

Ames Procedural Requirements

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COMPLIANCE IS MANDATORY

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Ames Health and Safety Procedural Requirements

Chapter 57 - Facility Safety Management Plan

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PREFACE

P.1 Purpose

- a. This document describes NASA Ames Research Center's methods for assuring that facilities and facility systems are assessed, evaluated and that the appropriate level of engineering oversight and system safety are applied, documented and maintained current and accurate throughout the lifecycle of the facility.
- b. This plan is the implementing procedures for meeting the requirements of NPR 8715.3 - NASA General Safety Program Requirements; and NASA-STD-8719.7 - Facility System Safety Guidebook.

P.2 Applicability

- a. This Plan applies to all ARC operated, owned or leased facilities and facility systems including, but not limited to Construction of Facilities (CoF) projects, existing and vintage facilities, major renovations made to existing facilities. This Plan also applies to any facilities and facility systems occupied or operated by ARC tenet organizations, contractors, grantees, clubs and other persons or groups operating under the purview of ARC or on ARC property.
- b. All facilities must comply with applicable federal, state, and local codes, regulations and Consensus Industry Standards (CIS), unless otherwise stated. As described in this Plan, code compliance alone may be sufficient for lower-risk facilities. Higher-risk facilities will receive the appropriate level of analysis per the requirements in NPR 8715.3, NASA General Safety Program Requirements; and NASA-STD-8719.7 facility system safety guidebook or applicable program requirements.

P.3 Authority

- a. It is ARC policy that facilities and facility systems will be designed, operated, and maintained to adequately control hazards likely to cause physical harm to personnel, damage to system/facility and/or systems or equipment stored, tested or operated within the facility.
- b. The authority for this program is outlined in NASA Procedural Requirement (NPR) 8715.3, "NASA General Safety Program Requirements", and supported by NASA-STD-8719.7, "Facility System Safety Guidebook", and NPR 8820.2, "Facility Project Requirements". These standards and requirement documents outline specific processes and tasks that are to be carried out for the acquisition and operation of facilities:

- (1) NPR 8715.3, NASA General Safety Program Requirements
- (2) NASA-STD-8719.7, Facility System Safety Guidebook
- (3) NPR 8820.2, Facility Project Requirements

P.4 Applicable Documents and Forms

- a. Executive Order (EO) 12196, Occupational Safety and Health Program for Federal Employees
- b. Title 29 CFR, Part 1960, Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters
- c. Title 29 CFR, Parts 1910 to 1990, Occupational Safety and Health Administration
- d. Title 40 CFR, Protection of the Environment, Environmental Protection Agency
- e. Title 49 CFR, Parts 171 to 178, Transportation, Department of Transportation
- f. American National Standards Institute (ANSI)
- g. National Fire Codes (NFC) from the National Fire Protection Association (NFPA)
- h. International Building Code (IBC)

- i. Uniform Building Code (UBC)
- j. International Mechanical Code (IMC)
- k. Uniform Mechanical Code (UMC)
- l. American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Value and Biological Exposure Indices
- m. NPD 8710.2, NASA Safety and Health Program Policy
- n. NPR 1800.1, NASA Occupational Health Program Procedures
- o. NPR 8621.1, NASA Procedures and Guidelines for Mishap Reporting, Investigating, and Recordkeeping
- p. NPR 8820.2, Facility Project Requirements
- q. NPR 8715.1, NASA Occupational Safety and Health Programs
- r. NASA-STD-5005, Standard for the Design and Fabrication of Ground Support Equipment
- s. NASA-STD-8719.9, Standard for Lifting Devices and Equipment
- t. NASA-STD-8719.11, Safety Standard for Fire Protection
- u. NASA-STD-8719.17, NASA Requirements for Ground-Based Pressure Vessels and Pressurized Systems (PV/S)
- v. APR 8715.1 Ames Health and Safety Manual
- w. APR 8829.1 Ames Construction Permit Process
- x. APR 8705.1 System Safety and Mission Assurance

P.5 Measurement/Verification

Compliance with the requirements contained in this chapter of the APR will be verified by Ames Internal Audits and Assessments, and during HQ Institutional, Facility, and Operations (IFO) audits.

P.6 Cancellation

None

/S/

Eugene Tu
Center Director

CHAPTER 1. General

1.1 Objective

This plan describes the Ames Research Center's methods for implementation of the NASA facility system safety requirements (NPR 8715.3 - NASA General Safety Program Requirements: Chapter 8, Safety for Facility Acquisition, Construction, Activation and Disposal; and NASA-STD-8719.7 - Facility System Safety Guidebook), for performing facility system safety management for all existing facilities, Construction of Facilities (CoF) projects, and major renovations (Major renovations are any facility modifications controlled by a design review process).

This document defines the roles, responsibilities, and tasks associated with the ARC Facility system safety program throughout the lifecycle of facilities at Ames.

1.2 Accountability

Ownership of this document is by the Safety & Mission Assurance Directorate. Ames facility system safety involves a team effort of stakeholders, including but not limited to ARC Safety and Mission Assurance Directorate (Safety Technical Authority); ARC Chief Engineer's Office (Engineering Technical Authority); ARC Chief Scientist's Office, when applicable (Scientific Technical Authority); the Center Operations Directorate; the ARC Fire Department; ARC Security; ARC Information Technology; and the User Organization. At ARC, it is vital that the team of stakeholders maintain safety vigilance over facilities, especially those that have been deemed critical.

1.3 Compliance with Federal, Consensus, and NASA Standards

- a. Federal Agencies are mandated to provide a safe workplace for their employees in accordance with the Occupational Safety and Health Act, 1970, in accordance with Executive Order 12196, "Occupational Safety and Health Programs for Federal Employees," dated February 26, 1980, and with Title 29 CFR, Part 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters."
- b. Listings denoting authority and applicable documents are provided in sections P.3 - Authority; and P.4 - Applicable Documents.
- c. Applicable Consensus Industry Standards will be used to the extent practical to meet NASA and Occupational Safety and Health Administration (OSHA) design and operational needs.

1.4 Change Recommendations

Recommended changes to this document will be submitted to the Ames facility system safety Program Manager. Changes will be coordinated with stakeholders, and a consensus reached, prior to implementing any change requests.

2.0 Roles and Responsibilities

2.1 Center Director

The Office of the Director shall ensure the Center is in compliance with this plan and provide executive oversight of the Center's Facility Safety Management planning and implementation activities via its Center Program management Council (CPMC).

2.2 Director of Safety and Mission Assurance

The director of Safety and Mission Assurance (S&MA) is responsible for assuring implementation of this plan for existing/vintage facilities, for major renovations to existing facilities and for Construction of Facilities (CoF) projects. The director of S&MA also signs and dates each Facility Risk Indicator (FRI) assignment document, with concurrence from the ARC Chief Engineer, and the Director of Center Operations; and maintains an up-to-date list of FRI 1 and 2 Facilities.

2.2 Facility Project Manager (FPM) – New Construction or Major Renovations

The facility project manager is responsible for participating in the assessment and determination of the Facility Risk Indicator (FRI) for the facility project; and if required based upon the FRI - generation and maintenance of their facility project system safety plan; development of preliminary hazard list; preliminary hazard analysis; facility hazard analysis; hazard reports; and hazard tracking to closure until the facility reaches the Operation phase. At that time the documentation will be handed over to the Facility Manager. The Facility Project Manager is responsible for assuring that the facility project system safety is commensurate with the assigned facility project FRI.

2.3 Facility System Safety Engineer

The assigned facility system safety Engineer evaluates, coordinates, monitors, and performs engineering systems safety and risk analyses of facilities, systems, equipment, and operations. Reviews safety plans, test/operational plans, and operational procedures to ensure safety analysis safety controls and mitigations are implemented.

Coordinates with Facility Managers and other affected personnel on the interpretation and applicability of safety requirements and standards, including the impact of known future safety regulation revisions.

Participates in design and safety review boards and panels to review new facility and facility modifications, operations and tests, and safety variances to requirements.

2.4 Facility Manager – Existing and Vintage Facilities

The Facility Manager (not to be confused with the Facility Project Manager who supports the project until the Operation phase commences) is responsible for assuring that any facility system safety documentation required per the facility's FRI is maintained up-to-date from the beginning of the Operation phase through the decommissioning and disposal/deconstruction/demolition of the Facility and Facility Systems; and for assuring implementation of said documentation. Other responsibilities include, but are not limited to:

- Participate in FRI classification of the facility (if not already completed);
- FM is the Go-to person for any issues regarding the facility;
- The managers inform the employees about the existence and function of the FM. Managers tell PIs who the FM is and that she is available for looking into issues;
- If issues regarding the facility can result in a safety issue then the FM is notified and coordinates/facilitates the activity as appropriate.

2.5 Supervisors

Supervisors with employees working in a facility are responsible for assuring that employees under their supervision have a safe and healthful work environment. More detail on supervisor responsibilities is located in APR 8715.1, Chapter 2, section 2.2.3.

3.0 Hazard Management Approach

Project personnel will consider the facility, equipment, personnel, and environment where activities will take place for identifying and assessing hazards. Then, using engineering judgment; hazard and incident information from similar facilities, mishaps and lessons learned; draw on the knowledge and experience from around the Agency and elsewhere; and perform hazard analysis methods to more thoroughly identify and evaluate hazards (many of which eventually become hazard reports).

At NASA Ames, Risk Assessment is handled in accordance with the Center's Risk Management Process Requirements document, APR 8000.4, and Work Instruction QS.0011, Safety Hazard Report Preparation Tracking and Closure. Refer to NASA-STD-8719.7 for further insight and examples into facility system safety management.

3.1 Facility Risk and Criticality Classifications

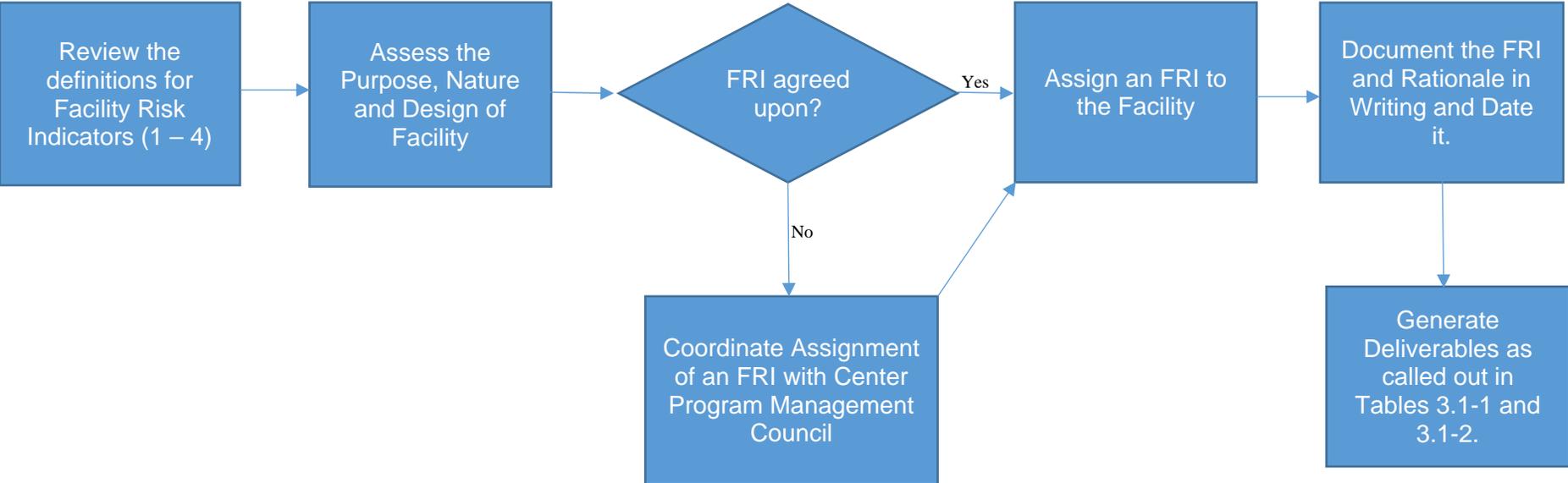
At Ames, facilities are categorized based upon their level of risk (technical criticality, safety criticality, budget criticality, or time criticality) using what is referred to as a Facility Risk Indicator (FRI). An FRI of 1 is assigned to facilities that are highly dangerous or are critical to Ames mission. An FRI of 4 designation is given to facilities that are purely administrative in nature. The criticality of facilities is coordinated with and between the facility system safety engineer; the facility manager/facility project manager; Ames Office of the Chief Engineer (reference Ames Critical Facilities, APR), the Director of Center Operations, and the Center Project Management Council. See Table 3.1-1 on the next page, and Figure 3.1-2 on the page after that, for insight into the Ames FRI assignment process.

Table 3.1-1: Ames Facility Risk Indicator (FRI) Definitions, Examples, and Requirements/Deliverables

FRI Classification	Ames Facility Examples for FRI	Facility System Safety Requirements/Deliverables – <u>New Construction or Major Renovations</u>	Facility System Safety Requirements/Deliverables – <u>Existing/Vintage Facilities</u>
FRI 1: Facilities whose design and operation can cause death and mass destruction; or facilities whose uniqueness; value; or continuous operation make them critical to the Center.	ARCJETS; NASA Advanced Supercomputing Facility; Power Substations	Facility Risk Indicator; Facility Safety Management Plan; Preliminary Facility Hazard List; Preliminary Facility Hazard Analysis; Facility Hazard Analysis; Facility Hazard Reports; Facility Hazard Tracking & Verification Matrix.	Facility Risk Indicator; Facility Hazard Analysis; Job Hazard Analysis
FRI 2: Facilities whose design and operation can cause death or dismemberment; or facilities whose operation on demand is important to the Center.	Wind Tunnels; Computer Facilities; Aircraft Simulators; Science Laboratories; Vertical Motion Facility;	Facility Risk Indicator; Facility Safety Management Plan; Preliminary Facility Hazard List; Preliminary Facility Hazard Analysis; Facility Hazard Analysis; Facility Hazard Reports; Facility Hazard Tracking & Verification Matrix.	Facility Risk Indicator; Facility Hazard Analysis; Job Hazard Analysis
FRI 3: Facilities whose design and purpose may result in serious injury.	Machine Shops; Model Shops;	Facility Risk Indicator; Facility Hazard Analysis; Facility Hazard Reports; Facility Hazard Tracking & Verification Matrix.	Facility Risk Indicator; Job Hazard Analysis.
FRI 4: Facilities having only administrative operations, and no high dollar assets or critical capabilities.	Administrative Facilities	Facility Risk Indicator; Adherence to applicable codes, standards, and regulations.	Facility Risk Indicator; Adherence to applicable codes, standards, and regulations.

Ames facilities receive a level of risk management oversight that is commensurate with their FRI. Facilities that are FRI Category 1 have dedicated facility system safety professionals assigned to them for assuring their safety and operational availability. FRI Category 1 and 2 facilities are also monitored by the Center Project Management Council (CPMC). Category 3 and 4 facilities are the responsibility of the user organization and supervisors of employees in the facility for assuring the deliverables required by this plan are up to date.

Figure 3.1-2: Ames FRI Assignment Process



As described above, the facility system safety deliverables for a facility project are dependent upon the Facility Risk Indicator classification that the facility project has been assigned. The deliverables for facilities at Ames are described in Table 3.1-2.

Table 3.1-2: Facility System Safety Deliverables

Title of Deliverable	Timeframe for Implementation of Deliverable	Rationale for Update of Deliverable
Facility Risk Indicator	Requirements and planning phases	Only required to be updated in the event that the FRI for the facility changes.
Preliminary Facility Hazard List	Requirements and planning phases	Does not require an update once the Hazard Analysis has been completed
Facility Safety Management Plan	Planning and design phases	Updated as new hazards, hazard causes, or mitigations are identified. Living document from conception through decommissioning and disposal or deconstruction phases.
Preliminary Facility Hazard Analysis	Design phase	Does not require an update once the Hazard Analysis has been completed
Facility Hazard Analysis	Design, construction, activation, operation, and disposal phases	Updated as hazard information changes.
Subsystem Hazard Analyses (as deemed necessary)	Planning, design, construction, activation, operation, and disposal phases	Updated as hazard information changes.
Hazard Reports	Planning, design, construction, activation, operation, and disposal phases	Updated as hazard information changes.
Hazard Tracking & Verification Matrix	Planning, design, construction, activation, operation, and disposal phases	Updated as hazard information changes.
Job Hazard Analysis	Construction, activation, operation, and disposal phases	Updated as hazard information changes.

3.2 Hazard Reports

Hazard reports are the method used by facility projects for documenting credible hazards identified via safety analysis techniques. The hazard reports describe the hazard, causes, likelihood (with and without mitigations), mitigations, consequences, and status (open or closed). The person assigned the hazard report must complete all required safety verifications before the hazard report can be closed. Hazard reports at Ames are processed in accordance with Work Instruction QS.0011, Safety Hazard Report Preparation Tracking and Closure.

3.2.1 Hazard Consequence and Likelihood

For each identified hazard, an analysis of the associated risks is reviewed and each hazard is assigned a hazard likelihood category, and a hazard consequence level. Hazard likelihood is the estimation based

upon engineering judgment that a hazard will result in a mishap. Hazard Consequence and likelihood at NASA Ames are handled in accordance with the Center's Risk Management Process Requirements document, APR 8000.4, and Work Instruction QS.0011, Safety Hazard Report Preparation Tracking and Closure.

3.2.2 Risk Assessment Code

For each identified hazard, the plausible causes are reviewed and each hazard is assigned a hazard consequence category, a hazard likelihood level, and the two are combined to form a hazard classification or Risk Assessment Code. At NASA Ames, Risk Assessment Codes are handled in accordance with the Center's Risk Management Process Requirements document, APR 8000.4, and Work Instruction QS.0011, Safety Hazard Report Preparation Tracking and Closure.

3.2.3 Hazard Control and Verification

The hazard report must identify means for controlling the hazard to at least an acceptable level of risk. The assignee working the hazard must assess what can and will be done with the hazard, and must be able to defend their decision. The assignee will assure that any controls and the associated verifications are 1) achievable; 2) clear and understandable; 3) address the issue to an acceptable level of risk, and 4) that their effectiveness can be proven (test, demonstrate, analyze, or by inspection). Refer to Work Instruction QS.0011, Safety Hazard Report Preparation Tracking and Closure.

3.3 Safety Variances

When safety requirements cannot be met, the Project Manager, Discipline Leads, and System Safety will submit deviation or waiver requests per NPR 8715.3.

4.0 Facility Safety Life Cycle Process

Facility system safety tasks will be integrated into the CoF project life cycle for new facilities or existing and vintage facilities undergoing major renovation.

4.1 Requirements Phase

- a. The Center Operations Directorate will ensure that safety management requirements are identified in Construction of Facilities (CoF) and Center-funded facilities projects.
- b. All ARC facilities will develop and maintain, for each major operation - brief process descriptions including a list of anticipated energy sources (e.g., electrical, chemicals, machinery), to be provided to the Ames Safety and Mission Assurance Directorate for inclusion in the FRI assessment and the Preliminary Hazard List (PHL) of the facility.

4.2 Planning Phase

- a. The Safety and Mission Assurance Directorate will assess and review requirements, specifications, and design drawings for facility acquisitions, per the facilities standards requirements document, to ensure the incorporation of safety and fire protection requirements and resolution of identified hazards. Reviews will determine compliance with NPR 8715.3, "NASA General Safety Program Requirements"; NPR 8715.1, "NASA Occupational Safety and Health Programs"; NFPA standards; applicable building codes; and other applicable fire protection and safety standards and codes. Review findings will be incorporated into and tracked with the HT&V MATRIX.
- b. Together, Ames Office of the Chief Engineer, Safety and Mission Assurance Directorate, and the Center Operations Directorate will review requirements, specifications, and design drawings for facility modifications, per the facilities standards requirements document, to ensure incorporation of safety and fire protection requirements and to ensure the resolution of identified hazards. Reviews

will follow the APR 8829.1 – Ames Construction Permit Process. In addition, modification to designs will be reviewed to ensure that existing hazard controls are not compromised and that additional are not created. Review findings will be incorporated into and tracked with the HT&V MATRIX.

- c. A Facility Safety Management Plan (FSMP) will be developed and reviewed for every FRI 1 and 2 facility acquisition in partnership between the operating organization, the Office of Safety and Mission Assurance, and the Facility Manager. FRI 1 facilities are required to have an FSMP.
- d. A Facility Hazard Analysis (FHA) will be performed in accordance with NASA-STD-8719.7 for all FRI 1 facility acquisitions. An FHA is required for FRI 2 and hazardous operations in FRI 3 facilities. The FHA builds upon the PHL and PHA.
- e. Ames Safety and Mission Assurance Directorate will ensure that an FHA is performed during the planning and design phases, and should be updated during the operations phase as changes occur and as new information is gathered.

4.3 Design Phase

- a. The FHA, necessitated by the FRI, will be continued into the design phase as facility design elements are specified. During this phase, additional safety analyses may be deemed necessary and may be included in the FHA.
- b. For those facilities requiring an FHA, the (Hazard Tracking and Verification) HT&V MATRIX is first established using the FHA Worksheet. Otherwise, the HT&V MATRIX is built upon the Preliminary Hazard List (PHL). The HT&V MATRIX is an information management tool that ultimately becomes a living document/tool for use throughout the life cycle of the facility.

4.4 Construction Phase

- a. This phase is concerned not only with construction worksite safety but also with validation of the construction with respect to design drawings, specifications, and hazard controls. The HT&V MATRIX will be utilized and updated when safety tasks are conducted during this phase.
- b. For facility acquisitions in which an FHA was performed, an HRV will be conducted to verify that all the recommendations from the FHA Worksheet (using the HT&V MATRIX) have been implemented/closed and all identified hazards have been eliminated, reduced, or accepted.
- c. Safety requirements applicable during construction are stated in APR 8715.1, Chapter 27.

4.5 Activation Phase

The Center Operations Directorate will conduct an Initial Systems Test (IST) and Operational Readiness Review (ORR) as required, with support from the Ames Office of the Chief Engineer, Safety and Mission Assurance Directorate, Facility Project Manager, and Facility Manager. The test will include, but not be limited to:

- a. Review the facility hazards (as documented in the HT&V MATRIX) and controls;
- b. Review the IST results;
- c. Conduct a facility acceptance walk-down;
- d. Verify an initially safe operation; and
- e. Make recommendations for final decision and approval concerning the status of residual hazards and any restrictions or limitations on the operation of the facility.

4.6 Operations Phase

- f. The HT&V MATRIX will be administered and updated in an information management system throughout the entire facility life cycle. The HT&V MATRIX will be accessible to those personnel who identify, assess, recommend, install/implement, and validate controls for and are affected by facility hazards. Any modifications made to the original design (or new activities performed in the facility) will

be reviewed to ensure that any new hazards or mitigated safety controls are accurately reflected in the HT&V MATRIX.

- g. The Safety and Mission Assurance Directorate and Center Operations Directorate will assess each facility for compliance with applicable NASA requirements, Federal and state laws, and other applicable fire protection and safety standards and codes. Facility inspection findings will be incorporated into and tracked with the HT&V MATRIX.
- h. The Safety and Mission Assurance Directorate will review the FRI classification of each facility with the Facility Manager, and reclassify, if necessary, to reflect changes to the hazards inherent in the facility.
- i. The Center Operations Directorate will ensure that information regarding anticipated changes to facility operational capabilities is communicated to Ames Office of the Chief Engineer, and Safety and Mission Assurance Directorate.
- j. The Safety and Mission Assurance Directorate will work closely with the Center Operations Directorate to assure application of facilities engineering and facilities maintenance resources to eliminate or control facility hazards.

4.7 Mothball Facilities Phase

A facility system safety analysis will be required for abandoned and mothballed facilities (facilities in a non-operational state), and will need to be maintained current, as well. Mothballed facilities are to be tracked on the FRI list maintained by the Safety and Mission Assurance Directorate.

4.8 Demolition Phase

- a. The Safety and Mission Assurance Directorate, along with Center Operations will evaluate the potential safety and environmental aspects of demolition of a facility. Hazard analyses are required to be reviewed, updated as necessary and used for assessing and addressing risk during this phase.
- b. During this phase, the Safety and Mission Assurance Directorate, along with the Center Operations Directorate, and the Office of the Chief Engineer, will ensure that all identified hazards are resolved in the HT&V MATRIX. Subsequently, the HT&V MATRIX for the facility will be closed out, documented as demolished on the FRI list, and archived.