORIES

5-12.1. AUTHORITY

5-12.1.a. 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories"

5-12.1.b. NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"

5-12.1. FUNCTIONS

Laboratories are operated in accordance with Authority Documents, MM 1845.2, "MSFC Hazardous Chemicals in Laboratories Protection Program," and NFPA 45, "Fire Protection for Laboratories Using Chemicals."

SECTION 5-13

EMERGENCY SHOWERS AND EYEWASHES

5-13.1. AUTHORITY

29 CFR 1910.151, "Medical Services and First Aid"

5-13.1. RESPONSIBILITIES

5-13.1.a. Supervisors of Users:

- (1) Prohibit all operations where there is a possibility of exposure to hazards which dictate the need for an emergency shower or eyewash until the emergency shower and eyewash is installed or returned to operation.
- (1) Ensure employees, who might be exposed to chemical splash, are instructed in the proper use of emergency showers and eyewashes.
- (1) Post an "Emergency Shower and Eyewash Test Record Tag" on or near the shower or eyewash.
- (1) Ensure emergency showers and eyewashes are inspected and tested.

5-13.1.a. Industrial Safety Office:

Assures eyewashes are installed, inspected, and maintained in accordance with this standard.

5-13.1.a. Management Operations Office:

Issues "Emergency Shower and Eyewash Test Record" tags.

5-13.1.a. Facilities Office:

Services emergency showers and eyewashes as requested.

5-13.1. FUNCTIONS

5-13.1.a. General

- (1) Emergency showers and eyewashes are required where the eyes or body of any person may be exposed to injurious corrosive materials.
- (1) MSFC emergency showers and eyewash stations comply with the ANSI Z358.1, "Emergency Eyewash and Shower Equipment," design and operational requirements.
- (1) An "Emergency Shower and Eyewash Test Record" tag is attached to each emergency shower and eyewash unit (Figure 5-13-1).
- (1) In areas where cryogenics are handled, emergency showers and eyewashes are conspicuously marked, "Not to be used for treatment of cryogenic burns."

5-13.1.a. Inspections and Tests

- (1) Emergency showers and eyewash stations are inspected and flushed monthly. During testing, the water is turned on fully to ensure the debris in the water line is completely expelled.
- (1) The date of inspection and the inspector's initials are recorded on the "Emergency Shower and Eyewash Test Record" tag with a waterproof pen.
- (1) Users test emergency showers and eyewashes prior to each operation where there is a chance of exposure to highly corrosive chemicals.
- (1) Portable eyewash solutions are replaced at regular intervals (Table 5-13-1).
- (1) Defective emergency showers or eyewash stations are reported to the Facilities Office.

Table 5-13-1, Eyewash Station Solution Replacement Schedule

FLUSHING SOLUTION	EMPTY and REFILL
Tap Water Only	Weekly
Tap Water with Antimicrobial Additive (e.g. Fendall ABA Plus)	At least every 6 months
Tap Water with Buffered Saline Solution (e.g. Eyesaline Preserved)	At least every 6 months

CHAPTER 6

HAZARDOUS MATERIALS STANDARDS

SECTION 6-1

HAZARDOUS MATERIALS GENERAL

6-1.1. AUTHORITY

6-1.1.a. Code of Federal Regulations

- (1) 29 CFR 1910, Subpart H, “Hazardous Materials”
- (2) 49 CFR 172, “Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements”

6-1.1.b. National Aeronautics and Space Administration

- (1) NHB 1700.1 (V1), “NASA Safety Policy and Requirements Document”
- (2) NPD 6000.1, “Transportation Management”

6-1.1. DEFINITIONS

Hazardous Material - A substance or materials in a quantity and form which may pose an unreasonable risk to health and safety or property. A list of hazardous materials can be found in 49 CFR 172.101. Typical hazardous materials are those that may be highly reactive, poisonous, explosive, flammable, combustible, corrosive, or radioactive, produce contamination or pollution of the environment, or cause adverse health effects or unsafe conditions.

6-1.1. RESPONSIBILITIES

6-1.1.a. Users

Use, store, and handle hazardous materials in accordance with the requirements of this document.

6-1.1.a. Industrial Safety Office

- (1) Upon request, assists users in developing procedures to use, store, and handle hazardous materials safely.
- (2) Reviews user hazardous material programs to ensure compliance with this document.
- (3) Periodically monitors hazardous material operations to ensure compliance with safety plans, standards, and requirements.

6-1.1.b. Property Management Division

Upon request, transports and stores hazardous materials in accordance with MM 4000.1, and the requirements of this document.

6-1.1. FUNCTIONS

6-1.1.a. Hazardous materials are used, handled, and stored in accordance with the requirements of the authority documents, the Material Safety Data Sheets (MSDS), and MMI 1845.1, "Hazard Communication Program," plus the following additional requirements as applicable:

- (1) Radioactive materials are used, handled, and stored in accordance with MM 1860.2, "Radiation Safety Manual."
- (2) Explosive devices and materials, hydrazine, hydrogen, nitrogen, and oxygen are used, handled, and stored in accordance with Sections 6-2 through 6-6 of this document.
- (3) Flammable and combustible liquids and gases are used, handled, and stored in accordance with Section 7-1 of this document.
- (4) Cryogenic liquids are used, handled, and stored in accordance with CGA P-12, "Safe Handling of Cryogenic Liquids."

NOTE: Treatment of cryogenic-induced injuries requires medical supervision because incorrect first aid practices invariably aggravate the injury. In the field, it is safest to do nothing other than cover the involved area, if possible, and call 911 for emergency medical assistance. Some important first-aid don'ts are the following:

- Don't remove frozen gloves, shoes, or clothing except in a slow, careful manner (skin may be pulled off inadvertently).

- Don't massage the affected part.
- Don't expose the affected part to temperatures higher than 112° F. This superimposes a burn and gravely damages already injured tissues.
- Don't expose the affected part to temperatures lower than 100°F.
- Don't apply snow or ice.
- Don't use safety showers, eyewash fountains, or other sources of water because the temperature will almost certainly be incorrect therapeutically and will aggravate the injury.

6-1.1.b. Oxygen deficiency detection systems are provided in areas where gas release could reduce the oxygen levels below 19.5 percent.

6-1.1.c. The MSFC Hazardous Waste Disposal contractor is contacted for disposal of hazardous material waste (see classified section of MSFC Telephone Directory).

6-1.1.d. In event of an accidental release of hazardous materials that enters or threatens to enter the external environment, the incident is handled in accordance with MM 1040.3, "MSFC Emergency Plan" (in revision as MPG 1040.3F).

SECTION 6-2

EXPLOSIVE DEVICES AND MATERIALS

Note: Section 6-2 was canceled by MWI 8715.10 dated December 27, 1999

6-2.1. AUTHORITY

6-2.1.a. National Aeronautics and Space Administration

- (1) NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"
- (2) NASA-STD 8719.12, "NASA Safety Standard for Explosives, Propellants, and Pyrotechnics"

6-2.1. DEFINITIONS

6-2.1.a. Explosive Materials - Linear-shaped charges, electro-explosive devices, mild and confined detonating fuses, safe and arm devices, pressure cartridges, initiators, igniters, and electrical blasting caps (i.e., anything consisting of or containing any chemical compound or mixture which is to function by explosion with substantially instantaneous release of energy, gas, or heat). This definition includes propellants and ordnance devices (i.e., bombs, grenades, rockets).

6-2.1.b. See NASA-STD 8719.12 for a list of comprehensive definitions.

6-2.1. RESPONSIBILITIES

6-2.1.a. Users:

- (1) Identify operations involving explosives to the ISO.
- (2) Initiate procurement for required explosive materials in accordance with MM 4000.1.
- (3) Initiate request for issue and turn-in of explosive materials (see MM 4000.1).
- (4) Prepare and utilize procedures, plans, detail drawings, and other documentation to safely control explosive operations in accordance to Section 4-7, "Hazardous Operations."

- (5) Provide documentation for explosive operations to the ISO for timely review and approval.
- (6) Assure explosive operations are restricted to trained and certified personnel.
- (7) Help Property Management maintain a current and accurate inventory of explosive materials.

6-2.1.b. Industrial Safety Office:

- (1) Appoints an Explosive Safety Officer [NASA-STD 8719.12].
- (2) Reviews and approves all explosive operations documentation.
- (3) Monitors explosive operations to ensure compliance with safety plans, standards, and requirements.

6-2.1.c. Property Management Division:

- (1) Upon request, transports and stores MSFC explosive materials.
- (2) Maintains a current inventory of explosive materials located at MSFC.

6-2.1. FUNCTIONS

- 6-2.1.a.** Requisitions for procuring explosive materials are forwarded to MSFC's ISO for review and approval.
- 6-2.1.b.** Explosive materials are received by the Army at Building 8700.
- 6-2.1.c.** Explosive materials are stored and inventoried in accordance with NASA-STD 8719.12 and MM 4000.1.
- 6-2.1.d.** Personnel transporting, storing, and handling explosive materials are certified in accordance with NASA-STD 8719.12 and Section 3-2, "Training and Certification."
- 6-2.1.e.** Detailed procedures are written for the transportation, storage, and handling of explosive materials in accordance with Section 4-7, "Hazardous Operations."
- 6-2.1.f.** Disposal and shipping of explosive materials are in accordance with MM 4000.1.
- 6-2.1.g.** Hazard assessments are performed on all phases of explosive operations (i.e., quantity distance study and transportation routes).

SECTION 6-3

HYDRAZINE

Note: Section 6-3 was canceled by MWI 8715.10 dated December 27, 1999

6-3.1. AUTHORITY

NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"

6-3.1. FUNCTIONS

Hydrazine systems and operations conform to the recommended precautions of Chemical Propulsion Information Agency (CPIA) Publication 394, Volume III, "Hazards of Chemical Rockets and Propellants."

SECTION 6-4

HYDROGEN

Note: Section 6-4 was canceled by MWI 8715.10 dated December 27, 1999

6-4.1. AUTHORITY

- 6-4.1.a.** NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"
- 6-4.1.b.** 29 CFR 1910.103, "Hydrogen"
- 6-4.1.c.** NASA-STD 8719.16, "Safety Standard for Hydrogen and Hydrogen Systems"

6-4.1. FUNCTIONS

- 6-4.1.a.** Hydrogen systems and operations conform to the requirements of the Authority Documents, and the following:
 - (1) Hydrogen systems are cleaned to requirements of MSFC-SPEC-164, "Cleanliness of Components for use in Oxygen, Fuel, and Pneumatic Systems."
 - (2) Areas around hydrogen burnstacks are maintained clear of vegetation and other combustibles for a radius of 100 feet.
 - (3) All hydrogen detection systems are monitored by a special test system or MSFC Utility Control System (UCS).

SECTION 6-5

NITROGEN

Note: Section 6-5 was canceled by MWI 8715.10 dated December 27, 1999

6-5.1. AUTHORITY

NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"

6-5.1. FUNCTIONS

- 6-5.1.a.** Nitrogen systems and operations conform to the recommended precautions of Chemical Propulsion Information Agency (CPIA) Publication 394, Volume III, "Hazards of Chemical Rockets and Propellants."
- 6-5.1.a.** Oxygen deficiency detection systems are provided in areas where nitrogen release could reduce the oxygen levels below 19.5 percent.

SECTION 6-6

OXYGEN

Note: Section 6-6 was canceled by MWI 8715.10 dated December 27, 1999

6-6.1. AUTHORITY

6-6.1.a. NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"

6-6.1.a. 29 CFR 1910.104, "Oxygen"

6-6.1.a. NASA-STD 8719.15, "Safety Standard for Oxygen and Oxygen Systems"

6-6.1. FUNCTIONS

6-6.1.a. Oxygen systems and operations conform to the requirements of the Authority Documents.

6-6.1.a. Oxygen systems are cleaned to the requirements of MSFC-SPEC-164, "Cleanliness of Components for Use in Oxygen, Fuel, and Pneumatic Systems."

6-6.1.a. Venting of relief valves in lox/gox systems at high pressures and flow rates is hazardous. Precautions are taken to ensure the safety of personnel and minimize property damage.

SECTION 6-7

TRIETHALUMINUM (TEA)/TRIETHYBORANE (TEB)

Note: Section 6-7 was canceled by MWI 8715.10 dated December 27, 1999

6-7.1. AUTHORITY

NHB 1700.1(V1), "NASA Safety Policy and Requirements Documents"

6-7.1. FUNCTIONS

6-7.1. a. TEA/TEB systems storage, handling, designs, and operations conform to the manufacturer's recommendations and product safety information (e.g.; Texas, Alkyls). This includes the following considerations:

- (1) TEA/TEB reacts violently with air, water, and compounds containing hydrogen and oxygen.
- (1) Store TEA/TEB containers in a cool, dry, well ventilated area. Store away from flammable materials and sources of heat and flame.
- (1) Full face shields, impervious clothing, including gloves, and aluminized suits are worn when handling TEA/TEB.
- (1) Design TEA/TEB system for minimal usage and purging of all residual.
- (1) The most effective fire extinguishing agent is dry chemical powder pressurized with nitrogen.
- (1) All TEA/TEB operations are performed by certified personnel using approved procedures.

CHAPTER 7

FIRE SAFETY

NOTE: Chapter 7 was canceled by MWI 8715.11 dated February 2, 2000

NOTE: Section 7-1 was canceled by MWI 8715.1 dated December 20, 1999

SECTION 7-1

FIRE PREVENTION AND PROTECTION

7-1.1. AUTHORITY

7-1.1.a. 29 CFR 1910, "Occupational Safety and Health Standards"

7-1.1.b. NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"

7-1.1.c. NASA-STD 8719.11, "NASA Safety Standard for Fire Protection"

7-1.1. RESPONSIBILITIES

7-1.1.a. Industrial Safety Office:

- (1) Acts as the AHJ in administration and enforcement of the code.
- (2) Conducts fire protection engineering surveys and fire inspections.
- (3) Conducts fire drills.
- (4) Monitors maintenance and testing of fire protection systems and equipment.
- (5) Coordinates fire emergency readiness activities with the local fire department.

7-1.1.b. Facilities Office:

- (1) Ensures all designs and work orders comply with the authority documents, National Fire Protection Agency (NFPA) and National Fire Codes (NFC).
- (2) Maintains and tests fire protection systems and equipment in accordance with the NFC.

7-1.1.c. Safety Monitors:

- (1) Conduct monthly inspections.
- (2) Inspect fire extinguishers and hose stations.

7-1.1. FUNCTIONS

7-1.1.a. General

MSFC complies with the fire protection and prevention requirements of the authority documents and the NFC. Where conflicting requirements exist, the most stringent is used.

7-1.1.a. Building Marking

- (1) Building numbers are placed in a legible position and are visible from the street.
- (2) Explosive markings are placed where explosives are stored or handled, in accordance with NASA-STD 8719.12.

7-1.1.b. Fire Protection Systems and Equipment

- (1) Fire protection systems and equipment are installed, inspected, and maintained in accordance with requirements of NASA-STD 8719.11.
- (2) All automatic fire protection systems and equipment are monitored by the MSFC central fire alarm system.

7-1.1.c. Fire Exit Drills

Fire exit drills are conducted at least annually in every facility with a normal occupancy load of 10 or more.

7-1.1.a. Electrical Fire Safety

- (1) Electrical wiring, appliances, fixtures, etc., are installed and maintained in accordance with the NFPA 70, "National Electric Code" (NEC).
- (2) Wiring no longer needed is removed, if possible. If not, termination and junction points are identified as "Abandoned in Place."

- (3)** Extension cords (cord sets, power taps, power strips) are rated (voltage and amperage), sized, and used in compliance with the NEC, and the following additional requirements:

Exception: Extension cords used for temporary wiring per paragraph 4 below.

- (a)** Conductor sizes are at least as large as the conductors in the cord of the appliance being supplied, but in no case smaller than 16 gauge.
- (b)** Cords are rated for portable and hard or extra hard use per NEC Table 400-4. Types approved for hard use include; SJ, SJE, SJEO, SJEOO, SJO, SJOO, SJT, SJTO, SJTOO, SO. Type approved for extra hard use include; G, PPE, S, SC, SCE, SCT, SE, SEO, SEOO, SOO, ST, STO, STOO, and W. Look for Type Letters on cord.
- (c)** Cords are equipped with ground conductors.
- (d)** Cord lengths do not exceed 15 feet.
- (e)** Multi-outlet extension cords are equipped with circuit breakers.
- (f)** Extension cords are factory assembled and listed by Underwriter Laboratories (UL). Look for the UL trademark on the cord set.
- (g)** Extension cords are not used in series (more than one extension cord connected together to extend a longer distance).
- (h)** Only single outlet extension cords are used to supply an appliance requiring a safety permit (coffee pots, hot plates, personal heaters, etc.).
- (i)** Extension cords are not attached to building surfaces.

Exception: Extension cords may be restrained on fire-treated communication backboards using approved non-metallic fasteners.

- (a) Extension cords are not routed under carpet, through walls, ceilings, or doorways, or where they are exposed to physical damage or create a tripping hazard.
- (2) Extension cords used for temporary wiring comply with the NEC. Temporary usage includes wiring used only for the duration of an emergency, test, experiment, development work, construction, or maintenance activity, or 90 days for Christmas decorative lighting and other similar purposes. Reference NEC, Article 305, "Temporary Wiring," for detailed requirements.

7-1.1.b. Magnetic Security Door Locks

- (1) Magnetic security door locks are only used on exit doors under the following conditions:
 - (a) The door does not serve a high hazard occupancy. High hazard occupancies include areas where flammable liquids, hazardous chemicals, or explosives are handled or stored, where flammable dust is produced, and other similar situations.
 - (b) The door is located in a building protected throughout by either an automatic fire detection system or an automatic sprinkler system, arranged to automatically release the magnetic door lock upon activation.
 - (c) A sensor is provided to automatically release the magnetic door lock when a person approaches to exit through the door.

Exception: Sensor need not be provided if pushing on the door releasing device for 3 seconds, or less, initiates an irreversible process that will release the magnetic door lock within 15 seconds. Operation of the release device activates a signal in the vicinity of the door to ensure those attempting to exit that the system is functional. A sign explaining this operation is provided on the door.

- (a) A clearly labeled emergency switch is located directly adjacent to the door providing a manual means to release the magnet in event the sensor fails.

Exception: Doors not required to have a sensor per item (c) above.

- (a) The magnetic door lock automatically releases in event of loss of controlling power.

Note: These restrictions do not apply to electric door latch type mechanisms that permit override by operation of a simple door handle or panic bar.

7-1.1.a. Construction Operations

- (1) Construction, alteration, and demolition operations are fire safeguarded in accordance with NFPA 241, “Standard for Safeguarding Construction, Alteration, and Demolition Operations.”
- (2) Tar kettle operator complies with requirements of NFPA 241 and the following:
 - (a) Obtain a safety permit from the ISO.
 - (b) Locate the tar kettle at least 25 feet from any building or combustible material, unless specifically approved by the ISO.
 - (c) Attend the tar kettle at all times when in use.
- (3) Torch-Applied Roofing System Installers comply with NFPA 241 and the following:
 - (a) Obtain a safety permit from the ISO.
 - (b) Do not use torch in areas where the flame impingement cannot be fully viewed.
 - (c) Cover combustible insulation and other combustible substrates with a base ply.
 - (d) Maintain a fire watch at least **1 hour** after torches have been extinguished.

7-1.1.a. Holiday Fire Safety

- (1) All artificial trees bear the Underwriters Laboratories’ (UL) label as evidence of being “flame-retardant.”

- (2) All natural trees are kept fresh and green and are removed from inside the building if needles turn brown or start falling.
- (3) All electrical decorations bear the UL label for intended use.
- (4) Interior electrical decorations are disconnected from the electrical outlet at the end of the work day.
- (5) Only indirect lighting is used on metal trees - lights are not installed on tree itself.

7-1.1.b. Smoking

- (1) Smoking is not permitted inside buildings at MSFC, Government owned/ leased vehicles, or in controlled hazardous exterior locations.
- (2) The responsible organization conspicuously marks and controls exterior smoking areas in hazardous locations.
- (3) Smoking material and matches are discarded in ash trays or other receptacles especially designated for that purpose.
- (4) Adequate receptacles are provided for discarded smoking material.
- (5) Custodial personnel dump these receptacles into special containers containing no combustible material.

7-1.1.c. Housekeeping

- (1) Housekeeping and cleanliness are maintained in accordance with requirements of NFPA 101 and 29 CFR 1910.22.
- (2) Furniture, equipment, supplies, or other substantial physical objects are not stored in corridors, stairwells, or paths of egress without approval of the ISO.
- (3) Objects are not stored or placed where they would prevent or delay access to, or use of, fire protection equipment.
- (4) Sufficient waste cans are provided in all areas. Metal cans with self-closing lids are provided in areas where cloth rags or paper towels saturated with combustible or flammable liquids may be found.

- (5) Areas where activities that generate a large quantity of combustible trash and debris, such as woodworking and building construction, are cleaned up at the end of each work day.
- (6) Furnace rooms, boiler rooms, or equipment rooms are not used for storage unless specifically approved by the ISO.

7-1.1.d. Portable Appliances

- (1) The user requests approval from the area safety monitor for portable appliances with heating elements, including coffee pots, heaters, urns, hot plates, ovens, and grills.
- (2) The area safety monitor posts a permit, MSFC Form 3798 (Figure 7-1-1), at each location of approved portable appliances. Approval is based on the checklist provided on the permit form.
- (3) The user operates portable appliances in accordance with the permit's requirements and manufacturer's recommendations.
- (4) The user unplugs portable appliances with heating elements when left unattended.

Exception: Industrial grade appliances having safety interlocks to prevent overheating.

- (5) Heaters are designed and located so that they cannot be easily overturned.
- (6) Heaters are equipped to deenergize electric power to the unit when tilted or turned over.
- (7) Heaters are located at least three feet from paper, curtains, clothing, or anything else that can be easily ignited.
- (8) Security or ISO may require portable appliances be removed from the premises for failure to have a portable appliance permit or failure to comply with the requirements of the permit.

7-1.1.a. Flammable Liquids

- (1) Flammable and combustible liquids are used and stored in accordance with NFPA 1, NFPA 30, and 29 CFR 1910.106, Subpart H.

- (2) If more than 10 gallons of flammable liquids are stored in one fire area, the containers are stored in an approved flammable storage cabinet.

Exception: In specific facilities meeting the requirements of NFPA 30.

- (3) Gasoline is not used for cleaning purposes.
- (4) Portable flammable liquid burning stoves and heaters are not used without ISO approval.

7-1.1.b. Flammable Gas

- (1) Natural fuel gases are stored and used in accordance with NFPA 54.
- (2) Liquefied petroleum gases (LPG) (propane, butane) are stored and used in accordance with NFPA 58 and 29 CFR 1910.110.
- (3) LPG containers are stored outside, with the following exceptions:
 - (a) Small hand-held propane torches are stored in approved flammable storage cabinets.
 - (b) Facilities under construction, subject to ISO approval.
- (4) Oxygen-fuel gas systems are designed, installed, and used in accordance with NFPA 51.
- (5) See Chapter 6 for requirements on hydrogen and oxygen.

7-1.1.c. Heat, Flame & Spark Producing Operations

- (1) Safety permits are obtained from the ISO for all heat, flame, and spark producing operations not performed in areas designated and approved for such work in accordance with Section 4-8, "Hot Work Permit."
- (2) The permit is displayed at the scene of the operation.
- (3) The work is performed in conformance with the specific instructions on the Safety Permit Form (MSFC Form 1155) and the requirements of 29 CFR 1910, Subpart Q, and NFPA 51B.

7-1.1.d. Magnesium - Handling and Machining

- (1) Magnesium is handled and machined in accordance with NFPA 480.
- (2) Magnesium chips and shavings are placed in covered metal drums and removed from buildings at regular intervals. In no case are these chips and shavings left in buildings overnight.
- (3) These drums are marked with “Magnesium Only” signs and stored separate from other scrap.
- (4) Class D fire extinguishers are provided in areas where magnesium is machined.

7-1.1.e. Portable Structures (Trailers, Mobile Homes, Relocatable Buildings, etc.)

- (1) The ISO reviews and approves the use and location of portable structures.
- (2) Portable structures must meet the same fire protection requirements established for permanent structures at MSFC.
- (3) Single trailers are located at least 7.6 m (25 feet) from any permanent building and at least 3 m (10 feet) apart.

Exception: If fire wall separation or sprinkler protection is provided, the ISO may approve closer spacing.

- (4) If trailers are connected to a building or other trailers, the materials used for interconnection are fire resistive or non-combustible.
- (5) Two or more trailers may be interconnected to form a complex (single unit) subject to the following requirements:
 - (a) The complex is located at least 15.2 m (50 feet) from any permanent building.
 - (b) Total unsprinkled floor space does not exceed 5,000 ft² (465 m²) or 10,000 ft² (930 m²) for a sprinkled space.
 - (c) If normally occupied, an automatic/manual fire alarm system is installed and connected to the Center fire alarm system.
 - (d) Interior finishes comply with this document’s requirements for permanent structures.

- (6) Portable structures are located such that they do not block roads, access to any building, or fire hydrants.
- (7) Portable structures are supported and anchored in accordance with applicable state and local standards.

7-1.1.f. Interior Finishes

- (1) Interior walls, partitions, modular partitions, and ceiling finish materials have a Flame Spread Index less than 25 and a Smoke Density Index less than 50, as determined by the test method described in NFPA 255.
- (2) Interior floor finish materials have a critical radiant flux value of 0.05 or above (as determined by the method described in NFPA 253) and have a maximum specific optical density of not over 450 (flaming and nonflaming) as determined in NIST Technical Note 708, "Smoke Density Chamber."
- (3) Material used for tents or temporary clean rooms at MSFC complies with at least one of the following:
 - (a) Flame Resistant when tested in accordance with NFPA 701, "Flame-Resistant Textiles and Films."
 - (a) Have a flame spread rating of 25 or less when tested in accordance with NFPA 255, "Surface Burning Characteristics of Building Materials."
 - (a) Conform to the criteria contained in Section 7 of ASTM E136, "Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C," when tested in accordance with this standard.

PERMIT FOR PORTABLE APPLIANCES		
TO: (Area Safety Monitor)	FROM: (Originating Organization)	DATE:
COMPLETED BY RESPONSIBLE SUPERVISOR		
<i>I hereby apply for approval of a portable appliance as described below:</i>		
DESCRIPTION OF APPLIANCE:	LOCATION OF APPLIANCE:	
CONFORMANCE TO FIRE PROTECTION REQUIREMENTS: (Check if O.K.) <input type="checkbox"/> Underwriters approved appliance and cord. <input type="checkbox"/> Plugged directly into floor or wall receptacle or with a flexible extension cord of hard or extra hard usage per NEC Table 400-4, types G, PPE, SC, SCE, SE, SED, SECO, SJ, SJE, SJEQ, SJO, SJOQ, SJT, SJTO, S, SO, SOC, ST, STO, STOO or W wire. <input type="checkbox"/> No extension cords over 15 feet permitted. <input type="checkbox"/> No combustible material within 3 feet. <input type="checkbox"/> To be unplugged at end of shift. <input type="checkbox"/> Cords to be arranged to prevent tripping hazard. <input type="checkbox"/> Permit to be conspicuously posted. <input type="checkbox"/> Tip-Over switch on electric heater (Effective October 1, 1997).		
<i>I understand that failure to comply with the Fire Protection Requirements in the above block may result in withdrawal of this permit.</i>		
NAME OF SUPERVISOR:	SIGNATURE OF SUPERVISOR:	DATE:
COMPLETED BY AREA SAFETY MONITOR OR DESIGNATED ALTERNATE		
NAME OF AREA SAFETY MONITOR:	SIGNATURE OF AREA SAFETY MONITOR:	DATE:

MSFC Form 3798 (Rev. February 1997)

Computer Generated

Figure 7-1-1 MSFC Form 3798

SECTION 7-2

MAINTENANCE OF FIRE SURVEILLANCE & SUPPRESSION SYSTEMS

7-2.1. APPLICABILITY

This document is applicable to all fire protection systems and equipment, including sprinkler, fire alarm, CO₂, halon, dry or wet chemical, and standpipe.

7-2.1. AUTHORITY

NASA-STD 8719.11, "NASA Safety Standard for Fire Protection"

7-2.1. RESPONSIBILITIES

7-2.1.a. Facilities Office:

- (1) Maintains all fire protection systems except fire extinguishers.
- (2) Controls all fire protection system outages.

7-2.1.b. Information Systems Services Office:

Maintains the cabling between buildings that interconnects fire alarm system components.

7-2.1.a. Industrial Safety Office:

- (1) Monitors the fire protection system maintenance program.
- (2) Investigates fire alarms and follows up to ensure satisfactory completion of corrective actions.
- (3) Conducts annual fire drill program.

7-2.1.b. Security:

Increases surveillance of facility areas affected by fire protection system outages during unoccupied periods.

7-2.1.a. Safety Monitor:

Conducts inspections of fire extinguishers per Section 4-1, "Safety Monitors."

7-2.1. FUNCTIONS

7-2.1.a. Fire protection systems are inspected, tested, and maintained in accordance with the requirements of the NFPA, National Fire Codes.

7-2.1.b. Fire protection system outage times are minimized as much as possible. If a system must be deactivated, affected building occupants, Facilities Office, Security, and the Fire Department are notified prior to deactivation and upon return to normal. If a system must be deactivated for a period exceeding eight hours, the following additional precautions are taken:

- (1) An impairment plan, approved by the ISO, is established.
- (2) An outage log is maintained documenting impairment plan requirements, the name of the person responsible for completing the outage, and the "start" and "returned to normal" times.

CHAPTER 8

MISHAP REPORTING, RECORDKEEPING, AND INVESTIGATION

SECTION 8-1

MISHAP REPORTING AND INVESTIGATION

8-1.1. AUTHORITY

- 8-1.1.a. NHB 1700.1(V1), “NASA Safety Policy and Requirements Document”
- 8-1.1.b. NMI 8621.1, “Mishap Reporting and Investigating”
- 8-1.1.c. 29 CFR 1904, “Recording and Reporting Occupational Injuries and Illnesses”
- 8-1.1.d. 29 CFR 1926.22, “Recording and Reporting of Injuries”

8-1.1. DEFINITIONS

- 8-1.1.a. **Mishap** - A mishap is an unexpected occurrence, event, or sequence of events which results in injury or death to employees or visitors, or damage to NASA equipment or property. For mishap reporting purposes, mishaps are classified as follows:
 - (1) **Type A Mishap** - A mishap causing death or damage to NASA equipment or property equal to or greater than \$1,000,000.
 - (2) **Type B Mishap** - A mishap resulting in permanent disability to one or more persons, or in-patient hospitalization of three or more persons, or damage to NASA equipment or property equal to or greater than \$250,000 but less than \$1,000,000.

- (1) **Type C Mishap** - A mishap causing occupational injury or illness resulting in a lost workday case (any injury or illness which results in day(s) lost beyond the shift in which it occurred) or damage to NASA equipment or property equal to or greater than \$25,000 but less than \$250,000.
- (2) **Mission Failure** - Any mishap of such serious nature that it prevents accomplishment of a majority of the primary mission objectives.
- (3) **Incident** - A mishap causing occupational injury or illness which does not result in lost workdays, but requires medical treatment beyond first aid or damage to NASA equipment or property equal to or greater than \$1,000 but less than \$25,000.

8-1.1.b. Close Call - A close call is an unexpected occurrence, event, or sequence of events which does not meet the definition above, but bears reasonable probability to be a mishap in the event of recurrence.

8-1.1.c. Responsible Organization - The NASA organization that had the mishap, or controls the contractor which had the mishap.

8-1.1.d. Responsible Authority - The management official who is authorized to determine the level of mishap investigation. NHB 1700.1(V1) provides requirements for the responsible authority.

- (1) For Type A, or mission failure mishaps, the responsible authority is normally the NASA HQ Program Manager and the Center Director.
- (2) For Type B mishaps, and close calls with the potential of being a Type A or B mishap, the responsible authority is normally the Center Director.
- (3) For less significant mishaps, the responsible authority is normally the responsible organization manager or the ISO Director. The option to elevate the responsible authority always belongs to the senior official.

8-1.1.e. Appointing Official - The NASA official authorized by the responsible authority to appoint an independent investigator or mishap board. The appointing official should have management responsibility over all organizations which are likely to take corrective action as a result of the mishap. The appointing official for board investigations at the MSFC level is normally the Deputy Director.

8-1.1.f. Validating Organization - For Type A and B mishaps, or close calls with Type A or B potential, the S&MA Office is the validating organization. For less significant mishaps, the ISO is the validating organization.

8-1.1.g. Immediately Reportable Mishaps - All mishaps that require immediate telephonic notification. Included in this category are Type A, B, and C mishaps.

Exception: Contractor personnel not located on NASA property do not have to provide immediate notification of Type C injury or illness cases.

8-1.1.a. Levels of Investigation - Based on the significance or potential significance of a mishap, and on the potential for lessons learned, mishap investigations are performed at four general levels.

- (1) **Independent Board** - The group of people selected by the appointing official to investigate the mishap. Members are selected in accordance with Appendix 8-1-A.
- (2) **Independent Investigator** - A single investigator appointed by the appointing official to investigate a mishap. This person has no vested interest in the results of the investigation. The independent investigator investigates the mishap using similar rigor and techniques as a mishap board.
- (3) **Local Investigation Team** - A group of people selected by the responsible organization or ISO to investigate a mishap. Members may be from the responsible organization and the ISO.
- (4) **Local Investigator** - A single investigator selected by the responsible organization or ISO to investigate a mishap. The individual may be from the responsible organization or the ISO. If not specifically selected, the responsible supervisor is the local investigator.

8-1.1.b. Costs - Direct costs of repair, retest, delay, replacement, or recovery of NASA materials including hours, material, and contract costs, but excluding indirect costs of cleanup, investigation, and injury.

8-1.1. RESPONSIBILITIES

8-1.1.a. Employees and Supervisors:

- (1) Take emergency actions in accordance with MM 1040.3, “MSFC Emergency Plan” (in revision as MPG 1040.3F).
- (2) Report mishaps to the ISO.
- (3) Preserve evidence.

8-1.1.b. Industrial Safety Office:

- (1) Notify NASA Safety and Risk Management Division in accordance with NHB 1700.1(V1).
- (2) Ensure appropriate action is taken immediately following a mishap to control the emergency, preserve evidence, and limit further damage or injury.
- (3) Arrange for a special charge code for mishap board independent investigators or mishap boards.

8-1.1. FUNCTIONS

8-1.1.a. Initial Reporting

- (1) When a mishap occurs, the responsible organization immediately reports the occurrence to management and to the ISO.
- (2) The ISO immediately reports mishaps that will likely require a board investigation to NASA Headquarters, Code QS, in accordance with NHB 1700.1(V1), and to appropriate Center management.

8-1.1.b. Securing the Site

- (1) The responsible organization takes immediate action to secure the site to prevent further damage or injury.
- (2) Additionally, the ISO takes action to preserve the mishap site for the investigator or investigation board, should one be appointed.

- (3) The site is not released without the investigator or Board approval.
- (4) If an investigator, or Board, is not appointed, the site is not released until the responsible organization and ISO agree.

8-1.1.c. Determining the Level of Investigation

- (1) The responsible authority determines the level of mishap investigation.
- (2) An independent board, or investigator, is used for all Type A and B mishaps [NHB 1700.1(V1), 1003].
- (3) The level of investigation for other type mishaps and close calls is based on the requirements of NHB 1700.1(V1), Chapter 10, and the following:
 - (a) Personnel injury/illness
 - (b) Property damage
 - (c) Programmatic, public, or political impact
 - (d) Potential for any of the above
 - (e) Complexity
 - (f) Potential for lessons learned

8-1.1.d. Mishap Investigation

- (1) All mishaps and close calls are investigated.
- (2) Local investigators and teams use NASA Form 1627, "Mishap Report," as a guide for conducting investigations.
- (3) Independent boards and investigators use NHB 1700.1(V2), "Guidelines for Mishap Investigation," as a guide for conducting investigations.

8-1.1.e. Local Investigator or Team Process

- (1) The local investigator or Team:
 - (a) Collects and analyzes data, as required, to identify what, when, where, and why.

- (b) Works with responsible organization(s) to develop a corrective action plan.
 - (c) Reports findings and corrective action plan using NASA Form 1627. Attaches additional data to the form as required.
 - (d) Within 10 working days of the mishap, submits report to the ISO. The report identifies the person responsible for each open action item.
- (2) The ISO initiates the mishap abatement process in accordance with Section 8-2.

8-1.1.f. Independent Investigators and Mishap Board Process

- (1) The responsible authority selects an appointing official.
- (2) The appointing official then appoints an independent Mishap Board or Independent Investigator to investigate the occurrence. Independent Investigator/Board member selection guidelines are provided in Appendix 8-1-A. The appointment announcement is routed through the S&MA Director, appointees' managers/directors, and the Chief Counsel's Office for concurrence.
- (3) The ISO familiarizes the Independent Investigator or Mishap Board with the investigator(s) roles and responsibilities and provides them with the appropriate tools to conduct a proper investigation. Additionally, ISO will provide a Board Facilitator to the Mishap Board to help keep the process on track.
- (4) Once appointed, the Independent Investigator/Mishap Board takes responsibility for the mishap site and all evidence associated with the mishap. Only the Independent Investigator or Board Chairman may release the site or evidence for normal activities.
- (5) The Independent Investigator or Mishap Board investigates the mishap using NHB 1700.1(V2) as a guide.
- (6) The ISO turns over all evidence gathered at the scene of the mishap.
- (7) The responsible organization supports the Independent Investigator or Mishap Board with records, data, experts, etc., as requested.

- (8) The appointing official arranges for any necessary administrative support, such as meeting rooms, clerical help, photographic support, laboratory analysis, etc., as requested.
- (9) The appointing official monitors the progress of the Independent Investigator or Mishap Board and provides any management concerns to the Board. The validating organization will support the Independent Investigator/Mishap Board and the appointing official by providing the Board facilitator, experts, etc., as requested.
- (10) The Independent Investigator or Mishap Board uses the Management Oversight and Risk Tree (MORT) or other structured techniques to assimilate all available data and to analyze the mishap occurrence to determine what happened, when it happened, and why it happened. The Independent Investigator or Mishap Board strives to find both the technical causes of the mishap and the management causes of the mishap.
- (11) The Independent Investigator or Mishap Board submits the Mishap Investigation Report to the appointing official within 30 days unless originally tasked otherwise by the appointing official. Any extensions are requested in writing and submitted to the appointing official.
- (12) The Mishap Investigation Report is formatted in accordance with Appendix 8-1-B. The Independent Investigator or Mishap Board normally does not provide recommended corrective actions in the Mishap Investigation Report. The focus and priority of the investigation report is that the causes of the mishap are technically accurate, well defined, and easily understood. The Independent Investigator or Mishap Board is expected to provide comments and recommendations on the corrective actions to the appointing official when they review the corrective action plan submitted by the responsible organization(s). If the Independent Investigator/Mishap Board has recommendations at this time, they are submitted to the appointing official under separate cover.
- (13) The appointing official may accept or reject the Mishap Investigation Report.

- (1) If the Mishap Investigation Report is rejected, the appointing official appoints a new Independent Investigator or Mishap Board to re-investigate the mishap. The appointing official may not change the Mishap Investigation Report. The Independent Investigator/Mishap Board Chairman is totally responsible for the content of the report and, as such, may not be required to make any changes.
- (2) If the appointing official accepts the Mishap Investigation Report, the report is forwarded to the responsible organization(s) with an action to develop a corrective action plan. (See Section 8-2, "Mishap Abatement and Recordkeeping.")
- (3) The Mishap Investigation Report is also forwarded to the responsible authority for information and to the ISO. The ISO distributes the report to other local organizations, NASA Headquarters, other NASA field centers, and other Federal agencies.

APPENDIX 8-1-A

INDEPENDENT INVESTIGATION AND BOARD MEMBERSHIP GUIDELINES

1. The Associate Administrator for Safety and Mission Assurance, or designee(s), may participate at his/her discretion as an ex-officio nonvoting member in the proceedings of all mishap investigation boards.
2. Appointing officials will appoint chairpersons and members of investigation boards who are independent, i.e., not directly connected with the operation in which the mishap occurred.
3. The board chairperson and board members will be Federal employees. Non-Federal employees may be added to appointing orders as observers or consultants, but not as board members. Other non-Federal employees may be excluded from any deliberations at the discretion of the board chairperson.
4. Board members may be appointed from another Federal agency having technical affiliation with the type of mishap.
5. Board members will be selected, to the extent possible, from personnel who have completed the NASA Mishap Investigation Course or the equivalent. At least one of the board members must have attended the NASA course or equivalent.
6. Boards will be composed of an odd number of members including the chairperson.
7. To ensure objectivity, the appointing official will select the chairperson and as many of the board members as possible from field installations or programs other than those responsible for the installation or the program in which the mishap occurred, except:
 - a. Where necessary expertise cannot be obtained in this way, and
 - b. Where appointments from within the Installation or program can be made without compromising objectivity.
8. Members of the investigation board shall have sufficient background and technical expertise to understand the technology and management interfaces related to the mishap.

9. Local safety and legal personnel will be appointed as advisors (nonvoting) to the board, but will not serve as board members. This exclusion does not apply to reliability, maintainability, or quality assurance personnel.
10. For mishaps with public interest, the Associate Administrator for Public Affairs or the field installation Public Affairs Director, will designate a qualified Public Affairs Officer to be an advisor/nonvoting member of the board. This person will advise and assist the board in developing and coordinating information to be released to the public in accordance with NASA policies.
11. A NASA or resident NASA contractor physician will be included as an advisor/nonvoting member of the board if the mishap involves death or critical injury, or if human factors are thought to be substantially involved. The physician will be a flight surgeon in cases involving flight crews or use of crew egress equipment.

APPENDIX 8-1-B

MISHAP INVESTIGATION BOARD REPORT FORMAT

8-1-B.1. EXECUTIVE SUMMARY

This section should provide a brief description of the mishap, including the extent of damage and casualties, and the major findings.

8-1-B.1. BOARD ACTIVITIES

This section documents the board formation, lists the board members, and summarizes the structured analysis techniques used by the board during the investigation.

8-1-B.1. MISHAP DESCRIPTION

This section should describe, in detail, the sequence of events leading up to the mishap. It should also document the actual mishap event and the events initiated as a result of the mishap occurrence, i.e., safing activities, impoundment, site preservation, management actions, etc. This section should describe what happened, who was involved, where, and when for each event in the sequence. A detailed timeline of events is recommended in this section. Detailed analyses, test reports, witnesses' statements, and other evidence used to establish the mishap description should be attached as appendices to the report and referenced as appropriate.

8-1-B.1. FINDINGS

This section should provide why the mishap sequence of events occurred. It should describe all of the system's configurations, personnel actions or inactions, management policies or practices (documented or not), and management actions or inaction which contributed to the occurrence of each event in the mishap sequence of events. Redundant findings (findings which refer to more than one event in the mishap sequence) should be referenced, not repeated. Detailed analyses, test reports, witness statements, and other evidence used to establish the findings should be attached as appendices to the report and referenced as appropriate. Recommendations to correct deficiencies are not required, but may be included, in this report.

8-1-B.1. MINORITY REPORTS

A minority report is any information presented in the report disputed by a board member. It is helpful to specifically reference the facts or findings disputed. Detailed analyses, test reports, witnesses' statements, and other evidence used to establish the minority facts or findings should be attached as appendices to the report and referenced as appropriate.

8-1-B.1. REPORT RELEASE SIGNATURES

A signature page, which denotes that the signatories certify that the information contained herein is true to the best of their knowledge, is required. Each board member shall sign and date. Signature of the chairman denotes completion of the investigation and reporting process.

8-1-B.1. APPENDICES

As necessary to the report are attached.

SECTION 8-2

MISHAP ABATEMENT AND RECORDKEEPING

8-2.1. PURPOSE

This section establishes and defines the operations and interactions to provide review, tracking, and guidance for processing MSFC mishaps as defined in Section 8-1, "Mishap Reporting and Investigation." These tasks and products comprise the MSFC Center for Mishap Abatement (CMA).

8-2.1. AUTHORITY

8-2.1.a. NHB 1700.1(V1), "NASA Safety Policy and Requirements Document"

8-2.1.b. NMI 8621.1, "Mishap Reporting and Investigation"

8-2.1. DEFINITIONS

8-2.1.a. Mishap Abatement Review Board (MARB)

A board, consisting of appropriate management and safety personnel, reviews the mishap investigation and corrective action plan, assigns and statuses action items, and provides mishap report closure approval. See Appendix 8-2-A for minimum board membership requirements

8-2.1.a. Mishap Reporting/Corrective Action System (MR/CAS)

The mishap database, maintained by the ISO, contains mishap investigation data and provides tools to track corrective action plans to completion, submits status and closure data to NASA Headquarters, and performs mishap trend analysis.

8-2.1.a. MSFC CMA Reportable Mishap

Any unplanned occurrence or close call involving MSFC personnel, property, or visitors resulting in, or having the potential to result in, a Type A,B, or C mishap or incident as defined in Section 8-1, "Mishap Reporting and Investigation."

8-2.1.a. Mishap Closure

Final closure report submitted by the mishap originator consisting of the revised and signed NASA Form 1627, formal report where applicable, and description or corrective action. Corrective action implementation is required for MSFC closure approval.

8-2.1. RESPONSIBILITIES

Although the primary responsibility of implementing the CMA lies with the ISO, mishap report processing involves several elements and consists of interactions among these elements to ensure proper mishap review, corrective action, and closure

8-2.1.a. MSFC Industrial Safety Office:

- (1) Maintains database of mishap investigations.
- (2) Tracks mishap corrective actions to completion.
- (3) Performs mishap trend analysis

8-2.1.b. The Mishap Abatement Review Board:

- (1) Reviews and approves proposed corrective action plans.
- (2) Reviews formal closure submittal and assigns action items, if appropriate.
- (3) Provides closure approval upon implementation of corrective action plan.

8-2.1.c. Manager of Responsible Organization:

Directs contractor participation in CMA activities.

8-2.1.a. Responsible Organization:

- (1) Prepares corrective action plan.
- (2) Supports MARB activities.
- (3) Provides status of corrective action as required.
- (4) Generates final report requesting MSFC closure.

8-2.2. FUNCTIONS

8-2.2.a. General

- (1) Corrective action plans are developed for all mishaps and close calls. The plan shall include actions to correct the situation that caused the mishap and prevent the same or similar mishap from recurring.
- (2) The ISO uses MR/CAS to maintain records of all mishaps and close calls, track corrective actions to completion, submit status and closure data to NASA Headquarters, and perform mishap trend analysis.

8-2.2.b. Corrective Action Plan Process for Mishaps Investigated by a Local Investigator or Team

- (1) The local investigator or team submits the corrective action plan to the ISO on NASA Form 1627.
- (2) The ISO Director may approve the corrective action plan or may convene the MARB. The decision to convene the MARB is based on the significance and complexity of the mishap, and the adequacy of the corrective action plan.
- (3) When the MARB is convened, the local investigator or team presents the mishap findings and corrective action plan.
- (4) The MARB may approve the plan or request additional actions.
- (5) Once a plan is approved, the ISO enters the corrective actions into the Incident Reporting Information System (IRIS), and tracks actions to completion.

8-2.2.c. Corrective Action Plan for Mishaps Investigated by an Independent Investigator or Mishap Board

- (1) The responsible organization(s) submits the corrective action plan to the appointing official with a copy to the ISO. The format provided in Appendix 8-2-B is used as a guide in preparing the plan.
- (2) The appointing official may approve or convene the MARB to review the proposed corrective action plan.
- (3) When the MARB is convened, the responsible organization(s) presents the mishap report findings and the proposed corrective action plan.

- (4) The MARB may approve the plan or request additional actions.
- (5) The responsible organization implements the approved corrective action plan as directed by the appointing official or the MARB.
- (6) The responsible organization tracks the corrective action performance and provides status to the appointing official and the ISO in accordance with the plan.
- (7) As actions are completed, the responsible organization provides evidence of action completion to the appointing official, as agreed to in the plan.
- (8) Upon receipt of the evidence, the appointing official may close the action. The appointing official is responsible for determining if the action performed and accompanying evidence closes the action. The appointing official notifies the responsible organization(s) and the ISO if an action is closed.
- (9) The ISO enters the data into IRIS and tracks actions until completion.

8-2.2.d. Corrective Action follow-up

- (1) The ISO spot checks corrective actions to determine if they are carried out per plan. Compliances and noncompliances are communicated to the responsible organization(s) and to the appointing official, if appropriate.

- (1) For mishaps investigated by an independent investigator or mishap board, the appointing official closes all corrective actions as reported by the responsible organization. When all corrective actions are closed, the appointing official produces a Mishap Summary Report. This report provides the mishap

investigation report, the corrective action plan, any changes to the plan, and final status or corrective actions. The Mishap Summary Report includes the appointing official's statement that all corrective actions are completed per plan. A suggested format for the Mishap Summary Report is included in Appendix 8-2-C.

- (2) The Mishap Summary Report is delivered to the responsible authority and the ISO. The validating organization will distribute the report to other local organizations, NASA Headquarters, other NASA field centers, and other Federal agencies. At this point, the appointing official has met his/her obligations for this mishap and is released from this position.
- (3) The ISO assesses completed corrective actions for effectiveness. Each corrective action is given adequate time to determine its effectiveness. The validating organization assesses the corrective action and determines if it has corrected the situation as intended.
- (4) If the situation is corrected, the corrective action and its resolution are considered as candidates for a Lessons Learned. The method for documenting Lessons Learned is provided in Appendix 8-2-D.
- (5) If the corrective action has not provided the intended results, the ISO notifies the responsible organization. The responsible organization addresses the situation and provides additional corrective action, if needed.

APPENDIX 8-2-A

MISHAP ABATEMENT REVIEW BOARD (MARB) MEMBERSHIP

Membership is based on the level of investigation. Membership includes, as a minimum, the following for each level of investigation:

Mishaps Reviewed at the Local Investigator or Team Levels

- Chairperson - Director, Industrial Safety Office
- Members - Manager(s) of the responsible organization(s)
 - Responsible Industrial Safety Office Lead Engineer

Mishaps Reviewed at the Independent Investigator or Mishap Board Levels

- Chairperson - Appointing Official
- Members - Director, Safety and Mission Assurance Office
 - Manager(s) of responsible organization(s)
 - Director, Industrial Safety Office
 - The independent investigator or mishap board chairman

Exception: The MSFC Safety and Health Committee may act as the MARB for any level of investigation.

APPENDIX 8-2-B

CORRECTIVE ACTION PLAN FORMAT

The proposed corrective action plan shall identify the detailed actions that will be taken to prevent recurrence. It shall individually address each finding of the investigation report, and shall include action(s) for each finding, the name of the specific organization responsible for completing each action, and an estimated completion date (ECD) for each action. Any format may be used as long as all of these items are addressed. The following is a suggested format:

Proposed Corrective Action Plan
for
(Name of Mishap)

Finding No. 1 - Write out the finding or observation exactly as it appears in the Mishap Report.

Action(s):

1.1 Clearly describe detailed Action No. 1 for correction of Finding No. 1.

Actionee: Identify responsible organization or person.

ECD: Month/Day/Year

Status Reporting Frequency:

1.2 Clearly describe detailed Action No. 2 for correction of Finding No. 1.

Actionee: Identify responsible organization or person.

ECD: Month/Day/Year

Status Reporting Frequency:

1.3 Etc. (As Needed)

Finding No. 2 - Write out the finding or observation exactly as it appears in the Mishap Report.

Action(s):

- 2.1 Clearly describe detailed Action No. 1 for correction of Finding No. 2. (If an action is the same as for another finding, reference that action.
Example: Same as Action 1.1)

Actionee: Identify responsible organization or person.

ECD: Month/Day/Year

Status Reporting Frequency:

Finding No. 3 - Continue as needed to address each finding and observation.

APPENDIX 8-2-C

MISHAP SUMMARY REPORT FORMAT

TO: Responsible Authority
FROM: Appointing Official
SUBJECT: Mishap Summary Report for (Mishap Title)

This letter certifies that all corrective actions associated with the subject mishap and subsequent investigation are closed.

This package is the complete official documentation associated with (mishap title). Mishap Investigation Board files containing raw data and information are maintained by (organization and person). (This last sentence can be deleted if desired.)

Attached are:

Mishap Investigation Report (Enclosure 1)
Corrective Action Plan (Enclosure 2)
Final Corrective Action Status (Enclosure 3)
(This report, developed by the Appointing Official, documents the closure status of all corrective action items. It shall also provide any changes to the Corrective Action Plan and their closure statuses.)

NOTE: The documents listed above are subject to the Privacy Act of 1974.

With the submission of the report, the appointing official has completed all required functions as specified in NHB 1700.1(V2), "Safety Standard for Mishap Investigation Process Guidelines."

Appointing Official

APPENDIX 8-2-D

LESSONS LEARNED INPUT

Lessons learned from mishaps and close calls are identified, developed, documented, and entered into the NASA-wide Lessons Learned Information System (LLIS) per the respective MSFC LLIS Plan. The enclosed lessons learned report form, or equivalent, is used to document and submit these lessons to the LLIS Data Manager in the S&MA Office.

Each action or lesson must be submitted on a separate report form. If you are submitting several lessons or several actions from the same source, fill out the source information on only one of the report forms. The information you provide will be entered into the Agencywide LLIS. Leave any item blank if not applicable.

Report form instructions:

BLOCK NO.

1. The automated system will generate this number.
2. Provide the date this lesson is written.
3. Provide the name of the NASA facility that is preparing this lesson: ARC, GSFC, HQ, JPL, JSC, KSC, LaRC, LeRC, MSFC, SSC. If SSF program office, use SSPO.
4. Specify the subject or topic of the lesson; e.g., range safety, deviations/waivers, tear-down procedures, bolt installation, electrical harness wire insulation, etc.
5. Briefly explain the lessons learned including the risk to be eliminated or mitigated.
6. Briefly state the action that should be taken to eliminate or mitigate the risk.
- 7-9. Provide your name as submitter of this lesson, the name of your organization, and your phone number.
10. Provide the number of the source document that describes the event from which the Lesson was developed.
11. Provide the name of the facility that reported the triggering event and has possession of the source document.
12. Provide the date of the source document (not the date of the driving event).

13. Briefly describe the driving event or problem that resulted in the development of the lesson. Attach additional sheets if necessary.
14. Briefly describe the evidence that the corrective action is effective. Attach additional sheets if necessary.
- 15-16. For Data Management Use Only.

The lessons learned data base is available to MSFC personnel via the internet at <http://envnet.gsfc.nasa.gov>

LESSON LEARNED REPORT

1. LESSON NUMBER	2. DATE	3. FACILITY ID			
		M	S	F	C
4. SUBJECT					
5. LESSON LEARNED					
6. ACTION REQUIRED					
7. SUBMITTED BY	8. ORGANIZATION	9. PHONE NO.			
SOURCE INFORMATION					
10. SOURCE NO.	11. REPORTING FACILITY	12. SOURCE DATE			
		MSFC			
13. DESCRIPTION OF DRIVING EVENT <small>(attach additional sheets if necessary)</small>					
14. EVIDENCE OF RECURRENCE CONTROL EFFECTIVENESS <small>(attach additional sheets if necessary)</small>					
APPROVAL & CONCURRENCE					
15. TECHNICAL REVIEW AND APPROVAL					
16. SR&QA CONCURRENCE	<small>Print or Type Name</small>	<small>Signature</small>	<small>Full Code</small>	<small>Phone No.</small>	
	<small>Print or Type Name</small>	<small>Signature</small>	<small>Full Code</small>	<small>Phone No.</small>	

CODE QS MAR 93 v3.0P

Figure 8-2-D-1 Lessons Learned Report Form

REFERENCESREFERENCESREFERENCESREFERENCESREFERENCES

1. 90M05001, "Design Guidelines for Pressure Piping at MSFC"
2. Air Force Manual (AFM), AFM 161.30, "Aerospace Medicine, Chemical Rocket/Propellant Hazards"
3. American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (current Edition)
4. American National Standards Institute (ANSI), ANSI A11.1, "Practice for Industrial Lighting"
5. ANSI A119.5, "Park Trailers"
6. ANSI A13.1, "Scheme for Identification of Piping Systems"
7. ANSI B5 and B11 series, ANSI tool standards
8. ANSI Z49.1-88, "Welding and Cutting, Safety in"
9. ANSI Z87.1, "Occupational and Educational Eye and Face Protection, Practice for"
10. ANSI Z89-1-1989, "Protective Headware for Industrial Workers - Requirements"
11. ANSI Z117.1-1989, "Safety Requirements for Confined Spaces"
12. ANSI Z136.1, "Lasers, Safe Use of"
13. ANSI Z244.1, "Lockout/Tagout of Energy Sources - Minimum Safety Requirements"
14. ANSI Z358.1-1990, "American National Standard for Emergency Eyewash and Shower Equipment"
15. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ANSI/ASHRAE), ANSI/ASHRAE 15-1989, "Safety Code for Mechanical Refrigeration"
16. ASHRAE 34-1989, "Number Designation and Safety Classifications of Refrigerants"
17. American Standard of Mechanical Engineers (ASME), ASME B31.1, "American National Standard for Power Piping"

18. ASME B31.3, "American National Standard for Chemical Plant and Petroleum Refinery Piping"
19. ASME B56.1, "Safety Standard for Low Lift and High Lift Trucks"
20. Army Material Command Regulation (AMC-R), AMC-R 385-100, "Safety Manual"
21. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section VIII, Division 1 and 2
22. ASTM Committee G4.05, "Fire Hazards in Oxygen Systems"
23. Code of Federal Regulations (CFR), Title 24, Part 280, "Department of Housing and Urban Development"
24. Code of Federal Regulations, Title 29, Part 1910, "Department of Labor"
25. Code of Federal Regulations, Title 29, Part 1926, "Department of Labor"
26. Code of Federal Regulations, Title 40, Parts 100-199, "Environmental Protection Agency"
27. Code of Federal Regulations, Title 49, "Department of Transportation"
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