# Kennedy NASA Procedural Requirements

**Effective Date:** **November 18, 2011**

**Expiration Date:** **November 18, 2016**

**Responsible Office:** **Spaceport Integration and Services**

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# KSC INDUSTRIAL HYGIENE PROGRAMS

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***National Aeronautics and Space Administration***

**John F. Kennedy Space Center**

KDP-KSC-T-2120 Rev. Basic

## Change Log

| Date | Revision | Description |
|---|---|---|
| 11/18/11 | C | Revised to implement new program requirements identified in NPD 1800.1C, NASA Occupational Health Program Procedures. Changes include a new Indoor Air Quality Program, Hazardous Material Management policy, and Health Hazard Evaluation Program requirements. |
| 12/7/11 | C-1 | Administratively changed to clarify Action Level definition in Appendix A. The application of the action level to exposures to chemicals substances identified in CFR 1910, where use of the action level is an OSHA requirement**.** |
| 05/18/15 | C-2 | Administrative changes only to reflect change in name of directorate from Center Operations to Space Integration and Services. |

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## PREFACE

### P.1 Purpose

a. It is Kennedy Space Center's (KSC) policy to provide employees with an environment in which occupational health hazards are identified, evaluated, and eliminated or controlled in such a manner that personnel do not suffer adverse health effects as a result of their employment. Activities shall be conducted in a manner that conforms to all applicable federal, state and local regulatory requirements. Exposure to chemical and physical hazards will be managed to ensure they are below regulated exposure limits and as low as reasonably achievable.

b. This Kennedy National Aeronautics and Space Administration (NASA) Procedural Requirements (KNPR) provides direction for development, management, and implementation of the KSC Industrial Hygiene (IH) Program. NASA, contractor management, and operations organizations shall supplement the provisions of this KNPR by implementation of internal policies and instructions as needed.

c. Additional requirements for the KSC IH Program are contained within Kennedy NASA Policy Directive (KNPD) 1800.2, KSC Hazard Communication Program, KNPR 1820.4, KSC Respiratory Protection Program, and KNPR 1820.3, KSC Hearing Loss Prevention Program.

### P.2 Applicability

a. This KNPR applies to all NASA organizational elements located at KSC, and NASA-KSC facilities and operations at other locations. This includes NASA-KSC contractors, grant recipients, or parties to agreements only to the extent specified or referenced in the appropriate contracts, grants, or agreements.

b. In this directive, all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The terms: “may” or “can” denote discretionary privilege or permission, “should” denotes a good practice and is recommended, but not required, “will” denotes expected outcome, and “are/is” denotes descriptive material.

c. In this directive, all document citations are assumed to be the latest version unless otherwise noted.

### P.3 Authority

a. NASA Procedural Requirement (NPR) 1800.1, NASA Occupational Health Program Procedures

b. NPR 8715.1, NASA Occupational Safety and Health Programs

### P.4 Applicable Documents and Forms

a. Title 40, Code of Federal Regulations (CFR), Parts 60 – 80

b. 29 CFR 1960.25, Qualifications of Safety and Health Inspectors and Agency Inspections

c. NASA Federal Acquisition Regulation (FAR) Supplement 1823.70, Safety and Health

d. Occupational Safety and Health Act of 1970

e. Privacy Act of 1974

f. NASA Policy Directive (NPD) 8820.2, Design and Construction of Facilities

g. NASA Form 1534, Privacy Act Cover Sheet

h. KNPD 1800.2, KSC Hazard Communication Program

i. KNPR 8715.3, KSC Safety Practices Procedural Requirements

j. KNPR 1820.3, KSC Hearing Loss Prevention Program

k. KNPR 1820.4, KSC Respiratory Protection Program

l. KNPR 8500.1, KSC Environmental Requirements

m. American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents Biological Exposure Indices (BEIs)

n. ACGIH Manual on Industrial Ventilation

o. American Industrial Hygiene Association (AIHA), A Strategy for Occupational Exposure Assessment

p. American National Standards Institute (ANSI) Z9.2, Fundamentals Governing the Design and Operation of Local Exhaust Systems

q. National Institute for Occupational Safety and Health (NIOSH) Criteria for a Recommended Standard: Working in Confined Spaces

r. NIOSH, Occupational Exposure Sampling Strategy Manual

s. NIOSH, Guide to Industrial Respiratory Protection

t. NIOSH, Guide to Industrial Ventilation

u. NIOSH Manual of Analytical Methods

v. NIOSH, Recommendations for Chemical Protective Clothing A Companion to the NIOSH Pocket Guide to Chemical Hazards

**P.5 Measurement/Verification**

None

**P.6 Cancellation/Supersession**

This revision supersedes KNPR 1840.19, Rev. C-1, KSC Industrial Hygiene Program, dated November 18, 2011.

*Original signed by*_____
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Director, Center Operations

Distribution: TechDoc Library

## PROCEDURES

### Chapter 1. Responsibilities

### 1.1 Heads of Organizations

Heads of Primary Organizations and Heads of Contractor Organizations to the extent provided by their contracts shall:

a. Prepare written policies and procedures when required to implement IH Program requirements, identify, and assign IH Program responsibilities within the organization.

b. Develop and maintain written procedures for operations and equipment involving the procurement, use, exposure to, generation of, or control of occupational health hazards.

c. Ensure assessment plans, processes, and operations are reviewed to implement and maintain control measures required to prevent or otherwise reduce exposure to these hazards.

d. Ensure personnel:

(1) Are provided appropriate training and orientation to identify occupational health hazards in their work places and the protective measures required for their safety.

(2) Are notified of any changes or modifications to policies or systems used to control exposure to these hazards.

e. Comply with the provisions of FAR Supplement 1823.70 for procurement requests and statements of work issued (involving IH Program concerns).

f. Ensure Material Safety Data Sheets (MSDS) are provided to the Medical and Environmental Support Contract (MESC) MSDS Program Coordinator (KSC-DL-EnvHealth@nasa.gov)

g. Designate representatives to act as organization points of contact for IH Program business, monitor the implementation of the requirements of this KNPR in their areas, and track implementation of corrective actions to eliminate or control hazards or correct program discrepancies.

h. Ensure that any mishap, close call, injury, or illness that involves occupational health hazards is properly reported to the NASA Incident Reporting Information System.

i. Review design and modification packages for systems involving the use, storage, or processing of hazardous materials or which have the potential to expose employees to hazardous materials or physical agents, to identify required hazard controls.

j. Communicate operational hazards to other employers whose employees may be affected by the hazards.

k. Ensure that results of Health Hazard Evaluations (HHE) are provided to affected employees.

### 1.2 The KSC Industrial Hygiene Officer

KSC Industrial Hygiene Office (IHO) shall:

a. Act as liaison between KSC and federal and state regulatory agencies on IH matters.

b. Provide technical guidance to KSC organizations on IH matters.

c. Review and assess the use of toxic and hazardous substances.

d. Develop IH policies, requirements, and general practices for KSC.

e. Assist and advise the Procurement Officer in implementing the requirements of NASA FAR Supplement 1823.70 as it applies to the acquisition of toxic and hazardous substances.

f. Assist safety and operations organizations in the investigation of accidents, incidents, near misses, injuries, and illnesses that involve hazardous chemical or physical agents.

g. Monitor the implementation of this KNPR.

### 1.3 The Medical and Environmental Support Contract Industrial Hygiene Office

MESC IH Office shall:

a. Provide HHEs of operations, tasks, or procedures with the potential to expose employees to occupational health hazards as described in this KNPR.

b. Review and assess the use of Personal Protective Equipment (PPE) used to prevent exposure to occupational health hazards.

c. Provide to organization representatives, supervisors, site managers, or responsible safety and health organizations in the affected work area the following:

(1) Results of surveys and recommendations.

(2) Recommended methods for the elimination or control of occupational health hazards.

(3) Requirements for employees to participate in a medical monitoring program.

(4) Recommendations on the management of MSD related risk factors.

(5) Identified requirements for compliance with applicable Occupational Safety and Health Administration (OSHA) regulations.

d. Investigate reports of occupational exposures to health hazards reported through the KSC Occupational Health Facility (OHF).

e. Evaluate employee complaints of potential health hazards.

f. Review facility plans, projects, and operational procedures to assess the adequacy of precautions taken to control hazards.

g. Provide technical assistance in the selection and design of engineering controls and work practices, and selection of PPE.

h. Provide custody and maintenance of IH records for NASA employees employed at KSC, in accordance with the requirements of 29 CFR 1910.1020.

i. Provide technical assistance in the development of training and certification courses relating to IH matters.

j. Maintain a listing of hazardous materials and provide Center-wide access to MSDS for each hazardous material reported in accordance with KNPD 1800.2.

k. Chair the KSC IAQ Working Group and the KSC Ergonomics Working Group.

### 1.4 Civil Service and Contractor Line Management

Civil Service and Contractor Line Management shall:

a. Ensure workplace inspections are conducted and operations or procedures are reviewed to identify hazardous materials and physical agents.

b. Ensure the MSDS for materials used in the workplace are reviewed to identify health hazards, symptoms of exposure, and requirements for safe use of the material.

c. Ensure written procedures are in place for operations that require use of hazardous materials and physical agents. Written procedures shall identify the hazards and include instruction on use of required engineering, work practice controls, and required PPE.

d. Ensure employees are aware of hazardous materials and physical agents in the work area, understand the requirements for safe work with these materials and agents, and know what actions to take in an emergency (e.g. chemical spill or release).

e. Contact the NASA IHO to determine requirements for work in the following categories:

(1) Work with hazardous chemicals.

(2) Construction or demolition where regulated hazardous materials (e.g. asbestos or lead-containing paints) may be present.

(3) Work in confined spaces.

(4) Work involving employee exposure to excessive heat, vibration, or noise.

(5) Potential ergonomic hazards.

f. Coordinate the scheduling of HHEs.

g. Implement requirements identified in the HHE.

h. Ensure affected employees are provided results of HHE reports. Where reports include employee exposure monitoring data, provide the employees who are monitored with their exposure monitoring results.

i. Contact the KSC IHO or the MESC IH Office to reassess hazards when operational or process changes are made which may affect exposure levels.

j. Ensure the proper operation of engineering controls.

k. Ensure employees with signs and symptoms of exposure report to the OHF.

l. Coordinate procurements of hazardous substances and articles in accordance with the organization's hazardous materials procurement policy.

### 1.5 Safety and Health Organizations

Cognizant Safety and Health Organizations shall:

a. Inspect the workplace for potential hazards and exposures. Contact the MESC IH Office to initiate HHEs of operations in which hazards are identified. If an employee has symptoms of exposure to hazardous materials, direct the employee to the OHF.

b. Inspect work areas to ensure implementation of hazard control measures as required by OSHA or NASA regulations or otherwise required to control or eliminate employee exposure.

c. Coordinate with the KSC IHO or the MESC IH Office in instances of deviations or waivers to Technical Operating Procedures affecting health hazard control requirements.

### 1.6 Training Organizations

The Kennedy Institutional Support Services contractor or other contractor training organizations shall, to the extent provided by contract, provide required training described in this KNPR and maintain associated employee training records.

### 1.7 Employees

Employees shall:

a. Notify supervisors of areas, operations, or equipment that may be a source of chemical or physical hazards.

b. Report signs and symptoms of exposure to the supervisor and the OHF.

c. Use, maintain, and store PPE as required.

## Chapter 2. Industrial Hygiene Program

### 2.1 General

The KSC IH Program provides general direction for the recognition, evaluation, and control of workplace health hazards within the organizational and contractual responsibilities assigned at the KSC. The program includes instruction on hazard identification and risk assessment; recordkeeping and reporting; selection and use of IH monitoring equipment; engineering and administrative control measures; and the selection and use of PPE.

**2.2 Applicable Exposure Limits**

a. NASA has adopted health standards promulgated by OSHA or recommended by the ACGIH, whichever is more stringent. Additionally, NASA Headquarters may issue NASA health policy to address exposure limits.

b. In the absence of a specific OSHA, ACGIH, or NASA standard, other sources of health standards or exposure limits may be selected by the KSC IHO to include NIOSH Criteria Documents, ANSI standards, National Academy of Sciences recommendations, AIHA exposure guidelines, or chemical manufacturer exposure limits.

c. Management policies and programs shall be developed to ensure employee exposures to such materials or agents are below the applicable exposure limit(s). In addition, policies and programs will implement appropriate control measures when exposure levels exceed the "Action Level" for the hazardous material or agent of concern.

d. Where there are no published exposure criteria for hazardous materials, such as nanoparticles, control banding as described by AIHA or Control of Substances Hazardous to Health, shall be used to determine appropriate controls.

**2.3 Initial Hazard Assessment**

a. An initial hazard assessment shall be initiated whenever a potential hazard is identified as a result of:

(1) Inspection of workplaces for potential health hazards.

(2) Review of procedures or operations to identify hazardous materials or physical agents.

(3) Investigation of complaints of illness or injury that may be work-related.

(4) Employee reports of potential health hazards.

b. The organization's line management, safety committee, or Safety and Health organization, shall typically conduct this assessment.

c. The initial assessment shall involve identification and preliminary evaluation to gather data in support of the HHE conducted by the MESC IH Office.

d. Once the potential health hazard is identified, the MESC IH Office shall perform an initial assessment.

e. The initial assessment shall gather data to:

(1) Support the HHE.

(2) Control hazards in the interim.

(3) Eliminate the hazard and the need for further HHE.

f. The initial assessment consists of the following elements where applicable:

(1) Identification of the processes involved.

(2) Information gathering (e.g. review MSDSs) on the materials (chemicals).

(3) Description of the health hazard(s) present.

(4) Identification of the controls in place.

(5) Identification of any PPE in use.

(6) Description of exposure routes.

(7) Identification of exposure groups.

g. A HHE shall be conducted where there is a reasonable potential for employee exposure to hazardous material or conditions.

h. Line management organization or Safety and Health organization shall consult with the NASA IHO or the MESC IH Office to determine the need for a HHE. If it is determined that a HHE is required, it is the responsibility of the line management organization or Safety and Health organization to coordinate the HHE with the MESC IH Office and provide the information gathered during the initial assessment.

**2.4 Health Hazard Evaluation**

a. HHEs shall be performed to evaluate and document employee exposures to hazardous materials or physical agents.

b. HHEs include identification and assessment of potential chemical, biological, or physical reproductive or developmental hazards. HHEs shall comply with the minimum requirements established below:

(1) HHE sampling strategy shall be developed in accordance with recognized IH practice, e.g. use of NIOSH's “Occupational Exposure Sampling Strategy Manual” or AIHA's "A Strategy for Occupational Exposure Assessment" to provide exposure data. Personnel breathing zone measurements based on the applicable exposure limit (e.g. 8-hour Time-Weighted Average [TWA] or 15-minute TWA) will be performed and documented using the sampling strategy.

(2)When possible, employee exposure monitoring should characterize exposure for similarly exposed work groups. Representative exposure data for similarly exposed personnel shall be made available for incorporation in employee medical records.

(3) All employees monitored for exposure level shall be informed of their legal rights to their exposure records (29 CFR 1910.1020).

(4) Exposure monitoring results shall be compared to the applicable exposure standard to determine compliance.

(5) HHEs shall represent the operations as they are typically performed.

c. Follow-up HHEs shall be performed:

(1) To assess conditions after any modifications which may increase the potential for employee exposure or the implementation of hazard control measures are completed; or

(2) At intervals specified in substance specific standards identified in 29 CFR 1910 and 29 CFR 1926.

d. The name and Universal Uniform Personal Identification Code (UUPIC) of all employees monitored, as well as those other employees in the work unit with similar exposures shall be recorded during the HHE.

e. When possible, samples representing the worst case employee exposure shall be collected.

f. KSC MESC Workers Health At A Glance (WHAAG) Database

(1) The WHAAG database is designed to provide NASA, Air Force and their contractors with a quick method of viewing data from HHE, including potential health hazards, hazard control methods, air monitoring results, health hazard ratings, similar exposure group profiles, and a follow-up status of required and recommended corrective actions.

(2) Access to the WHAAG database can be gained through the NASA Account Management System (NAMS). The MESC IH office can be contacted for guidance with completing the NAMS application.

(3) Uses of the Database

(a) The database provides the ability to view individual employee exposure profiles to hazardous agents for which exposure monitoring data has been collected.

(b) Exposure profiles for similar exposure groups, considered to be representative of data collected for individual workers within the group, can be viewed.

(c) Various data fields can be queried and reports can be created.

(d) Hazards identified during the evaluation will be added to the WHAAG database. Users can update their status on completing these corrective actions and status reports can be generated.

g. Sampling Requirements

(1) All IH sampling shall be performed in accordance with the NIOSH or OSHA methodologies. The KSC IHO will approve with the selection of alternate sampling methodologies if no NIOSH or OSHA methodology exists.

(2) Sampling equipment shall be operated according to the manufacturer's specifications.

(3) Sampling pumps shall be calibrated before and after sampling usage to verify that the flow rate is within sampling specifications.

(4) After the completion of sampling, all samples shall be properly stored in appropriate containers and uniquely labeled.

(5) Field and lot blanks shall be taken in accordance with NIOSH sampling procedures.

(6) Bulk samples shall be collected in accordance with the analytical laboratory requirements.

(7) Sampling data shall be recorded on a sampling data sheet that includes the following, as applicable:

(a) Sample identification.

(b) Employee names and UUPIC.

(c) Description and location of task being performed.

(d) Monitoring instrument manufacturer, model, identification number, and calibration date.

(e) Pump pre-calibration, post-calibration, and average flow rate.

(f) Sample date, start time, and stop time.

(g) Description of PPE used.

(h) Description of factors that may affect sampling (e.g., ventilation system, weather data).

(i) Facility number, name and room number.

(j) Contaminant or agent being sampled.

(k) Sampling method used.

(l) Contact name and organization.

(m) Name of individual performing the sampling.

(8) When samples are obtained for laboratory analysis, a sample chain-of-custody document shall accompany all samples. The custody of the samples during the time period from sampling to laboratory receipt of samples must be recorded on the document.

h. Analysis Requirements

(1) Laboratories performing IH sample analysis shall be accredited by the AIHA except for the following:

(a) A laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) shall perform bulk asbestos sample analysis.

(b) Airborne fiber sampling and analytical procedures shall be by Phase Contrast Microscopy in accordance with the most current version of the NIOSH 94-113, Method 7400.

(c) Analysis shall be performed in accordance with OSHA analytical methods, NIOSH analytical methods, or, in their absence, documented standard laboratory analysis procedures.

(2) The laboratory analysis results shall be reported on a document to include the following:

(a) Laboratory name, address, phone number.

(b) AIHA certification number or NVLAP accreditation number.

(c) Sample number.

(d) Sampling date and time.

(e) Sample matrix.

(f) Parameter name and Chemical Abstract Service (CAS) number.

(g) Date samples received.

(h) Date samples analyzed.

(i) Signature of laboratory manager.

(j) Name of analyst.

(k) Lab report identification and task identification number.

(l) Analysis method and reference (e.g., OSHA or NIOSH reference), reporting limit, and limit of detection of the method.

(m) Units of measure.

(n) Itemized results for each sample number.

i. Report Requirements

(1) Upon the completion of HHEs, a report of the findings shall be issued. The following information will be included in the report:

(a) Name and organization of the person requesting the evaluation.

(b) A description of the reason for the evaluation.

(c) The location (facility name and number), date, and time of sampling performed.

(d) Any observations, including photographs of operations, employees work practices, or other actions that may contribute to employee exposure.

(e) The name, number, and description of the procedure for which the HHE was made.

(f) The names and quantities of the hazardous materials used which are evaluated in the report. Manufacturer and product names will be used when available. Where chemical substances are identified the chemical names and CAS number will be listed.

(g) The potential for employees and work groups affected by exposures to reproductive and developmental hazards shall be identified.

(h) The job classifications and task description of all employees monitored.

(i) The frequency and duration of the operation evaluated.

(j) The environmental conditions at the time of the HHE.

(k) All hazard control measures used, such as engineering controls or PPE.

(l) The name and UUPIC of employees for which exposure monitoring is performed and their determined exposure levels.

(m) The contract employer of personnel monitored.

(n) The sampling method and instrumentation used during the HHE.

(o) Identification of applicable OSHA and NASA requirements for the substances monitored, nonconforming conditions, and recommended interim and permanent corrective actions.

(2) All reports in which an employee's Social Security number is included shall be covered with NASA Form 1534, in accordance with the Privacy Act of 1974.

(3) Copies of all HHEs shall be provided to the KSC IHO.

**2.5 Instrument Selection, Calibration, and Use**

This section establishes procedures for the selection, calibration, and use of instruments utilized for monitoring of health hazards. Monitoring instruments are devices that detect the presence of hazardous materials or physical agents and provide direct measurement of their presence.

a. Instrument Selection

(1) Instruments shall be selected based on the specific hazardous material or physical agent to be monitored and the applicable monitoring requirements.

(2) User organizations shall coordinate the selection and use of real-time monitoring equipment with the NASA IHO.

(3) The user organization shall provide to the MESC IH Office the following information:

(a) The concentration range and physical state of the hazardous material or physical agent in the workplace. If the concentration range is unknown, an IH HHE should be performed (Refer to Section 2.4).

(b) The manufacturer, model, and technical specifications of the instrument.

(c) The intended use of the monitoring instruments.

(4) The MESC IH Office shall:

(a) Maintain a database of IH monitoring instruments used by KSC user organizations.

(b) Provide consultation on the selection of IH instrumentation.

b. Instrument Calibration

Instrument calibration shall be performed to verify the proper function of the instrument prior to use. The user organization will ensure the following calibration procedures are performed:

(1) Instrument calibration shall be performed either in accordance with the manufacturer's instructions or as specified by the calibration lab.

(2) The manuals and calibration procedures for the instrument shall be provided to the organization's calibration laboratory.

(3) The organization’s calibration laboratory or the instrument's manufacturer will calibrate the instrument. A calibration sticker with an expiration date will be affixed to the instrument by the calibrating organization.

(4) The calibration cycle shall be determined by the manufacturer's recommendations, or the organization's calibration laboratory.

(5) Calibration records shall be maintained by the organization's calibration laboratory and the user organization.

c. Instrument Use

Monitoring instruments shall be used in accordance with the manufacturer's instructions. The user organization will ensure the following:

(1) Operators are trained and qualified to properly operate the monitoring instruments. Operator training shall be documented in an auditable format.

(2) Instruments shall not be used beyond the calibration expiration date.

(3) The user shall perform a functional check of the instrument prior to each use in accordance with manufacturer's instructions.

**2.6 Health Hazard Controls**

a. Hazard controls are the methods used to eliminate or reduce personnel exposure to hazardous agents. Exposures to hazardous chemicals or agents in the workplace are controlled by the application of one or more of the methods listed below. Hazard controls shall be directed first toward eliminating the source of the hazard, second toward the route or path the potential hazard takes, and third toward shielding or protecting specific personnel who may be subject to exposure to the hazard.

b. General Provisions

(1) Engineering Controls - The primary method of health hazard control shall be through the application of engineering controls. Engineering controls include, but are not limited to, the following:

(a) Substitution to a less hazardous agent or process.

(b) Isolation or enclosure of an operation or process.

(c) Ventilation and air cleaning to remove or reduce air contaminant levels.

(2) Work Practices and Administrative Controls - When workplace health hazards cannot be sufficiently reduced or eliminated by engineering control methods alone, administrative controls shall be established. This includes work schedules, procedures, and practices which, when used in conjunction with engineering controls, will minimize worker exposure to hazardous agents. Administrative control measures include:

(a) The use of modified work schedules, medical removal, work limitations, or frequent rest periods to minimize worker exposures.

(b) The use of alternate work procedures that reduce exposures.

(c) Implementation of access controls or clear areas to limit the number of personnel with access to a hazardous location.

(3) PPE is used only when the combination of engineering and administrative control methods are not feasible or insufficient to reduce the hazard to safe levels or as interim control measures. The use of PPE shall not be considered a substitute for engineering

or administrative controls. PPE is intended to shield individual workers from hazardous environments that cannot be reduced or eliminated by any other control methods. PPE includes:

(a) Eye and face protection such as safety glasses, goggles, or face shields.

(b) Hearing protection (e.g., ear plugs, ear muffs).

(c) Protective clothing (e.g., gloves, aprons, boots, and coveralls).

(d) Protective creams and lotions to minimize skin contact to irritant chemicals.

(e) Respiratory protection.

## 2.7 Personal Protective Equipment

This section establishes procedures for the selection, use, and maintenance of PPE. PPE is used as a protective barrier between an individual employee and hazardous materials or agents. PPE is required when other health hazard controls, such as engineering controls, have been shown to be infeasible or inadequate in eliminating or controlling the health hazard. PPE requirements for Self-Contained Atmospheric Protective Ensemble operations are not addressed in this KNPR but may be found in KNPR 8715.3, KSC Safety Practices Procedural Requirements.

a. Selection

(1) The use of PPE is based on the specific health hazards present, the type of operation to be performed, and the level of protection provided by the PPE. The PPE selected must provide adequate protection for the employee while enabling the employee to perform the operation. PPE shall be selected and used in accordance with 29 CFR 1910 subpart I - Personal Protective Equipment.

(2) PPE requirements for operations shall be determined based upon HHE.

(3) The PPE requirements shall be incorporated into the written technical operation procedure or other applicable shop instructions.

(4) The PPE selection shall be reviewed when changes in procedures or exposure hazards might alter its effectiveness.

(5) Guidelines for selection of specific PPE for chemical protection may be found in "Recommendations for Chemical Protective Clothing - A Companion to the NIOSH Pocket Guide to Chemical Hazards" at http://www.cdc.gov/niosh/ncpc/ncpc2.html.

(6) Recommended PPE for common operations are listed in the following table:

| EYE AND FACE PROTECTION | |
|---|---|
| Hazards to Consider | Required PPE |
| Splash, splatter, and spray of chemicals or biological materials; cryogenic liquids | Chemical goggles or safety glasses with side shields covered by a full-face shield |

| | |
|---|---|
| High pressure cleaning or spraying | Safety glasses with side shields or safety glasses covered by a full-face shield |
| Power tools (air or electrical) | Safety glasses with side shields |
| Typical laboratory – chemical splash | Chemical goggles or safety glasses with side shields covered by a full-face shield |
| Acetylene welding, cutting, burning, molten metals | Cutting goggles with appropriate filter lens numbers |
| Arc welding and cutting | Welding hood with appropriate filter lens numbers |
| Chipping, drilling, grinding or machining – flying particles | Goggles, safety glasses with side shields or face shield (face shield required for heavy grinding) |
| **HAND AND ARM PROTECTION** | |
| Hazards to Consider | Required PPE |
| Skin exposure to solvents, pesticides, acids, caustic or corrosive liquids, other chemicals | Chemical resistant gloves. *See note* |
| Handle tools or materials likely to cause scrapes, cuts or bruises | Metal mesh, leather, canvas, Kevlar material or cloth gloves |
| Skin contact with hot surfaces | Oven mitts, Leather or aluminized gloves, arm protection |
| Cryogenic liquids, skin contact with cold surfaces | Cryogen mitts, leather gloves |
| Exposure to exposed high voltage electrical wiring, etc. | Electrical insulating rubber gloves per electrical safety specifications |
| Welding and cutting with exposure to hot surface or molten melts | Welding gloves, welding apron, wool or cotton clothing |
| **FOOT, LEG AND BODY PROTECTION** | |
| Hazards to Consider | Required PPE |
| Hazards to feet related to sharp or heavy objects or equipment | Metatarsal guards, toe guards, combination foot-toe guards, safety shoes |
| Splash, splatter, and spray of chemicals or biological materials | Nomex coveralls, Tyvek garment, rubberized apron, chemical splash garment, chemical resistant boots. *See note* |
| Cryogenic materials, flammable liquids and gases | Nomex coveralls |
| High voltage | Safety shoes |
| **HEAD PROTECTION** | |
| Hazards to Consider | Required PPE |
| Work under elevated work platforms, suspended loads or low overhead clearance | Hard hats |
| **HEARING PROTECTION** | |
| Hazards to Consider | Required PPE |
| Exposed to loud noise from machines, tools, etc. | Ear muffs and ear plugs,or ear plugs with sufficient noise reduction rating to lower exposure below 85 dBA. *See note* |

| RESPIRATORY PROTECTION | |
|---|---|
| Hazards to Consider | Required PPE |
| Exposure to dusts, fumes, mists, gases, vapors, smoke. | Half face or full face air-purifying respirator; Self-Contained Breathing Apparatus; Supplied-Air Respirator. *See note.* |

**Note:** Selection of chemical resistant gloves, chemical protective clothing, hearing protection, and respiratory protection devices should be coordinated with the MESC IH Office.

b. Use and Maintenance of PPE

(1) PPE shall be used and maintained in accordance with manufacturers' instructions.

(2) PPE shall be used when required by the operational procedure or applicable shop instruction.

(3) Personnel shall be trained on the use and maintenance of PPE.

(4) Maintenance and repair of respiratory protection is specified in KNPR 1820.4.

c. Decontamination of PPE

(1) All reusable protective clothing may require thorough cleaning or decontamination before the PPE can be reused. Requirements for decontamination or cleaning shall be in accordance with the manufacturer's recommendation.

(2) Contaminated disposable PPE such as splash suits, gloves, booties, etc., shall be disposed of as hazardous waste where designated as such by the KSC Waste Management Office, as defined in KNPR 8500.1.

d. Inspection of PPE

(1) Inspection of PPE shall be performed in accordance with manufacturers' instruction to ensure the integrity of the equipment.

(2) Protective clothing and gloves shall be inspected (prior to use) for leaks, imperfect seams, non uniform coating, tears, cracks, pinholes, deterioration, etc.

e. Storage of PPE

PPE shall be stored in a manner to protect PPE from damage, dust, sunlight, chemical contamination, or extreme temperatures.

### 2.8 Training

Appropriate training shall be provided to personnel who may be exposed to hazardous materials or physical agents, to the supervisors of these affected personnel, and to personnel who implement the provisions of the KSC IH Program.

a. Employees shall be trained to recognize potential health hazards and the means to protect themselves from such hazards in their workplace. This training will include:

(1) Hazard Communication Training (29 CFR 1910.1200).

(2) Instruction on the proper use and care of PPE (29 CFR 1910.132).

(3) Instruction on the proper use of engineering controls.

(4) Instruction on the proper procedures to be implemented during spills or accidents that involve hazardous material, including emergency notification.

b. Supervisors - Training for management representatives supervising operations involving health hazards should include:

(1) Regulatory and KSC requirements for health hazard control measures.

(2) Identification of potential health hazards and how to request a HHE.

(3) Procedures for reporting employee exposures, and accidents involving hazardous materials.

c. Safety Representatives or other employees delegated safety responsibility shall be capable of performing the functions of their assigned areas of responsibility. Examples include:

(1) Identification of health hazards in the work area and recognition of potential exposures.

(2) Procedures for requesting an IH evaluation for potential hazards that are identified.

(3) Procedures for reporting employee exposures, mishaps, and accidents involving hazardous materials.

(4) Use and care of required PPE.

(5) Use and care of monitoring equipment, as required.

d. IH Personnel or other employees delegated with IH responsibility shall be competent in their assigned areas of responsibility. IH personnel should be knowledgeable of applicable federal and NASA health hazard regulations and requirements and be able to recognize, evaluate, and control health hazards using standard IH procedures.

e. Training described in this section shall be reviewed by the organization safety and health program. Written comments concerning the information in the training course will be provided to the applicable, responsible training organization for review and possible incorporation into training materials.

## 2.9 Records

a. IH records are maintained to document employee exposure for future epidemiology studies, regulatory compliance verification, and exposure analysis.

b. Employee Exposure Records and IH Surveys

(1) Employee exposure records and associated IH survey reports shall be maintained for all IH activities performed at KSC in accordance with 29 CFR 1910.1020 and *the Privacy Act of 1974.*

(2) Examples of IH Surveys include facility walk through inspections, local and general ventilation surveys, illumination surveys, hazardous noise surveys, employee complaint investigations, heat stress surveys, exposure incident investigations, and emergency response reports.

(3) It is the responsibility of each employer to maintain employee exposure and survey records for their affected employees.

## Chapter 3. Special Topics

3.1 Ventilation

This section provides requirements for the design, use, and testing of local exhaust ventilation systems and laboratory hoods used to control the generation of toxic air contaminants.

a. The design specifications for the control portion (i.e. hoods, enclosures, ducts, and fans) of local exhaust ventilation systems are specified in OSHA regulations, the ACGIH Manual on Industrial Ventilation, and other consensus industry standards. Other designs may be used if they are shown to control the air contaminant hazard.

b. Use

(1) Responsible engineering and operations organizations are responsible for ensuring the proper installation, operation, and maintenance of ventilation systems to ensure that:

(a) Fans are operating and rotating in the proper direction.

(b) Fan belts are not slipping or broken.

(c) Pressure drop across filters (if present) is within operating limits.

(d) Ducts are free from leaks.

(e) There is adequate make up air for the system.

(f) Baffles (if present) are configured properly.

(g) The hood and ducts are free from debris or airflow restrictions.

(2) Where movable hoods are used, the hoods shall be placed as close as possible to the point of air contaminant generation without interfering with the work. Operators are

responsible for ensuring that movable hoods are not positioned where the hood draft pulls contaminated air through the operators breathing zone.

(3) Ventilation systems designed to control toxic air contaminants shall be tested on initial installation and at least annually to determine proper operation. The user organization is responsible for contacting the MESC IH Office to schedule evaluations of laboratory hoods and local exhaust ventilation systems. It is the responsibility of the user organization to correct any deficiencies identified in the MESC IH Laboratory Hood or Local Exhaust Ventilation System Evaluation report.

(4) Systems that meet recommended design criteria shall be affixed with a decal approving its use, the date of approval, and the date of the next scheduled evaluation.

(5) Systems that are not operating effectively and may put employees at risk of exposure shall be tagged out of service.

(6) The user organization is responsible for ensuring that employees are trained in the use of ventilation systems and are aware of the ventilation systems' capabilities and limitations.

c. Testing

(1) The MESC IH Office shall provide evaluations for all local exhaust and laboratory hood ventilation systems.

(2) Systems shall be evaluated using the recommended design criteria in the ACGIH Industrial Ventilation Manual, applicable OSHA regulations, ANSI, or other applicable consensus industry standards.

(3) The MESC IH Office shall maintain an inventory of all registered local exhaust ventilation systems and laboratory hoods and schedule all evaluations.

d. Baseline Evaluation

(1) The MESC IH Office shall perform an initial baseline evaluation of local exhaust and laboratory hood ventilation systems on notification by the engineering or user organization.

(2) The baseline evaluation shall include a characterization of the type of ventilation system, identification of the air contaminants the system is designed to control, and a description of the operation or process that generates the air contaminants.

(3) It is the responsibility of the engineering or user organization to effect repairs or redesign for systems that are not approved for use.

e. Periodic Reevaluation

(1) Local exhaust and laboratory hood ventilation systems listed in the MESC IH Office's inventory shall be reevaluated at least annually. Ventilation systems used to control high toxicity air contaminants may be tested more frequently as determined by the MESC IH Office.

(2) Local exhaust and laboratory hood ventilation system survey results shall be evaluated to determine performance degradation or changes in materials, operations, or procedures.

(3) (Systems that effectively control air contaminant hazards shall be affixed with a decal approving the system's use.

(4) Systems that do not meet minimum recommended design criteria shall be tagged out of service if the MESC IH Office determines that continued operation of the system poses a hazard to personnel.

(5) The MESC IH Office shall provide the user organization a written report with the results of the survey and recommendations for correcting identified deficiencies.

(6) It is the responsibility of the user organization to repair or replace systems that are not approved for use.

### 3.2 Facility Design and Modifications

This section defines IH facility design requirements that must be considered when performing facility design and modification tasks and assigning implementation responsibilities. The incorporation of hazard controls into the initial design or modification of any facility or process is one of the most effective methods for controlling health hazards in the workplace.

a. Requirements - Designs or modification of existing facilities or systems involving the use, storage, or processing of hazardous materials; or which have the potential to expose employees to hazardous materials or physical agents shall be coordinated with the NASA IHO or the MESC IH Office. Design packages must be submitted during the normal design review cycles (typically 30%, 60%, 90%), for review. Design packages should include the Document Release Authorization (KSC Form 21-68VS) with all available design data and task requirements. Reference NPD 8820.2, Design and Construction of Facilities. Examples of specific design applications that will be reviewed include the following:

(1) Systems or processes that involve demolition, hot work, abrasive blasting, or surface coating maintenance.

(2) Design or modification of facilities used as a welding shop, painting shop, chemical processing facility, laboratory, or photo processing area.

(3) Systems that generate excessive heat (e.g., drying ovens).

(4) Systems that generate noise levels greater than 85 decibels A-weighted scale.

(5) Design or modifications that involve asbestos containing building materials (ACBM).

(6) Design or modifications of ventilation systems used to control air contaminants.

b. Design strength

When designing new facilities or planning modifications to existing facility equipment or processes, the Design Engineer must consider the occupational health hazards involved and incorporate applicable IH hazard controls into the design.

(1) General Design Requirements - The general health hazard control methods shall be considered during facility design and modification. These include:

(a) Substitution of a less harmful material or process. Example: The use of non-asbestos insulating materials or paints that do not contain lead pigments.

(b) Isolation of an operation or process to limit personnel exposure. Example: The use of closed systems for transfer of hazardous chemicals.

(c) Barriers to reduce or eliminate the escape of hazardous chemicals or physical agents to other areas. Example: Use of sound absorbing barriers to attenuate noise transmission.

(d) Ventilation systems to remove or reduce the air contaminant levels. Example: Laboratory hoods, welding exhaust systems, etc.

(2) Specific Design Requirements - Design requirements identified in the following sources shall be referenced for facility design and modification specifications:

(a) Illumination systems shall meet the design criteria listed in the "Illuminating Engineering Society Lighting Handbook," or other consensus industry standards for workplace illumination.

(b) Equipment or operations that generate hazardous noise shall incorporate hazard controls to reduce noise levels in accordance with KNPR 1820.3, KSC Hearing Loss Prevention Program.

(c) Asbestos abatement project design shall be conducted in accordance with the Class I, II, III, or IV Methods of Compliance as required by 29 CFR 1926.1101, 40 CFR 61 Subpart M, 49 CFR 171, 49 CFR 172, Florida Administrative Code (FAC) Chapter 62-257, and Florida Statute (FS) Chapter 469.

(d) Ventilation systems shall be designed in accordance with best practices described in OSHA regulations, the ACGIH Industrial Ventilation Manual, or other consensus industry standards.

### 3.3 KSC Asbestos Management Program

This section implements 29 CFR 1910.1001, 29 CFR 1926.1101 (Asbestos), 40 CFR part 61, 40 CFR part 763, FAC, Rule 61E1-2, Asbestos Consultant Examination, and FS Chapter.469, Asbestos Abatement. The requirements of 29 CFR 1910.1001 apply to all occupational exposure to asbestos, except as provided in 29 CFR 1910.1001, paragraph (a)(2). All construction work excluded from coverage in the general industry standard for asbestos by 29 CFR 1910.1001, paragraph (a)(2), is covered by 29 CFR 1926.1101. Special attention should be paid to the scope and application paragraph of the construction standard (the preface of the standard) as most asbestos abatement activities performed at KSC are covered within the construction standard.

a. Material Identification

A list of suspect asbestos containing materials is provided in Appendix D. These materials must be assumed to contain asbestos or tested prior to performing maintenance, renovation or demolition activities at KSC. Sampling and analysis of bulk asbestos materials shall be under the direction of a Florida licensed Asbestos Consultant.

b. Asbestos Management Information System (AMIS)

(1) The AMIS database is provided to facility managers, system engineers, work-site supervisors and employees to obtain information for use in the performance of their various tasks. The KSC AMIS is an on-line index of identified ACBM in NASA KSC and CCAFS facilities that includes digital images of the ACBM and a hazard assessment associated with areas or rooms containing friable asbestos.

(2) Uses and Limitations of AMIS

(a) Material quantities and room dimensions are based on estimated values determined by the facility inspector at the time of the inspection, and the room configuration at the time of the survey.

(b) Sampling was performed on a non-destructive basis that may result in additional materials being found during facility renovations.

(c) The AMIS database does not include any roofing materials or other exterior building materials such as window caulking.

(d) The AMIS does not include any facilities built after 1986. While the use of ACBMs was discontinued after this date, some ACBMs like roof sealants and mastics may still be encountered.

(e) The AMIS does not include comprehensive survey data on trailers used for temporary housing.

(f) Printouts of the inspection should be used for planning purposes only. All survey information should be verified as accurate and complete at the time facility or system modifications actually occur. Send questions or comments to the MESC IH Office.

(3) Facility survey data is located on the KSC home page at http://amis.ksc.nasa.gov. To use the AMIS, select the Asbestos Survey Data option and enter a facility number to review and print specific room survey information.

c. Material Labels and Warning Signs

The MESC IH Office shall assist the workplace supervisor or facility manager in identifying the appropriate locations to post warning signs and labeling of ACBMs.

d. Ceiling Access Guidelines

There is potential for asbestos debris contamination above false ceilings. Due to the potential for personnel exposure to ACBM and possible facility contamination during entry

into above ceiling areas, all unnecessary activities involving the removal of ceiling tiles should be avoided. Where work above drop ceilings requires the removal of ceiling tiles an organization should develop and use specific guidelines that minimize the likelihood for any ACBM being disturbed in the above ceiling area and ensure compliance with OSHA asbestos regulations. As part of those guidelines the KSC AMIS should be reviewed by the organization required to perform the work for the presence of ACBM. Above Ceiling Access Guidelines are provided in Appendix E.

e. Employee Training and Licensure

(1) Asbestos Awareness training in compliance with the OSHA Hazard Communication, Asbestos in General Industry and Asbestos in Construction should be provided to employees as required.

(2) Employers shall provide maintenance and custodial personnel asbestos awareness training in accordance with the requirements of 29 CFR 1910.1001(j) or 29 CFR 1926.1101(k).

(3) All personnel who conduct activities that involve the identified asbestos disciplines, to include inspector, management planner, worker, supervisor, project designer, and project monitor shall receive initial and annual refresher training as specified in 40 CFR part 763 Model Accreditation Program, and FAC, Rule 61E1-2.

(4) All employers performing asbestos abatement shall be licensed as specified in 469 FS Chapter..

(5) All personnel performing asbestos consulting services to include inspector, management planner, project designer, and project monitor shall work under a Licensed Florida Asbestos Consultant as specified in FS. Chapter. 469.

f. Employee Medical Surveillance

The KSC MESC contractor shall provide asbestos worker medical examinations to KSC civil service and resident contractor employees, to the extent provided by contract, in accordance with the requirements of 29 CFR 1910.1001(l) or 29 CFR 1926.1101(m).

g. Operations and Maintenance Activities

(1) Operations and maintenance activities shall be conducted in accordance with the Class I, II, III, or IV Methods of Compliance as required by 29 CFR 1926.1101, 40 CFR 61 Subpart M, and FS Chapter. 469.

(2) Periodic Facility Condition Assessments are performed by Institutional Services Contract (ISC) in accordance with the ISC Asbestos Management and Operations Plan (ENG-P-0022) to periodically inspect the condition of identified ACBM and implement operations and maintenance actions as needed to maintain the ACBM in good, undamaged condition.

h. Employee Notification

It is the responsibility of the operations or the responsible construction management to notify facility managers of abatement operations. Facility managers are responsible for forwarding notifications of asbestos abatement to facility tenant management points of contact, as required (29 CFR 1926.1101(d) and 29 CFR 1910.1001(j).

(1) Notification shall be provided to the manager of the facility in which the operation takes place, the MESC IH Office, the Fire Department, and the affected safety and health organization.

(2) Notification shall include:

(a) Estimated start date and times.

(b) Facility number and name.

(c) Work location or room number.

(d) Project Identification Number.

(e) Contact name and phone number (construction management point of contact).

(f) Brief description of work or operation to be conducted.

(3) Notices shall be posted at the point of operation.

(4) Placards, signs, or other notices shall be posted by the operations or responsible construction management organization at the perimeter of regulated areas. Posting will be in a location visible to other employees who work in the vicinity of the abatement operation. In addition to posting requirements identified in 29 CFR 1926.1101, the notice will identify the type of work in progress, Project Identification Number, and provide the name and phone number of a management representative point of contact for project information and for notification in the event of an emergency.

(5) Class I Abatement Operations

In addition to the above, Facility Managers shall provide notice of all Class I abatement operations in Space hardware processing areas in the Kennedy Integrated Control Schedule 72-hour scheduling and notification system.

i. PPE

The use of PPE shall be as necessary to comply with the requirements of 29 CFR 1926.1101(j) or 29 CFR 1910.1001(h).

j. Waste Disposal

(1) All asbestos waste shall be disposed of in accordance with 40 CFR part 61 and KNPR 8500.1 KSC Environmental Requirements and handled in accordance with provisions established in 29 CFR 1926.1101, 29 CFR 1910.1001.

(2) Friable asbestos waste shall not be disposed of in the KSC landfill.

(3) Asbestos waste shall not be disposed of in any unauthorized waste container or location.

k. Emergency and Mishap Procedures

(1) A written emergency and mishap procedure is required for each abatement operation. The procedure shall identify steps to take in the event of any emergency that takes place as part of any hazardous asbestos abatement operation in accordance with the requirements of KNPR 8715.3.

(2) The Emergency Procedure Document (EPD) shall:

(a) Ensure engineering controls and access barriers into the affected area remain in place or have been installed to ensure the safety of bystander employees.

(b) Ensure notification of the MESC IH Office of the emergency incident at 867-2400 or 853-5211 after 1600 hours Monday-Friday, the safety and health organization, and appropriate Contracting Officer (CO) representative (fixed price contracts).

(3) The operations organization is responsible for coordinating corrective actions not addressed in the EPD with the MESC IH Office.

l. Project Management

(1) Design

When a project involving the modification or demolition of a facility is proposed the project initiator must consider the potential hazards associated with ACBM. It is the responsibility of the project designer to determine the presence of ACBM and the need for its disturbance, or removal of, in determining the project scope. The project designer is responsible for ensuring the locations and quantities of identified ACBMs are included in any statement of work or other work control package provided to fixed-price or resident contractor organizations who will be performing asbestos abatement or whose work has the potential to disturb known ACBM. If assistance is needed in performing these aforementioned tasks, contact the MESC IH Office.

(2) Design Review

When the presence of ACBM has been determined to be within the scope of work of a project, either through use of the KSC Asbestos and Hazardous Metals/Polychlorinated Biphenyls Survey Database or through direct bulk sampling activities, the project designer is responsible for coordinating the review and approval of the design package with the MESC IH Office.

m. Written Compliance Plans

(1) Each fixed-price asbestos abatement contract is required to submit a written asbestos abatement plan that describes their implementation of the requirements of 29 CFR 1926.1101. It is the responsibility of the contracting organization to provide the

asbestos abatement plan to the MESC IH Office for review and concurrence prior to the start of the project.

(2) Each resident contractor performing in-house facility operations and maintenance is required to have a written policy that describes their implementation of the requirements of 29 CFR 1926.1101.

n. Project Monitoring

(1) Each fixed-price asbestos abatement contractor and resident contractors performing asbestos abatement operations as part of in-house facility operations and maintenance activities is responsible for ensuring project monitoring in accordance with the applicable requirements of 29 CFR 1926.1101.

(2) Pre-Work Asbestos Abatement Inspection

The MESC IH Office is responsible for conducting all pre-abatement workplace inspections for resident contractor work involving the establishment of regulated areas related to asbestos abatement. Asbestos abatement work shall not begin until the MESC IH Office successfully completes a KSC Form 28-1230, Environmental Health Asbestos Abatement Pre-Work Inspection Checklist.

(3) Final Asbestos Abatement Clearance Inspection

The MESC IH Office is responsible for final asbestos abatement clearance inspection for resident contractor work prior to the opening of a regulated area for normal occupancy following an asbestos abatement activity. A regulated area shall not be opened until the MESC IH Office successfully completes a KSC Form 28-1231, Environmental Health Asbestos Abatement Clearance Inspection Checklist.

### 3.4 Hazardous Paints and Protective Coating

This section implements the requirements of 29 CFR 1910.1025, 1910.1027, 1926.62, 1926.1126, and 1926.1127, as they apply to general industry and construction operations. These provisions apply to occupational exposure to lead, chromium, cadmium and other metals that may be encountered during the demolition, maintenance, and repair of structures where protective coatings containing these metals pose a hazard to personnel and the environment.

a. All paints and protective coatings containing hazardous metals shall be handled in accordance with the requirements of this section.

(1) Sampling and analysis of paints and protective coatings shall be conducted as a part of the design phase of the demolition, maintenance, or repair project. Sampling and analysis is the responsibility of the organization planning the project, or the operations and maintenance organization prior to performing operations and maintenance work.

(2) Where MSDS for paints and protective coatings are available and indicate the presence of hazardous metals, sampling is not required.

(3) Where the presence of hazardous metals is not determined prior to work, hazardous metals shall be assumed to be present.

b. Analysis results or MSDSs information shall be provided to the employer organization performing the corrosion control work.

(1) Where work shall be competed for award to a fixed price contractor, the results of the sampling and analysis will be provided with the statement of work.

(2) Where work shall be performed by a KSC tenant organization, the results of the sampling and analysis will be provided to the tenant safety and health organization.

c. Bulk samples shall be collected, as shown in the following table, to characterize each homogenous area of protective coating. Sample locations will be randomly selected.

| Surface Area, Square feet | Number of samples |
|---|---|
| < 1000 | Minimum of 3 |
| 1000 – 5000 | Minimum of 5 |
| 5000 – 10000 | Minimum of 7 |
| > 10000 | Minimum of 9 |

d. Bulk samples shall be taken in accordance with methods described in American Society for Testing and Materials (ASTM) E1729-99, 'Standard Practice for Field Collection of Dried Paint Samples for Lead Determination by Atomic Spectrometry Techniques.'

e. The analysis shall report the total hazardous metal content of the sample.

f. Safety and Health Plan

(1) A written Safety and Health Plan is required for each tenant or construction contractor that describes the implementation of measures required for compliance with applicable OSHA requirements.

(2) It is the responsibility of the Contracting Officer's Technical Representative (COTR) to provide a copy of the plan to the MESC IH Office prior to the start of the project. (See 3.11.c (1))

g. Notification

It is the responsibility of the operations or the responsible construction management to notify facility managers of hazardous operations requiring establishment of regulated areas when required by 29 CFR 1910. Facility managers are responsible for forwarding notifications to facility tenant management points of contact and the MESC IH Office.

(1) Notification shall include:

(a) Estimated start date and times.

(b) Facility number and name.

(c) Work location.

(d) Project Identification Number.

(e) Contact Name and Phone Number (Construction Management Point of Contact).

(f) Brief description of work or operation to be conducted.

(2) In addition to the above, Facility Managers shall provide notice of regulated areas in space hardware processing areas in the Kennedy Integrated Control Schedule 72-hour scheduling and notification system.

(3) Where a regulated control area is established, placards, signs, or other notices shall be posted by the operations or responsible construction management organization at the perimeter of regulated areas. Posting will be in a location visible to other employees who work in the vicinity of the operation. In addition to the applicable posting requirements of 29 CFR 1910.1025, 1910.26, 1910.1027, 1926.62, 1926.1126, or 1926.1127, the notice will identify the type of work in progress, Project Identification Number, and provide the name and phone number of a management representative point of contact for project information and for notification in the event of an emergency.

h. Waste Disposal

All waste streams shall be disposed of in accordance with KNPR 8500.1 KSC Environmental Requirements.

### 3.5 Confined Space Program

This section establishes the requirements and procedures for a program to manage the entry into and work within confined spaces and controlled access areas at the KSC.

a. General

(1) Confined spaces are spaces large enough and configured to allow an employee to bodily enter and perform assigned work; has limited or restricted means for exit; and is not designed for continuous employee occupancy.

(2) Work spaces not meeting the definition of confined space, but containing hazards that must be controlled prior to entry shall be classified as a controlled access area.

(3) All operations and activities (including construction) requiring entry into a confined space shall require implementation of this section and the applicable requirements of 29 CFR 1910.146, 1910.268, 1910.269, 1926, or 1915.

(4) All confined spaces, regardless of type or designation, shall require an entry authorization document identifying hazardous conditions and entry requirements.

b. Atmospheric Monitoring

Atmospheric monitoring is a requirement of the pre-entry assessment where air contaminants may be present. Continuous monitoring is required where the authorized entrants shall be working when the employer allows entry without pre-entry determination of acceptable entry conditions and where isolation of the work area from contaminant sources

is infeasible because the space is large or part of a continuous system such as a sewer system.

c. Confined Space Entry Program Plan

(1) Each contractor whose scope of work requires entry into and work in confined spaces shall have a Confined Space Entry Program Plan that implements the requirements of (29 CFR 1910.146, 1910.268, and 1910.269), this KNPR, and KNPR 8715.3 KSC Safety Practices Procedural Requirements.

(2) Where a contractor acts as a controlling employer with operational control over the permit space during multiple employer entry, the plan shall incorporate procedures to coordinate entry operations (for example, hazardous operations, required PPE, employee training, rescue, emergency services, and all other aspects of the entry requiring coordination) with each entrant's employer.

d. Confined Space Hazard Evaluation (CSHE)

(1) The CSHE process and program implementation is designed to provide interaction of relevant disciplines to develop and facilitate a thorough hazard evaluation of the confined spaces.

(2) It is the responsibility of the organization that controls access to the confined space to initiate the CSHE described in this section.

(3) The user organization shall perform an assessment of assigned work areas to identify potential confined spaces and complete a CSHE form (KSC Form 28-750) for each space and submit it to the MESC IH Office. Any change in the hazards associated with the confined space or operations requires reevaluation of entry requirements.

(4) Payload customers are required to submit a confined space hazard assessment using KSC Form 28-1113, Payload Confined Space Hazard Assessment, per the Launch Site Support Plan requirement, at least 30 days prior to the arrival of the spacecraft or other flight hardware at KSC. The user organization shall submit the completed Payload Confined Space Hazard Assessment form to the Launch Site Support Engineer. The responsible NASA Safety Office is responsible for coordinating the assessment, and any requests for reclassification or additional hazard evaluation with MESC IH Office, and Fire and Rescue.

When processing operations require entry into and work in confined spaces, the payload customers are also required to include a confined space entry program plan consistent with the requirements of this KNPR. Where appropriate, the confined space entry program plan shall manage integration of flight hardware elements that introduce hazards that affect the overall confined space hazard assessment and subsequent processing operations.

(5) The user organization is responsible for developing and coordinating the CSHE with the organization safety and health office, MESC IH Office, and Fire and Rescue. The user organization shall ensure that a safety representative from the user organization will be present during the requested CSHE. Other affected shop management and

personnel, organization operations and engineering may participate as required to identify:

(a) Hazards within or near the space.

(b) Hazards associated with the operations in the space.

(c) Hazard controls.

(d) Entry requirements and procedures.

(e) Emergency rescue requirements.

(6) Upon user organization request, the MESC IH Office will email the DRAFT CSHE Report to the user's Safety Office for review and approval prior to final report release.

(7) The MESC IH Office shall issue a CSHE report that identifies:

(a) The representatives who participated in the evaluation.

(b) Provide a description of the confined space.

(c) The operation(s) requiring personnel entry into the space.

(d) Any atmospheric or physical hazards and the monitoring requirements and hazard controls.

(e) The health and safety hazards in the space associated with the operations performed in the space.

(f) Any hazardous commodities stored in the space.

(g) Requirements for atmospheric testing for entry including required periodic or continuous monitoring.

(h) Requirements for employee training and certification, including medical certification, respirator use, etc.

(i) Requirements for PPE, including respiratory protection, to be used while working in the space.

(j) Special requirements such as method of entry, standby personnel, communications, access control, or emergency response.

(k) Applicable alternate entry procedures.

(l) Any recommendations necessary to ensure a safe authorized entry (i.e. additional hazard controls, special equipment).

(8) The MESC IH Office is responsible for maintaining a record of all confined space hazard assessment reports and maintaining the Confined Space Inventory.

(9) The MESC IH Office is responsible for adding CSHE Reports to the KSC Confined Space Inventory Website.

(10) The Fire Services is responsible for developing and maintaining the confined space rescue plans and providing rescue and emergency services in accordance with 29 CFR 1910.146(k) based on the confined space emergency rescue requirements identified in the CSHE.

(11) The user organization is responsible for internal implementation of the entry requirements identified in the summary report and communicating them to their subcontractors.

(12) A change in the hazards associated with the confined space or operations requires reevaluation of entry requirements. Requests for reclassification or additional hazard evaluation are submitted by the user safety and health organization to the MESC IH Office following the same procedures as the initial CSHE. Submittals include:

(a) Specific reference to the previous CSHE Report document.

(b) A review of permits and activities in the space since the previous evaluation.

(c) Specific reasons for and data to support a reclassification.

(d) An outline of proposed operation(s) and associated hazards (KSC Form 28-750).

e. Confined Space Permit System

The Confined Space Entry Permit and Authorization (KSC Form 16-287) is a written authorization that identifies and documents all conditions that must be met to ensure safe entry into confined spaces. This permit system is established to meet the requirement of 29 CFR 1910.146(c). Specific provisions for each permit shall be based on the results of the CSHE or hazard assessment performed at the time of entry.

(1) Entry into the following confined spaces shall require the completion, posting and cancellation of KSC Form 16-287:

(a) Permit Required Confined Space.

(b) Alternate Procedures Permit Space.

(c) Telecommunications Confined Space.

(d) Electrical Power Confined Space.

(2) A written work-authorizing document that specifies entry requirements of the CSHE may be used in lieu of the KSC Form 16-287.

(3) Where employees of more than one employer are required to work simultaneously as authorized entrants in a permit-required confined space, entry shall be under an integrated work-authorizing document approved by each employer’s safety

representative in accordance with the requirements for Hazardous Technical Operating Procedures described in KNPR 8715.3.

(4) Entry into designated non-permit confined spaces shall require written authorization that includes the date, the location of the space, operations in compliance with the CSHE, and the signature of the person authorizing entry. This authorization, documented on KSC Form 16-287 or equivalent work-authorizing document, is to be available to an entrant and a copy retained by the user organization.

(5) The user organization is responsible for retaining the canceled permits for at least one year, reviewing the permits annually, and revising the Confined Space Program as necessary to ensure that employees participating in confined space entries are protected from confined space hazards.

(6) Entry into a confined space that has not had a CSHE by the user organization is restricted to the following conditions:

(a) A KSC Form 16-287 shall be used to control work in the space pending issuance of a Confined Space Hazard Assessment Report.

(b) The user organization is responsible for coordinating completion of the KSC Form 16-287 with the organization safety and health office.

f. Prior to entry into a confined space the user organization ensures:

(1) The hazard controls and procedures of the entry plan documented in the CSHE are implemented.

(2) The confined space is tested for the atmospheric hazards identified in the space. Atmospheric testing is performed by personnel trained and certified by the user organization to perform the testing (section g. below) or MESC IH Office.

(3) Entry supervisors, entrants, and entry attendants have required training and certification.

(4) Entry supervisor has conducted a pre-task safety briefing for entrants and attendants to understand the hazards and requirements for the entry.

(5) The permit is signed by the entry supervisor to authorize entry.

(6) The permit is made available, at the time of the entry, to all authorized entrants, by posting it at the entry portal or by any other equally effective means so that the entrants can confirm that pre-entry preparations have been completed.

(7) Coordination with Fire and Rescue when required.

(8) The entry shall be terminated when the task covered by the entry permit is complete or if a condition arises which is not allowed under the permit.

g. Confined Space Training

(1) General Confined Space Entry Training (QG-103 or equivalent) is the minimum training required for all entrants, attendants, and entry supervisors entering confined spaces, with the exception of designated non-permit confined spaces and controlled access areas.

(2) Training content shall include elements identified in the applicable standards (29 CFR 1910.146 and 1910.268 or 1910.269).

(3) Additional training (e.g. fall protection, respirator user) to address specific hazards associated with confined space entry operations may be required by the user organization.

(4) Required training for entrants into non-permit confined spaces and controlled access areas shall be identified on the CSHE Report.

(5) The user organization shall be responsible for implementing an on-the-job training (OJT) package for the user organization's confined space entrants, attendants and entrant supervisors.

(6) The user organization is responsible for ensuring that personnel conducting atmospheric testing for entry into confined space receive training in the operation and care of testing equipment, interpretation of data, standards to be met, and procedures to follow when anomalies are determined.

(7) The MESC Occupational Medicine Office shall provide medical clearance when required for confined space training.

(8) The entry supervisor is responsible for ensuring that the confined space entrants meet the necessary training requirements for work in the space prior to authorizing the confined space entry.

### 3.6 Heat Illness Prevention Program

This section describes general policy for conducting heat stress hazard assessments and prevention of heat illness. These provisions apply to operations involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, strenuous physical activities, or activities requiring use of semi-permeable or impermeable protective clothing which are likely to cause heat stress among exposed workers.

a. Heat Exposure Guidelines

Guidelines for performing heat illness hazard assessments shall be based on the ACGIH publication, TLVs for Chemical Substances and Physical Agents, and BEIs.

b. Heat Illness Hazard Assessments

Heat illness hazard assessments shall include a background description of the operations or processes identified in the assessment, work-site interviews of employees performing the work, a work load assessment, and environmental monitoring measurements.

(1) Background – The operation description shall include the name, procedure number, or other identification; a brief description of the operation or procedure; the location(s) where the work is performed; duration and frequency; and a description of any work practices, engineering control measures, PPE provided, or break areas to provide for rest or protection from heat.

(2) Work-Site Interviews – Employee interviews shall be conducted to determine what heat stress problems have been experienced, any work practices or other measures taken to minimize heat stress; and any training or other information on heat stress provided to employees.

(3) Work Load Assessment – A metabolic work load assessment will be used to determine the work load category of each job being assessed. Guidelines for performing workload assessments are found in the ACGIH TLVs for Chemical Substances and Physical Agents and BEIs.

(4) The heat illness hazard assessment shall be based on the screening criteria for heat stress exposures for acclimated and un-acclimated employees published in the ACGIH TLVs.

c. Environmental Monitoring Measurements.

(1) The Wet Bulb Globe Temperature (WBGT) shall be measured using direct-reading portable heat stress meters or monitors and be calculated using the appropriate formula in ACGIH TLVs & BEIs publication.

(2) The MESC IH Office is responsible for measurement and posting of WBGT measurements and notification to the heat stress hazard website, http://mesc.ksc.nasa.gov/EnvironmentalHealthServices/HeatStress/Default.html, of affected operations organizations during the warm weather months (normally May through September) of each year.

d. Reports

Upon the completion of HHEs, a report of the findings shall be issued. The report format will be in accordance with that described in paragraph 2.4(i) of this KNPR.

e. Recommended Control Measures

When the heat illness hazard assessment identifies heat exposures in excess of those recommended by the ACGIH, an appropriate combination of acclimatization and fluid management, engineering control measures, administrative controls and work practices, and use of PPE shall be used to reduce risk of heat illness.

f. Hazardous Operating Procedures

A written policy or hazardous operating procedure is required for any work of more than one-hour duration requiring the use of semi-permeable or impermeable protective garments at ambient temperatures of more than 80 degrees Fahrenheit or for any other operation where required by a heat illness hazard assessment. Hazardous operating procedures shall be in accordance with the KNPR 8715.3, KSC Safety Practices Procedural Requirements.

g. Acclimatization and Fluid Management

(1) Acclimatization is acquired through performance at a specified workload under ambient environmental conditions over several days. Contact the MESC IH Office for recommended acclimatization schedules.

(2) Fluid Replacement – Ample supplies of cool water or other appropriate liquid should be readily available at the work-site. Employees should be provided frequent breaks to drink fluids.

h. Engineering Controls

Feasible engineering control measures should be considered as a primary means for controlling heat illness hazards. The heat illness hazard assessment shall identify operations where implementation of engineering control measures (in conjunction with other control measures) is appropriate. Examples of effective engineering controls include:

(1) Use of power assists and tools that reduce the physical demands placed on a worker.

(2) General ventilation (generally cooler air that is brought in from the outside).

(3) Air-conditioning where feasible.

(4) Cooling fans. Because this method does not actually cool the air, any increases in air speed must impact the worker directly to be effective.

**Note:** Use of cooling fans is not appropriate in some conditions. 1) If the dry bulb temperature is higher than 35°C (95°F), the hot air passing over the skin can actually make the worker hotter. 2) When the temperature exceeds 35°C and the relative humidity is 100%, air movement will make the worker hotter. 3) Increases in air speed have no effect on the body temperature of workers wearing vapor-barrier clothing.

(5) Shaded work areas.

(6) Heat shields and insulation of hot surfaces in the workplace.

i. Administrative Controls and Work Practices

Examples of effective administrative and work practice controls include:

(1) Scheduling hot jobs for the cooler part of the day.

(2) Scheduling routine maintenance and repair work in hot areas for the cooler seasons of the year.

(3) Reducing the physical demands of work, e.g., excessive lifting or digging with heavy objects.

(4) Providing cool rest areas.

(5) Using intermittent rest periods with water breaks.

(6) Using relief workers.

(7) Using worker pacing.

(8) Assigning extra workers and limiting worker occupancy, or the number of workers present, especially in confined or enclosed spaces.

j. PPE

Certain types of PPE may be effective in preventing heat related illnesses when used in combination with other control measures. These include:

(1) Commercially available cooling vests.

(2) Reflective Clothing.

(3) Water-cooled garments.

(4) Circulating air personal cooling systems, such as vortex coolers.

k. Worker Monitoring Programs.

A monitoring program may be required under extraordinary conditions such as wearing semi-permeable or impermeable clothing or working at extreme metabolic loads. Monitoring may be done by checking the heart rate, recovery heart rate, body temperature, or extent of body water loss. MESC IH Office shall determine appropriate worker monitoring requirements based on the heat illness hazard assessment.

l. Training

(1) Employers shall ensure that heat stress awareness is provided for employees who:

(a) Perform work outdoors or in un-insulated shops and equipment sheds;

(b) Work around radiant heat sources;

(c) Wear semi-permeable or impermeable protective clothing when required to perform assigned work.

(2) Determination of requirement for heat stress awareness training shall be made as a part of the Heat Illness Hazard Assessment report. The MESC IH Office can provide assistance with this type of awareness training, when needed.

**3.7 MSD Management Program**

This Section establishes the MSD management program at KSC. The support services described in this section are available to all Civil Service organizations and NASA contractor organizations as defined in their respective contracts.

MSDs constitute one of the most significant preventable causes of employee lost time injuries and illnesses. These injuries and illnesses are caused by irritation and inflammation to the muscles, tendons, and peripheral nerves and are associated with performing common everyday tasks, either in the workplace or at home.

a. Signs and Symptoms of Common MSDs

(1) Exposure to MSD risk factors can cause irritation and inflammation of muscles, joints, and tendons. Redness, swelling, and restricted movement are common signs of MSDs. Symptoms of MSDs can include persistent numbness, tingling sensations, pain, aches, or burning sensations. There are other causes of these signs and symptoms that may be unrelated to MSD risk factors. These may be of serious nature and should be further investigated by a physician.

(2) Table of Common MSDs

| | |
|---|---|
| Carpal Tunnel Syndrome | A disorder associated with chronic compression of the median nerve where it passes through the carpal tunnel of the wrist. |
| Cubital Tunnel Syndrome | A disorder associated with irritation of the ulnar nerve where it passes over the elbow. |
| Tendonitis | A general term given to irritation and inflammation of a tendon. |
| Epicondylitis | A term used to describe forms of tendonitis associated with the elbow and forearm. |
| Stenosing Tenosynovitis | A disorder that occurs when the tendon surface does not move smoothly over the tendon sheath due to inflammation that constricts the movement of the tendon. |
| Synovitis | An inflammation of the bursae (fluid filled sacs that act to cushion movement) that is in the shoulder, elbow and knee. |
| Ganglion Cyst | A swelling caused by accumulation of fluid in a tendon sheath. |
| Thoracic Outlet Syndrome | A disorder caused by compression of the nerves and blood vessels between the neck and shoulder. |
| Raynaud's Syndrome | A disorder caused by the constriction of blood flow to the hands and fingers. It is most commonly associated with the use of vibrating tools. |
| Vibration Trauma | A disorder of the lower back that has been associated with whole-body vibration. |

b. MSD Risk Factors

(1) Force – Tasks or motions that require the application of higher force place higher mechanical loads on muscles, tendons, ligaments, and joints and may cause muscles to fatigue more quickly.

(2) Repetition – When motions are repeated frequently (e.g., every few seconds) for prolonged periods such as several hours or an entire work shift, fatigue and strain of the muscle and tendons can occur because there may be inadequate time for recovery.

Repetition often involves the use of only a few muscles and body parts, which can become extremely fatigued even though the rest of the body is unaffected.

(3) Awkward or static postures – Awkward postures often are significant contributors to MSDs because they increase the exertion and the muscle force that is required to accomplish the task, and compress soft tissues like nerves, tendons, and blood vessels. Prolonged sitting and standing (a form of static posture) are also risk factors for MSDs.

(4) Contact stress – Contact stress commonly affects the soft tissue on the fingers, palms, wrists, forearms, thighs, shins and feet. This contact may create pressure over a small area of the body (e.g., wrist, forearm) that can inhibit blood flow, tendon and muscle movement and nerve function.

(5) Vibration – Hand-arm and whole body vibration can contribute to MSDs. Vibrating hand tools transmit vibrations to the operator and, depending on the level of the vibration and duration of exposure, may contribute to the occurrence of circulatory disorders. Whole-body vibration has been associated with back injury.

(6) Cold – Cold temperature is also a risk factor because it could require workers to increase the force necessary to perform their jobs (such as having to grip a tool more tightly).

(7) Pre-existing injury or illness – Certain injuries or illnesses that affect the musculoskeletal system, circulation, etc. may place affected employees at greater risk of a work-related MSD or aggravation of the existing condition.

c. MSD Hazard Assessment and Corrective Actions

Work area supervisors are responsible for completing a Job Hazard Analysis (JHA) for the following:

(1) Each office job where employees use a computer workstation for more than 4 hours a day.

(2) Non-office tasks (processing areas, shops, and labs) with possible ergonomic risk factors.

(3) Jobs where employees complain of work-related MSD signs or symptoms.

(4) Where work-related MSD injuries have occurred.

Examples of ergonomic risk factors and recommendations to be considered when completing JHAs for ergonomic hazards are listed in Appendix C, Table 1 and Table 2. The employer can also use the information provided in MESC IH Office's MSD Hazard Assessment (ergonomic evaluation) in completing a JHA. NASA employees should use the Job Hazard Analysis Form KDP-KSC-F-3242.

d. JHAs shall be reviewed annually with affected employees.

e. In the event that an employee reports persistent signs or symptoms of a possible MSD, or aggravation of a pre-existing medical condition, the employee's supervisor is responsible

for ensuring that the employee report to a KSC clinic for medical evaluation. On evaluation, the physician shall determine the necessity for the MESC IH Office to conduct a MSD Hazard Assessment.

f. The MSD Hazard Assessment shall identify ergonomic risk factors and provide recommendations on minimizing or abating those risk factors. A written report will be provided to the employee's employer, MESC Medical, and the NASA IHO.

g. The work area supervisor is responsible for abatement of MSD hazards identified in the MSD hazard assessment.

h. Employees shall be given the opportunity to participate in the identification and implementation of workstation changes and other corrective actions required to eliminate or control identified MSD hazards.

i. The MESC IH Office shall contact evaluated employees approximately 3 months following their MSD Hazard Assessment (ergonomic evaluation) to determine if symptoms have subsided and if recommendations provided in the written report were implemented.

j. The MESC IH Office shall provide consultation services on request from health and safety offices to assist in identifying appropriate workstation adjustments, accessories, ergonomic furniture, tools, or work practices required to abate or minimize identified hazards.

k. NASA employees who are office workers are required to complete office ergonomics training (KSC Office Ergonomics KSC-005-07).

l. Reporting of MSDs and Medical Assessment

(1) Employees shall report MSD signs and symptoms to their supervisors.

(2) Employees who report persistent MSD signs or symptoms shall report to the OHF for medical assessment. Persistent signs or symptoms, which last for days or weeks, may worsen over time if not treated.

(3) The examining physician shall provide a written opinion of the initial assessment and make employee referrals to a local medical provider, the KSC RehabWorks program, and the MESC IH Office as required.

(4) The physician's written opinion shall be on the KSC Form 6-2, Initial Record of Injury/Illness or the 16-261, KSC Medical Disposition. A copy will be provided to the employee, the safety office, and the employee's supervisor. The written opinion should include an initial diagnosis and any applicable work restrictions for the employee. The employee's supervisor will forward the physician's written opinion to the employer's MSD case manager.

m. MSD Case Management

(1) Each employer is required to provide for MSD case management, to include review of completed KSC Form 6-2s or 16-261s, JHAs or hazard assessments and, in

coordination with the treating physician, determine any necessary work restrictions or other accommodations required facilitating their recovery.

(2) The organization responsible for MSD Case Management shall develop a case file for each patient to track medical progress.

(a) Case files shall be closed when it is determined that the employee has recovered from the MSD or when a maximum medical improvement is reached.

(b) If the employee is not recovering as expected, the employee shall be re-examined at the OHF. The examining physician will then determine if another review of the employee's work-site should be initiated by contacting the MESC IH Office.

(c) The employee's line management organization is responsible for correction of MSD hazards affecting the employee's recovery.

n. The Ergonomics Working Group

The Ergonomics Working Group serves as a government and contractor forum, chaired by the MESC, for the implementation of Ergonomics Programs at the KSC. Membership consists of NASA and contractor ergonomics program representatives. The Working Group shall:

(1) Provide consultative services to KSC management and contractors on items related to ergonomics.

(2) Provide a forum for discussion and resolution of ergonomics issues

(3) Assist the KSC IH Officer in the development and maintenance of KSC MSD management policies.

(4) Keep members abreast of current developments in ergonomics.

### 3.8 Indoor Air Quality (IAQ)

This Section establishes the IAQ management program at KSC. The support services described in this section are available to all Civil Service organizations and NASA contractor organizations as defined in their respective contracts.

Workers are often concerned they have symptoms or health conditions from exposures to contaminants in the buildings where they work. While some indoor air contaminants can aggravate pre-existing employee medical conditions such as allergies, or be a cause of building-related illnesses such as Legionnaires disease, poor IAQ also adversely affects employee efficiency and productivity. Research shows that building-related symptoms are associated with building characteristics, including dampness, cleanliness, and ventilation characteristics.

a. Signs and Symptoms of Poor IAQ

Signs and symptoms associated with poor IAQ depend on the air contaminant(s) in question and are often mistaken for symptoms of unrelated health conditions caused by common colds or the flu. In many cases, people report that their symptoms occur several hours after

they come to work and resolve after they go home, or when they have been away on vacation. Common symptoms include:

(1) Dryness and irritation of the eyes, nose, throat, and skin.

(2) Headache.

(3) Fatigue.

(4) Shortness of breath.

(5) Hypersensitivity and allergies.

(6) Sinus congestion.

(7) Coughing and sneezing.

b. Causes of Poor IAQ

Poor IAQ is most often related to inadequate ventilation, chemical or biological contaminants from indoor sources, or chemical or biological contaminants from outdoor sources. Causes of symptoms are not always related to poor IAQ. For example, poor lighting, work at computers, or poor workstation ergonomics are often a cause of headaches and eye irritation. Cold and flu symptoms also are the same as those caused by poor IAQ.

(1) Inadequate ventilation

While not a contaminant, the buildup of exhaled carbon dioxide along with lack of sensible air motion is often related to IAQ complaints of ‘stuffy’ air.

(2) Chemical or biological contaminants from indoor sources

Most indoor air pollution comes from sources inside the building. For example, adhesives, carpeting, upholstery, manufactured wood products, copy machines, pesticides, and cleaning agents may emit volatile organic compounds. While airborne concentrations of these compounds may be well below OSHA or ACGIH exposure levels, they may be at sufficient concentrations to be detectable by odor or irritant effects. Biological contaminants such as mold and bacteria may form where there is a source of moisture that has accumulated in ducts, humidifiers and drain pans, or where water has collected on ceiling tiles, carpeting, or insulation.

(3) Chemical or biological contaminants from outdoor sources.

Pollutants from motor vehicle exhausts and odors from plumbing vents and building exhausts (e.g., bathrooms and kitchens) can enter the building through poorly located air intake vents, windows, and other openings. Biological contaminants include pollen, environmental molds, and smoke from fires.

c. Facility Design and New Construction:

Facility design shall endeavor to maintain a comfortable working environment through procurement and design of building Heating, Ventilation and Air Conditioning (HVAC) systems that meet American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) guidelines. Designers should consider operations and processes that generate air contaminants as a part of their normal operation and provide appropriate ventilation controls. Applicable facility plans will be reviewed by the MESC IH Office to assess the adequacy of controls planned for management of air contaminant sources.

d. Renovation of Occupied Facilities:

Construction or demolition activities in occupied buildings shall be planned and managed to minimize the generation of air contaminants. Plans for major modifications in occupied facilities may require construction of critical barriers to prevent migration of construction dust or chemical odors to occupied areas. Renovation plans will be reviewed by the MESC IH Office to assess the adequacy of controls planned for management of air contaminant sources.

e. Work area Inspection and Preventive Maintenance

(1) Work area supervisors or Facility Managers are responsible for inspection of their work areas and assigned facilities and submittal of work orders for correction of issues that may contribute to poor IAQ. Work areas should be inspected for:

(a) Visible water intrusion and water leaks.

(b) Visible water condensation on cold surfaces.

(c) Poor housekeeping and dust accumulation.

(d) Buildup of dust and debris on air diffusers.

(e) Use of cleaners, paints, adhesives or other products with volatile components.

(2) Facility Heating, Ventilation, and Air Conditioning (HVAC) and maintenance organizations are responsible for inspections to ensure proper function of HVAC system and facility structures and maintenance and repair of damaged or malfunctioning components required for maintenance of good IAQ. HVAC systems and structures should be inspected for:

(a) Damaged caulking, weather seals and other possible water leaks in exterior shells, windows, and doors.

(b) Cleanliness and proper drainage of mechanical room drain pans.

(c) Damaged or overloaded filters.

(d) Cleanliness and flow obstructions of fans and coils for proper setting and function of outdoor air intakes and dampers and damage to exclusion screens.

(e) Proper function and settings on thermostats and other HVAC controls.

(3) Mold remediation shall be in accordance with KSC Facilities Management Guidance for Mold Remediation, KSC-UG-1903.

(4) Pest Control shall ensure that only water based, low volatility pesticides are used inside occupied facilities.

(5) Facility Managers are responsible for:

(a) Ensuring all vehicles parked near HVAC air intakes, facility entrances, cul-de-sacs, or loading docks will be turned off to prevent exhaust fumes from entering facilities.

(b) Ensuring smoking at a facility is in compliance with KSC Smoke-Free Workplace Policy, KNPD 1216.1.

(c) Coordinating with MESC IH and the Grounds, Landscaping Maintenance and Pest Control Contract to evaluate pest infestations and cleanup, where required.

(d) Tracking closure of IAQ work orders related to their facility.

(e) Employees are responsible for ensuring they do not contribute to poor IAQ in their work area. Employees should keep their workstations clean and free of dust, not store perishable foods, and dispose of food waste in receptacles that are emptied daily. Employees should also be mindful of others and be aware that pet hair on clothing and certain perfumes or fragrances may contribute to coworkers IAQ symptoms.

f. Reporting IAQ signs and symptoms

(1) Employees shall report signs and symptoms they believe may be related to IAQ to their supervisors.

(2) Employees who report serious health problems are required to report to the OHF for medical assessment. Where, in the examining physicians opinion, the problem may be affected by workplace IAQ, the physician will schedule a work area IAQ assessment with the MESC IH Office.

(3) Where personnel complain of less serious symptoms, work area supervisors should contact the organization Health and Safety Office or MESC IH Office, as required by their employer, for evaluation of the work area.

g. IAQ Hazard Assessment

(1) The MESC IH Office will perform evaluation of the location(s) to identify possible causes of poor IAQ and recommend remediation or corrective actions.

(2) Evaluations may be initiated following an employee reporting to the OHF, at the request of organization Health and Safety Offices, or at the request of the area supervisor or Facility Manager, as required by their employer.

(3) When performing IAQ evaluations, IH personnel shall:

(a) Interview employees and area supervision to determine specific concerns of personnel.

(b) Perform visual inspection and sampling as required to identify possible sources of poor IAQ.

(c) Inspect carpeting and furnishings to determine condition and cleanliness.

(d) Complete a Facility IAQ Assessment Score Sheet.

(e) Review findings with the appropriate facility Operations and Maintenance and Safety and Health Offices to develop a recommended corrective action plan.

(f) Provide a written IAQ Assessment to report findings and recommended corrective actions. Report distribution shall be as directed by the responsible Safety and Health Office.

(f) Provide follow-up IAQ surveys when required to demonstrate effectiveness of corrective actions and work orders.

h. IAQ Work Orders

(1) Corrective actions requiring repair or maintenance services provided by the KSC ISC shall be initiated by submittal of work orders.

(2) Work orders shall include a Safety Risk Assessment Code where required by the organization safety and health office.

(3) A separate work order shall be submitted for each task required to close an IAQ corrective action.

i. IAQ Working Group (IAQWG)

The IAQWG serves as a government and contractor forum for the implementation of the IAQ program at the KSC. Membership consists of facility stakeholders and designated representatives of NASA and resident KSC contractor organizations representing: Occupational Medicine, Environmental Health, HVAC Maintenance, HVAC Design Engineering, Facilities Design Engineering, Fire Services, Contractor Safety, and Facility Maintenance. The panel shall:

(1) Provide consultative services to KSC management and contractors on items related to facility IAQ.

(2) Coordinate actions to resolve problems or rectify deficiencies identified in facilities that may result in reduction of air quality.

(3) Maintain an index of Facility IAQ Assessment Scores and facility locations ranked according to IAQ severity, to track closure of work orders required to correct IAQ problems.

(4) Review status of corrective actions and work orders and, as appropriate, update Facility IAQ Assessment scores on their closure.

(5) Provide a forum for discussion and resolution of issues related to stakeholders for indoor air quality at KSC and CCAFS.

(6) Assist the KSC IH Officer in the development and maintenance of indoor air quality policies and requirements.

(7) Keep members abreast of current developments in the management of IAQ.

### 3.9 Hazardous Material Management

Organizations procuring hazardous materials are required to have a written hazardous materials management policy, which assigns designated competent persons to manage hazardous materials procurements.

a. Competent Persons with the knowledge and skills to identify hazardous substances and articles are responsible for reviewing procurements and authorizing procurements of hazardous materials. The competent person shall:

(1) Identify baseline hazards associated with the acquisition.

(2) Determine safety and health requirements for the safe use of the material or equipment.

(3) Coordinate implementation of safe use requirements with the procurement originator.

b. Where feasible the procurement shall:

(1) Substitute a less hazardous substance or article, if one can reasonably be substituted.

(2) Procure the smallest quantity required to perform the required work.

### 3.10 Laboratory Operations

This section establishes Safety and Health management policy for laboratory-scale operations in chemical, biological, and physical science laboratories operated by NASA KSC civil service and support contractors.

a. For the purposes of this section, Laboratory-Scale means work with chemicals or biological agents or work with physical systems and equipment, which would typically be performed on a laboratory bench top or in a fume hood. This includes work that would normally be conducted within a laboratory, but may include associated work in field settings.

b. Directors of civil service and contractor organizations responsible for operation of chemical, biological, and physical science laboratories shall assign organizational responsibilities and develop and maintain written policy for the management of chemical and physical hazards associated with laboratory procedures, operations, and equipment.

c. Each organization will appoint a Laboratory Health and Safety Officer(s) who shall act as a laboratory point of contact and will be responsible for developing, implementing and updating Chemical Hygiene or Laboratory Safety Plan(s) that meets the requirements of 29 CFR 1910.1450 and this KNPR, and for reviewing procurements of chemicals and equipment used in the laboratory. The Health and Safety Officer may also act as the Chemical Hygiene Officer as required by 29 CFR 1910.1450.

d. In addition to the applicable portions of 29 CFR 1910.1450, Chemical Hygiene and Laboratory Safety Plans shall describe organizational responsibilities for laboratory operations, basic rules for use of laboratory facilities, direction for hazardous material management and work control, general safety and health requirements that are common to laboratory work, and requirements for documentation and tracking of task-specific safety and health requirements.

e. Where the civil service or contractors act as the controlling employer with operational control over a laboratory, the Chemical Hygiene and Laboratory Safety Plans will incorporate procedures to coordinate operations with other employers participating in the laboratory operations (e.g. hazardous operations, required PPE, employee training). These Plans shall apply to all permanent laboratory staff as well as authorized guests (i.e. subcontractors, visiting scientists, student interns) with access to laboratory facilities.

f. Task-specific safety and health requirements must be in the form of an auditable business record. These records may include:

(1) JHA or other equivalent documentation. These JHAs may be used to document safety and health requirements for hazards associated with common laboratory tasks.

(2) Lab Safety Worksheets used in Research and Development laboratory settings to document project-specific hazards and identify associated safety and health requirements.

(3) Operating procedures used for repetitive laboratory operations.

(4) Manufacturers operating instructions or laboratory-developed operating instructions.

g. Chemical Hygiene and Laboratory Safety Plans, JHA's, Lab Safety Worksheets, operating procedures, laboratory-developed operating instructions, and similar business records must be maintained in the KSC TechDoc database.

h. Laboratory Management are responsible for insuring Hazard Inventory and Hazard Mitigation Worksheet(s) are prepared for laboratory equipment, research and development procedures, and repetitive laboratory operations that require special precautions to prevent exposure to chemical or physical hazards associated with the use of equipment or completion of the procedure or operation. This process will be used for the development of Laboratory Safety Worksheets, operating procedures, and laboratory-developed operating instructions.

i. Hazard Inventory

(1) Prepare a list of hazards associated with the use of laboratory equipment or laboratory operation. Include hazards that are inherent to the operation or process. A separate Hazard Inventory will be prepared for each equipment item or procedure.

(2) Hazard Inventory shall include:

(a) Equipment inventory number, project task order number, and procedure number.

(b) Title (equipment name, project title, procedure title).

(c) Name of person preparing the Hazard Inventory checklist, mail code, phone number.

(d) Name of principle investigator, where applicable, mail code, phone number.

(e) Facility and location(s) of use.

(f) A short description of the equipment function, research and development project abstract or a brief description of the laboratory procedure.

j. Hazard Mitigation Worksheet. Prepare a Hazard Mitigation Worksheet for each hazard identified in the hazard inventory. The Worksheet shall include:

(1) Equipment inventory number, project task order number, and procedure number.

(2) Title (equipment name, project title, procedure title).

(3) Name of person preparing the worksheet, mail code, phone number.

(4) Name of principle investigator, where applicable, mail code, phone number.

(5) Description of the portion operation phase(s) where operators may be exposed to the identified hazard.

(6) Description of the hazard.

(7) List hazard mitigations and controls for the hazard.

k. A work package consisting of the Hazard Inventory and associated Hazard Mitigation Worksheets shall be provided to the responsible safety organization and MESC IH for review. The laboratory supervisor is responsible for coordinating this safety review and resolving safety and IH comments.

l. On completion of the review, the Laboratory Supervisor is responsible for incorporating the safe use requirements into the appropriate JHA's, operating procedures, laboratory-developed operating instructions, or Lab Safety Worksheets before authorizing work to proceed.

m. Where Safety or Environmental Health identifies work packages that require approval of the Ground Risk Review Panel (GRRP) or higher authority, the laboratory supervisor is

responsible for coordinating review and approval of the procedure through the Non-Routine Hazardous Operations Working Group (NRHOWG) Process.

n. Training

(1) All laboratory employees are required to complete Laboratory Health and Safety Training (QG216KSC) and Hazard Communication for Chemical Uses.

(2) Personnel assigned as Laboratory Health and Safety Officer or Chemical Hygiene Officer shall have training in one of the physical or life sciences, or engineering, which would enable the employee to develop an understanding of laboratory operations; the physiological action of toxic materials, biological entities, and physical hazards; and the means to recognize, evaluate, and control those hazards.

(3) Laboratory supervisors are responsible for ensuring laboratory personnel have reviewed and understand the operating procedures, associated hazards, and special precautions for the safe use of the equipment or completion of the operation.

### 3.11 Construction of Facilities Safety and Health

The provisions of this section are applicable to NASA KSC Construction of Facilities Projects and assigns requirements and responsibilities associated with project design and implementation.

Design shall consider all potential hazards associated with the project. It is the responsibility of the project designer to ensure the hazards are identified and included in any statement of work or other work control package provided to fixed-price or resident contractor organizations who will be performing the work. If assistance is needed in evaluating potential hazards based on the scope of work contact the MESC IH Office.

It is the responsibility of the CO to ensure that the safety and health requirements identified in their approved Site – Specific Safety and Health Plan are observed by all contractor and subcontractor employees on the jobsite. The contractor shall comply with all applicable OSHA standards and KNPR 8715.7, KSC Construction Contractor Safety and Health Practices Procedural Requirements.

a. Design

(1) Designs or modification of existing facilities or systems involving the use, storage, or processing of hazardous materials; or which have the potential to expose employees to hazardous materials or physical agents shall be coordinated with the NASA IHO or the MESC IH Office. Examples of specific design applications are discussed in Section 3.2 of this document.

(2) Notification

Design packages must be submitted during the normal design review cycles (typically 30%, 60%, 90%), for review. Design packages should include the Document Release Authorization (KSC Form 21-68V2) with all available design data and task requirements. Reference NPD 8820.2, Design and Construction of Facilities.

(3) Bulk Sampling

Evaluation and testing of suspect materials must be conducted during the project design.

(4) Specifications

The Architecture and Engineering designer must provide project specifications to the designated government CO for approval based on review comments or recommendations provided by the NASA Safety, Environmental and IH office.

b. Design Review process

(1) MESC Environmental Point of Contact shall attend design review meetings and identify plans for review by MESC IH.

(2) MESC IH shall review project designs and submittals to ensure compliance with applicable requirements. MESC will provide engineering design review comments to the project manager.

c. Site Specific Safety and Health Plan (SSSHP)

(1) SSSHP Submittals

(a) The Administrative Contracting Officer (ACO), shall provide the construction of facilities contractor SSSP submittals to the Contracting Officer Technical COTR for distribution and consolidation of comments from the construction team members.

(b) The COTR shall forward SSSHP submittals for review by MESC IH to MESC Work Control at KSC-DL-EnvHealth@ndc.nasa.gov .

(c) The ACO shall review consolidated comments from COTR and issue approval or non-approval to the Prime Contractor prior to commencement of any site work.

(2) Where required by OSHA, the SSSHP shall include, but not be limited to, the contractors written compliance plans for asbestos abatement, respiratory protection, confined space entry, hazard communication, and JHAs

(3) Where a prime contractor provides a SSSHP for approval that does not include written plans for work to be performed by subcontractors subsequent to contract start, MESC may provide a conditional approval for the SSSHP. It is the responsibility of the CO to ensure the SSSHP is revised to include the additional OSHA-required written compliance plans and provided to MESC IH for review and approval prior to commencement of subcontractor work.

d. Pre-work meetings

(1) It is the responsibility of the CO or the COTR to notify the MESC IH work control of pre-work meeting with construction contractors.

(2) MESC IH shall attend pre-work meetings to review IH work requirements for work at the KSC.

e. Nuts and bolts meetings

It is the responsibility of the CO or the COTR to notify the MESC IH work control of nuts and bolts meetings with construction contractors. Nuts and bolts meeting will be scheduled as needed to address IH-specific support requirements or scheduling issues related to the project.

f. Inspections and Audits

(1) The MESC IH shall perform unscheduled construction worksite audits for health program compliance.

(2) It is the responsibility of the NASA Construction Management Office to notify MESC IH Work Control to schedule asbestos abatement or other inspections.

(3) On arrival at a construction worksite, the MESC IH shall notify the site superintendent or site supervisor and the NASA Construction Management site representative of their presence at the worksite and determine any hazardous operation or conditions and PPE requirements for the worksite.

(4) The site superintendent or site supervisor and the NASA Construction Management site representative shall be provided an opportunity to accompany the IH during the site audit or inspection.

(5) The MESC IH is authorized to issue a stop work order on observing an Imminent Danger situation.

(6) Where an OSHA noncompliance finding is identified, the IH shall provide an informal review of the findings with the site superintendent or site supervisor and the NASA Construction Management site representative, when available, and a written summary of the findings to the CO.

(7) It is the responsibility of the CO to coordinate corrective actions or closure of the findings with the prime contractor.

g. Green Building Leadership in Energy & Environmental Design (LEED) Sampling

NASA Construction Management is responsible for scheduling LEED sampling and evaluation through MESC IH work control at KSC-DL-EnvHealth@ndc.nasa.gov (867-2400) when needed.

**APPENDIX A. DEFINITIONS**

Action Level - The concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Airborne Contaminant - A substance (dust, fume, mist, vapor, or gas) whose presence in air is harmful, hazardous, or undesirable.

American Conference of Governmental Industrial Hygienists (ACGIH) - A non-regulatory organization of industrial hygienists employed in the public sector. The organization develops and publishes TLVs for chemical and physical agents.

Asbestos Containing Building Material (ACBM) – Any material that contains greater than one percent asbestos by volume.

Breathing Zone - The area within a two-foot radius of the employee's mouth or nose. The breathing zone sample represents the atmosphere to which the employee would inhale and be exposed to during normal working conditions.

Corrosive - A chemical that causes visible destruction of or irreversible alterations in living tissue.

Enclosure – A physical barrier placed to contain a chemical or physical hazard.

Engineering Control - Any design procedure that eliminates or controls exposure to chemical or physical hazards by substitution of less hazardous materials or processes or preventing the escape of hazardous materials or physical agents into the workplace.

Entry - An action resulting in any part of the body breaking the plane of any of the confined space openings.

Exposure – The process by which a chemical or physical agent enters the body through any route of entry including inhalation, ingestion, or absorption through the skin. Potential for exposure exists where air contaminants are present or where hazardous materials can come into contact with the skin.

Fume - An aerosol consisting of minute solid particles arising from the volatilization from melted substances (such as molten metal).

Gas - A formless fluid that occupies the space of its enclosure. It can be changed to its liquid or solid state only by increased pressure and decreased temperature.

Hazardous Chemical or Hazardous Material - Chemicals or materials with dangerous health or physical properties.

Health Hazard – A health hazard is a chemical or physical agent where it is established that acute or chronic injury or illness may occur in exposed employees, based upon statistically significant evidence in at least one study conducted in accordance with scientific principles.

Industrial Hygiene (IH) - The profession devoted to the prevention of occupational illness or disease associated with exposures to hazardous materials and physical agents.

Laboratory Hood - An exhaust hood which partially encloses a contaminant producing operation.

Material Safety Data Sheet (MSDS) - Technical information on chemical products published by the chemical manufacturer, formulator, or importer. The MSDS contains product name, ingredients, toxicity, physical and chemical characteristics, fire and explosion data, health hazard information, and emergency and disposal procedures.

Mist - Suspended liquid droplets generated by condensation from the gaseous to the liquid state or by dispersing a liquid, by splashing, foaming, or atomizing.

Musculoskeletal Disorder – A condition where a part of the musculoskeletal system (muscles, joints, tendons, ligaments, and nerves) is injured over time. The disorder occurs when the body part is called on to work harder, stretch farther, impact more directly, or otherwise function at a greater level then it is prepared for.

National Voluntary Laboratory Accreditation Program (NVLAP) - A program administered by the United States Department of Commerce National Institute of Standards and Technology to accredit laboratories based on evaluation of their technical qualifications and competence.

Occupational Safety and Health Administration (OSHA) - A United States Department of Labor regulatory and enforcement agency created for the implementation of the Occupational Safety and Health Act of 1970.

Permissible Exposure Limit – The terminology used by OSHA for TWA concentration of a regulated air contaminant listed in 29 CFR 1910, Subpart Z.

Physical Agent - Physical factors such as heat, ultraviolet and ionizing radiation, humidity, noise, magnetic fields, or abnormal pressure and the like which may constitute a health hazard.

Physical Hazard - A chemical that is combustible, flammable, or explosive; is an oxidizer or organic peroxide; is a compressed gas; or is corrosive, pyrophoric, water reactive, or otherwise unstable.

Short-Term Exposure Limit (STEL) – A 15-minute TWA exposure that should not be exceeded at any time during the workday even if the 8-hour TWA is not exceeded. STELs are published in the TLVs for Chemical Substances and Physical Agents in the Work Environment for chemicals with short-term toxic effects.

Threshold Limit Value (TLV) - Established by the ACGIH and refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be exposed day after day without adverse health effects.

Time-Weighted Average (TWA) - The average concentration of a contaminant in air during a specific time period to which nearly all workers may be repeatedly exposed day after day without adverse effect. The TLVs are published periodically in the TLVs for Chemical Substances and Physical Agents in the Work Environment.

User - An individual who possesses or uses hazardous materials and physical agents.

Vapor - The gaseous state of a substance that is solid or liquid at ordinary temperature and pressure.

## APPENDIX B. ACRONYMS

| | |
|---|---|
| ACBM | Asbestos Containing Building Materials |
| ACGIH | American Conference of Governmental Industrial Hygienists |
| ACO | Administrative Contracting Officer |
| ACM | Asbestos-Containing Material |
| AIHA | American Industrial Hygiene Association |
| AMIS | Asbestos Management Information System |
| ANSI | American National Standards Institute |
| BEIs | Biological Exposure Indices |
| CAS | Chemical Abstract Service |
| CFR | Code of Federal Regulations |
| CO | Contracting Officer |
| COTR | Contracting Officer Technical Representative |
| CSHE | Confined Space Hazard Evaluation |
| EPA | Environmental Protection Agency |
| EPD | Emergency Procedure Document |
| FAC | Florida Administrative Code |
| FAR | Federal Acquisition Regulation |
| FS | Florida Statute |
| HHE | Health Hazard Evaluations |
| HVAC | Heating, Ventilation, and Air Conditioning |
| IAQ | Indoor Air Quality |
| IAQWG | IAQ Working Group |
| IH | Industrial Hygiene |
| IHO | Industrial Hygiene Officer |
| ISC | Institutional Services Contract |
| JHA | Job Hazard Analysis |
| LEED | Leadership in Energy & Environmental Design |
| KNPD | Kennedy NASA Policy Directive |
| KNPR | Kennedy NASA Procedural Requirements |
| KSC | Kennedy Space Center |
| MESC | Medical and Environmental Support Contract |
| MSD | Musculoskeletal Disorder |
| MSDS | Material Safety Data Sheets |
| NAMS | NASA Account Management System |
| NASA | National Aeronautics and Space Administration |
| NIOSH | National Institute for Occupational Safety and Health |
| NPD | NASA Policy Directive |
| NPR | NASA Policy Requirements |
| NVLAP | National Voluntary Laboratory Accreditation |
| OHF | KSC Occupational Health Facility |
| OSHA | Occupational Safety and Health Administration |
| PPE | Personal Protective Equipment |
| STEL | Short-Term Exposure Limit |
| SSSHP | Site Specific Safety and Health Plan |
| TLVs | Threshold Limit Values |
| TWA | Time-Weighted Average |
| UUPIC | Universal Uniform Personal Identification Code |
| WBGT | Wet Bulb Globe Temperature |
| WHAAG | Worker Health At A Glance |

## APPENDIX C. TABLES

### Table 1 – Examples of Office Work Ergonomic Risk Factors and Recommendations

| Risk Factor | | Recommendations |
|---|---|---|
| Repetitive Motion | | |
| Operating a keyboard and mouse for more than 4 hours a day.<br>Repetitively using a stapler, hole-puncher or other document preparation device for more than 2 hours a day.<br>Repetitively performing any task for more than 2 hours a day. | | Take short (5 min) breaks away from repetitive tasks.<br>Use automated equipment, such as an electric stapler.<br>Alternate keyboard work with other tasks.<br>Try using keyboard commands instead of mousing.<br>Try switching hands to operate a mouse. |
| Awkward or Static Posture | | |
| Back | Back is awkwardly bent or twisted.<br>Lower and upper back not fully supported by workstation chair.<br>Chair is not comfortable. | Position computer monitor and keyboard directly in front of operator.<br>Adjust chair in order to sit in an upright or slightly reclining position with lower and upper back supported by chair.<br>Use a chair that is comfortable, and supports lower and upper back. Use a small pillow, rolled towel, or lumbar device, if necessary for added support. |
| Arms | Elbows are positioned below the level of the keyboard/mouse.<br>Upper arms are held away from the body.<br>Upper arms and forearms are held at an acute (<90 degree) angle.<br>Over-reaching with an arm to operate the mouse.<br>Over-reaching with an arm or twisting the body to answer the phone or reach for an object. | Adjust height of chair or adjust keyboard height so that elbows are at same level or slightly higher than keyboard.<br>Adjust chair/keyboard so work can be performed with arms close to the body and upper arms and forearms are held at an open (90 – 110 degree) angle.<br>Move frequently used items within arm's reach.<br>Keep mouse adjacent to keyboard. If necessary:<br>-use a retractable keyboard tray if desk surface does not have adequate room<br>-use an alternative mouse such as a trackball or roller bar<br>-use a mouse bridge over keypad portion of keyboard |
| Wrists | Wrists bent backwards, forward, inward or outward and not in a straight position while operating a computer keyboard, mouse or adding machine. | Adjust keyboard/chair height so that the keyboard is in the same plane as the forearms.<br>Adjust keyboard slope to a flat or negative tilt position to achieve neutral wrist posture.<br>Use an alternative style keyboard or mouse, if necessary to keep wrists from being deviated (positioned inward or outward). |

| | Risk Factor | Recommendations |
|---|---|---|
| Legs<br>Knees<br>Feet | Inadequate legroom.<br>Feet are not flat on the floor or on a footrest. | Remove objects or desk drawer from under the desk to allow for sufficient legroom.<br>If a computer is used in the corner of an L shape workstation, try using a corner piece to bring the keyboard tray closer to the body. If necessary, obtain another desk or use a retractable keyboard tray.<br>After adjusting chair height, use a footrest if necessary. |
| Neck | Employee must twist neck to view computer monitor while keyboarding.<br>Employee must bend neck to view monitor.<br>Employee must bend/twist neck to view documents being copied.<br>Employee braces phone between shoulders and neck while working on the computer for more than 2 hours a day. | Position computer monitor and keyboard directly in front of operator.<br>Raise or lower the computer monitor so that top of monitor is approximately at eye level.<br>For employees with bifocals lower monitor to point where it can be viewed with neutral neck posture.<br>Use an adjustable document holder to hold documents at eye-level and next to the computer monitor.<br>Use a speakerphone or headset. |
| Static Posture | Operator sits at computer workstation without interruption. | Alternate keyboard work with other tasks to allow moving around.<br>Change positions frequently and if able perform stretching exercises.<br>Take short breaks (5 min/hr). |
| Contact Stress | | |
| Wrists, palms, legs, forearms, knees or elbows rest on sharp or hard surfaces. | | Avoid resting wrists, forearms on edge of desk.<br>Misuse of wrist rests may restrict circulation. When used, rest the palm of the hand and not the soft part of the wrist on the padding.<br>Do not use hard or firm wrist rests.<br>“Float” wrists above keyboard while typing.<br>Use a footrest to raise thighs and keep feet stable.<br>Use a chair that has a seat pan (width and depth) that accommodates the user.<br>Use a chair that has cushioned and rounded (“waterfall”) front.<br>If needed, rearrange workstation to avoid contact stress to legs. |
| Excessive Force | | |
| Excessive force required to grip or hold writing instruments, mouse or other office tools (staplers, hole punches, etc.) for more than 2 hours a day. | | Take short breaks.<br>Use soft padded gripping devices with writing instruments.<br>Use a mouse that adequately fits hand or use alternate device (trackball, rollerbar, etc.)<br>Ensure that ball on the bottom of the mouse is clean. |

| Risk Factor | | Recommendations |
|---|---|---|
| | | Ensure that mousing area is large enough.<br>Use ergonomic office tools to minimize forceful exertions. |
| Other Risk Factors | | |
| Eye-Strain | Monitor is not viewed between 18" to 30" away from the operator.<br>The VDT has excessive glare.<br>Low illumination levels are present where the operator views documents. | Place monitor just past arm's length (18" to 30").<br>If necessary, use a retractable keyboard tray to increase monitor viewing distance.<br>Minimize monitor glare by using a visor around the monitor, a glare screen, or by adjusting monitor away from light sources.<br>Adjust the color, brightness and contrast on VDT to minimize eye-strain.<br>Use supplemental lighting in document viewing areas. |
| Control over work pace | No control over work pace.<br>Machine paced, piece rate, constant monitoring, or daily deadlines. | Use administrative controls and job rotation to alternate personnel to perform various tasks, when able.<br>Take frequent micro-breaks. |

**Table 2 – Examples of Non-Office (Industrial) Ergonomic Risk Factors and Recommendations**

| Risk Factor | | Recommendations |
|---|---|---|
| Repetitive Motion | | |
| Repeating the same motions every few seconds or repeating a cycle of motions more than twice per minute for more than 2 consecutive hours.<br>Using an input device, such as a keyboard or mouse, in a steady manner for 4 hours total in a workday. | | Take frequent micro-breaks away from repetitive tasks. Use a timer, if necessary, to help as a reminder.<br>Use tools with multiple finger triggers.<br>Use automated equipment, when able.<br>See recommendations for keyboard and mouse use in Table 1. |
| Awkward or Static Posture | | |
| Back | Forward and backward bending and/or twisting of torso (back not straight and upright) for more than 2 hours per day.<br>Prolonged sitting without lower and/or upper back not fully supported by workstation chair.<br>Chair is not comfortable. | Perform task in a location, which minimizes bending and twisting.<br>If necessary, elevate item on workbench or lower workbench.<br>Adjust chair in order to sit in an upright position.<br>Use a chair that is comfortable, and supports lower and upper back. Use a small pillow, rolled towel, or lumber device, if necessary for added support.<br>If applicable, consider using a sit/stand chair.<br>Consider designing tools to enable work to be performed with a neutral back posture. |

| Risk Factor | | Recommendations |
|---|---|---|
| Arms | Forearms are not parallel to floor.<br>Forearms are not supported.<br>Upper arms are not vertical and close to the body.<br>Elbows are not at a 90$^{o}$ angle.<br>Over-reaching with an arm to reach for an object.<br>Repeatedly raising or working with hands above the head or elbows above the shoulders for more than 2 hours total per day. | Adjust height of workstation table or have worker stand on a platform in order for forearms to remain parallel to floor, upper arms close to body, shoulders relaxed and elbows at a 90$^{o}$ angle.<br>Use chair armrests, forearm support devices or a forearm support board for forearm support.<br>Move frequently utilized items within arm's reach and at waist height.<br>Consider designing tools that enable work to be performed with a neutral arm posture. |
| Wrists | Wrists bent backwards, forward, inward or outward and not in a straight position while operating tools. | Try various styles of tools or consider designing tools to keep wrists from being bent and deviated (positioned inward or outward). |
| Legs<br>Knees<br>Feet | When sitting thighs are not parallel to floor.<br>When sitting knees are not at a 90$^{o}$-110$^{o}$ angle.<br>When sitting feet are not flat on the floor or on a footrest.<br>Inadequate legroom.<br>Kneeling or squatting for more than 2 hours total per day.<br>Bending of ankle. | Adjust chair height to keep thighs parallel to floor.<br>Use a footrest to raise thighs and keep feet flat on the floor.<br>Remove objects or drawer from under the workbench to allow for sufficient legroom.<br>If necessary, perform task at another workbench.<br>If able, move task to another location that eliminate the need to kneel, squat or bend ankle.<br>Take frequent micro-breaks from extensive kneeling, squatting or bending ankle.<br>Use cushioned insoles in shoes. |
| Neck | Neck is bent or twisted while performing task for more than 2 hours a day. | Perform task in a location, which allows the worker's neck to remain straight and not bent.<br>Consider designing tools that enable work to be performed with a neutral neck posture. |
| Static Posture | Worker stands or sits while performing a task for more than 2 hours a day. | Change positions frequently and if able perform stretching exercises.<br>Alternate tasks to allow for sitting and standing throughout work day.<br>Use anti-fatigue mats.<br>Use a sit/stand chair. |
| Contact Stress | | |
| Wrists, palms, legs, forearms, knees or elbows rest on sharp or hard surfaces.<br>Using the hand or knee as a hammer more than 10 times per hour or more than 2 hours total per day. | | Use a soft edge on workstation edges.<br>Use a chair with soft padded armrests.<br>Use a chair that has a seat pan (width and depth) that accommodates the user.<br>Use a chair that has cushioned and rounded ("waterfall") front.<br>If needed, rearrange workstation to avoid contact stress to legs. |

| Risk Factor | Recommendations |
|---|---|
| | Use tools that have padded handles or add grip tape.<br>Avoid tools with sharp edges.<br>Avoid tools with handles that are too short; instead use long-handled tools.<br>Use padded gloves.<br>Use knee or elbow pads or padded mats.<br>Try using tools that eliminate using the hand or knee as a hammer. |
| Forceful Exertions | |
| Excessively gripping or pinching tools for more than 2 hours a day.<br>Pushing/pulling more than 20 pounds initial force for more than 2 hours total per day.<br>Pinching an unsupported object weighing 2 or more pounds per hand for more than 2 hours total per day.<br>Gripping force of more than 10 pounds for more than 2 hours total per day. | Take frequent micro-breaks away from excessively gripping or pinching.<br>Use tools with padded handles.<br>Use tools with proper grip span (between 50-67 mm).<br>Use tools with adequate diameter handles.<br>If possible, choose tools that require a power grip verses a pinch grip.<br>Avoid tools that are too heavy or bulky.<br>Use padded gloves.<br>Use automated tools, when able, to minimize forceful exertions.<br>If possible, use counter-balancing harness for heavier tools. |
| Lifting more than 75 pounds even once.<br>Lifting more than 55 pounds more than 10 times a day.<br>Lifting more than 25 pounds below knees, above shoulders, or at arms' length more than 25 times a day.<br>Lifting with a twisted torso.<br>Lifting one-handed.<br>Lifting un-stable loads.<br>Lifting above shoulder.<br>Lifting below the knuckle.<br>Carrying objects for an extended distance.<br>Lifting while seated or kneeling. | Use two people to lift items.<br>Use a lifting device (hoists, robotics, forklifts, dollies, etc.).<br>Use a cart to carry object extended distances.<br>Put less amount of weight in containers.<br>Make loads more compact and easier to handle.<br>Put items in containers with handles.<br>Try to lift items from waist height and close to body.<br>Carry items at waist height and close to body.<br>Use administrative controls and job rotation to alternate personnel to perform tasks that do not involve manual handling.<br>Take adequate breaks away from lifting tasks. |
| Vibration | |
| Performing tasks with localized vibration or whole-body vibration for more than 2 hours a day.<br>Using vibrating tools with high vibration levels, such as chainsaws or percussive tools, for more than 2 hours total per day.<br>Using tools with moderate vibration levels, | Perform routine maintenance on tools to reduce vibration.<br>Use vibration dampening material, where feasible.<br>Use anti-vibration gloves<br>Consider using tools that emit less vibration.<br>Look for tools with variable torque control. |

| Risk Factor | | Recommendations |
|---|---|---|
| such as grinders or sanders, for more than 2 hours total per day. | | Substitute with manual tools when possible. Use administrative controls to rotate workers to other tasks, which do not involve vibration. |
| Cold Temperatures | | |
| Worker exposed to air temperature of less than 60°F for sedentary work, 40°F for light work, 20°F for moderate/heavy work; cold exhaust blowing on hands. | | When able, increase ambient temperature. Wear body clothing and protective gear, such as gloves to reduce exposure. |
| Other Risk Factors | | |
| Eye-Strain | Low illumination levels are present where the worker performs task. | Use supplemental lighting in document viewing areas. |
| Control over work pace | No control over work pace. Machine paced, piece rate, constant monitoring, or daily deadlines. | Use administrative controls and job rotation to alternate personnel to perform various tasks, when able. Take frequent micro-breaks. |

## APPENDIX D. LIST OF SUSPECT ASBESTOS CONTAINING MATERIALS

Acoustical Plaster Joint Compounds
Asphalt
Blown-in Insulation
Boiler Insulation
Caulking and Putties
Ceiling Tiles
Cement Pipes
Cement Siding
Cement Wallboard
Chalkboards
Construction Mastics (floor tile, carpet, ceiling tile, etc.)
Cooling Towers
Decorative Plaster Spackling Compounds
Ducts
Electrical Cloth
Electrical Panel Partitions
Electric Wiring Insulation
Elevator Brake Shoes
Elevator Equipment Panels
Fire Blankets
Fire Curtains
Fire Doors
Fireproofing Materials
Flexible Fabric
Floor Tile
Flooring Backing Adhesives
High Temperature Gaskets
HVAC Duct Insulation
Laboratory Gloves
Laboratory Hoods and Table Tops
Pipe Insulation (corrugated air-cell, block, etc.)
Roofing Shingles Roofing Felt
Spray-Applied Insulation
Taping Compounds
Textured Paints and Coatings
Thermal Paper Products
Vinyl Floor Tile
Vinyl Sheet Flooring
Vinyl Wall Coverings
Wallboard Heating and Electrical

**Note:** This list does not include every product or material that may contain asbestos. It is intended as a general guide.

## APPENDIX E. ABOVE CEILING ACCESS GUIDELINES

1. ***Ceiling Access*** – Operations and maintenance activities conducted above drop ceilings should be performed using the following or similar access guidelines. These guidelines are to be employed by personnel when work is to be performed above drop ceilings with a potential for asbestos debris contamination. Due to the potential for personnel exposure to asbestos and possible facility contamination, all unnecessary activities involving the removal of ceiling tiles should be avoided.

2. ***Material Identification*** - Prior to removing or disturbing ceiling tiles, AMIS should be reviewed by a representative of the shop performing the work to identify the presence of Asbestos Containing Material. Based on the AMIS survey data or survey and inspection results of a Florida State qualified Asbestos Consultant, one of the three situations and appropriate response actions listed below should apply. [Note: If ACM survey not listed in AMIS, follow the procedures shown in section 2.1.3.

2.1 ***No ACM present*** - There are no restrictions to ceiling space entry. When no ACM or suspect ACM is present in the subject ceiling space, the ceiling entry guidelines are not required. If suspect ACM is encountered during work above a ceiling and it was not previously identified, work should be stopped immediately and EHS contacted to evaluate the discovered material and assess the potential for a health hazard.

2.2 ***Damaged ACM or debris is present*** – Access and entry restricted. Areas that have been identified as containing damaged or friable asbestos should not be accessed. Work that requires ceiling entry where damaged ACM or debris is present should not precede pending implementation of clean-up or decontamination activities by trained and qualified asbestos workers using appropriate work methods in accordance with OSHA's Asbestos Standards.

2.2.1 ***ACM is present in good, non-friable condition*** - Areas identified as containing ACM in good, undamaged, or non-friable condition, should not pose an inhalation hazard to personnel provided the identified ACM remains undisturbed. Employees required to remove or disturb ceiling tiles with the potential of containing asbestos contaminated debris, should have training equivalent to the 2-Hour Environmental Protection Agency (EPA) Awareness training course or greater. Access procedures as shown below must be used when entering the ceiling space.

a. The work area should be cleared of unprotected personnel a minimum of 25' perimeter from the ceiling access point.

b. The area beneath the ceiling entry should be covered with minimum 3-mil polyethylene sheeting to contain any falling debris. Where feasible, an alternate method of contamination control, such as a ceiling tile entry booth, should be used in lieu of the single sheet of polyethylene.

c. At a minimum, air purifying negative pressure respirators equipped with high efficiency particulate air (HEPA) filters and cartridges must be worn during the initial access above the ceiling. PPE to include disposable tyvek coveralls, gloves, and eye protection is also recommended.

d. Upon removing the ceiling tile and prior to performing work in the ceiling plenum, perform a visual check of the identified ACM for changed or new conditions (ie: damaged suspect ACM). If changed or new conditions are present, stop work, leave your area controls in place and notify

your supervisor. If no changed or new conditions exist, the required above ceiling work may proceed as normal provided you do not damage or disturb the identified ACM.

3. ***Completion of Work*** - After completion of work in the ceiling space, the ceiling tile(s) should be put back in place and the work area below the ceiling entry should be wet wiped of any residual ceiling dust. All polyethylene and used cleaning materials should be bagged and removed from the work area for appropriate disposal in accordance with the requirements of KNPR 8500.1.