Kennedy NASA Procedural Requirements

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Responsible Office: **Spaceport Integration and Services**

Kennedy Space Center Industrial Hygiene Programs

National Aeronautics and Space Administration

John F. Kennedy Space Center

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.
9/15/16	D	Global change to replace the Medical and Environmental Support Contract (MESC) with the Kennedy Environmental and Medical Contract (KEMCON) -1.1- Added instruction for submittal of SDS to the KEMCON SDS coordinator. -1.4- Clarified responsibility of line management in reporting biological, developmental, and reproductive hazards. -2.4- Added biological hazards and workplace observations, and clarified asbestos fiber analysis requirement. -2.7- Clarified policy for use of PPE; added reference to KNPR 8715.5. -Revised to eliminate the PPE section which is now covered by KNPR 8715.5. -3.2-Revised threshold for engineering design involving noisy equipment and added hazardous metals and silica to scope of designs or modifications requiring coordination with the NASA IHO. Added procurement and design requirement to implement Agency Buy Quiet/Quiet By Design policy. 3.3- Clarified requirements for asbestos inspections, posting asbestos labels and warning signs, training and licensure, facility manager abatement notification, and asbestos project management and design. Revised to implement new program requirements identified in NPR 1800.1D. -3.4- Added requirements for use of x-ray fluorescent testing of bulk paint samples. -3.5- Clarified requirement for continuous atmospheric monitoring during confined space entries. Added requirements for confined space entry plans for fixed price construction contracts, rescue plans to entry plans, confined space dewatering and ventilation, OJT for workers and emergency rescue personnel, and configuration of engineering controls required for safe entry. -3.7- Clarified requirement for review of JHA for MSD hazards and employer coordination with health care provider to determine medical accommodations.

		-3.8-Clarified requirement for inspection of HVAC systems during IAQ evaluations and processing of IAQ work orders and re-evaluation. -3.10-Section revised to reflect changes to NE and UB laboratory operations policy. -3.11- Clarified responsibilities of The Chief of Construction and Facilities Division for CofF Safety and Health and for identification of hazardous materials during CofF design and specification. -3.12- Added new policy for Oxygen Deficiency Hazard Assessment. -3.13- Added new policy for Biological Safety.

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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, physical, and biological agents 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 Requirement (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 are contained within KNPR 1820.4, KSC Respiratory Protection Program, KNPR 1840.1, KSC Hazard Communication Program, KNPR 1860.1, KSC Ionizing Radiation Protection Program, KNPR 1860.2 KSC Non-Ionizing Radiation 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. NASA Federal Acquisition Regulation (FAR) Supplement 1823.70, Safety and Health

b. Occupational Safety and Health Act of 1970

c. Privacy Act of 1974

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

e. NPR 1441.1D, NASA Records Management Program Requirements

f. KNPR 1840.1, KSC Hazard Communication Program

g. KNPR 8715.3-1, KSC Safety Practices Procedural Requirements

h. KNPR 1820.3, KSC Hearing Loss Prevention Program

i. KNPR 1820.4, KSC Respiratory Protection Program

j. KNPR 8500.1, KSC Environmental Requirements

k. KNPR 8715.5, KSC Personal Protective Equipment (PPE) Procedural Requirements

l. KNPR 8715.7, KSC Construction Contractor Safety and Health Practices Procedural Requirements

m. NASA Form 1534, Privacy Act Cover Sheet

n. NASA Form 28-313, Label, “CAUTION – DO NOT USE FOR TOXIC MATERIALS”

o. NASA Form 21-68VS, Document Release Authorization

p. NASA Form 28-1230, Environmental Health Asbestos Abatement Pre-Work Inspection Checklist (NCR)

q. NASA Form 28-1231, Environmental Health – Asbestos Abatement Clearance Inspection Checklist (NCR)

r. NASA Form 28-750, KSC/CCAFS Confined Space Hazard Evaluation Request

s. NASA Form 28-1113, Payload Confined Space Hazard Assessment

t. NASA Form 16-287, KSC/CCAFS Confined Space Entry Permit/Authorization

u. NASA Form 6-2, Initial Rercord of Injury/Illness

v. NASA Form 16-261, KSC Medical Disposition

w. NASA Form 28-1212, Environmental Health Facility IAQ Assessment Scoresheet (Industrial Air Quality)

x. NASA Form 50-211, Laboratory Hazard & Mitigation Inventory

y. NASA Form 28-1908V2, Reproductive and Developmental Health Hazard Questionnaire

z. Threshold Limit Values for Chemical Substances and Physical Agents Biological Exposure Indices, American Conference of Governmental Industrial Hygienists

aa. Industrial Ventilation, A Manual of Recommended Practice for Design, American Conference of Governmental Industrial Hygiene

bb. A Strategy for Occupational Exposure Assessment, American Industrial Hygiene Association

cc. Instruction Concerning Prenatal Radiation Exposure, U.S. Nuclear Regulatory Commission Regulatory Guide 8.13, Revision 3, June 1999

dd. NIOSH, Occupational Exposure Sampling Strategy Manual, NIOSH Publication No. 77-173

ee. NIOSH Manual of Analytical Methods

ff. Reproductive And Developmental Hazards: A Guide For Occupational Health Professionals, Navy and Marine Corps Public Health Center Technical Manual NMCPHC-TM-OEM 6260.01C April 2010

gg. Workplace Hazards to Reproduction and Development:
A Resource for Workers, Employers, Health Care Providers, and Health & Safety Personnel Washington State Department of Labor and Industries Technical Report Number: 21-3-1999, August 1999

hh. Using the Heat Index: A Guide for Employers, The Occupational Safety and Health Administration.

P.5 Measurement/Verification

Triennial audit of the KSC Occupational Health Program by the NASA Headquarters Office of the Chief Health and Medical Officer and interim KSC self-audits.

P.6 Cancellation or Supersession

This revision supersedes KNPR 1840.19, Rev. C-2, KSC Industrial Hygiene Program, dated May 15, 2015.

/original signed by/

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PROCEDURES

Chapter 1. Responsibilities

1.1 Heads of Organizations

1.1.1 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 as well as 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 and report 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 NASA FAR Supplement 1823.70 for procurement requests and statements of work issued (involving IH Program concerns).

f. Ensure Safety Data Sheets (SDS) are provided to the Kennedy Environmental and Medical Contract (KEMCON) SDS Program Coordinator (KSC-DL-EnvHealth@ndc.nasa.gov).

g. Designate representatives to act as organization points of contact for IH Program business, monitor 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 Mishap 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 potentially affected employees.

1.2 The Kennedy Space Center Industrial Hygiene Office

1.2.1 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 implementation of this KNPR.

1.3 The Kennedy Environmental and Medical Contract Industrial Hygiene Office

1.3.1 The KEMCON 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. Audit any IH program, process, and sampling performed by personnel or organizations outside the KSC Occupational Health organization, to include construction activities.

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

d. 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) Regulatory or NASA requirements for employees to participate in a medical monitoring program.

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

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

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

f. Evaluate employee complaints of potential health hazards.

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

h. Provide technical assistance in the selection and design of engineering controls and work practices as well as the selection of PPE.

i. Provide custody and maintenance of IH records, in accordance with the requirements of 29 CFR 1910.1020.

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

k. Maintain a listing of hazardous materials and provide Center-wide access to SDS for each hazardous material reported in accordance with KNPR 1840.1.

l. Chair the KSC Indoor Air Quality (IAQ) Working Group and the KSC Ergonomics Working Group.

1.4 Civil Service and Contractor Line Management

1.4.1 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 SDS 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 the use of hazardous materials and physical agents. Written procedures shall identify the hazards and include instructions on the use of required engineering and work practice controls as well as 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 KSC IHO or the appropriate safety and health organization to determine the requirements for work in the following categories:

(1) Work with hazardous chemicals as defined in Appendix A of this document.

(2) Construction or demolition activities where regulated hazardous materials (e.g. asbestos, lead-containing paints, silica, or other substances as defined in 29 CFR 1910 or 1926) may be present.

(3) Work in confined spaces as defined in Paragraph 3.5 of this document.

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

(5) Potential ergonomic hazards.

(6) Potential biological hazards.

(7) Potential reproductive and developmental hazards.

f. Coordinate the scheduling of HHEs.

g. Implement requirements identified in the HHE.

h. Ensure that potentially affected employees are provided the 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, appropriate safety and health organization, or the KEMCON 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 designed to control occupational exposures.

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

1.5.1 Cognizant Safety and Health Organizations shall:

a. Inspect the workplace for potential hazards and exposures. Contact the KEMCON 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 as otherwise required to control or eliminate employee exposure.

c. Coordinate with the KSC IHO or the KEMCON IH Office in instances of deviations or waivers affecting health hazard control requirements.

1.6 Training Organizations

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

1.7 Employees

1.7.1 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. 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

2.2.1 NASA has adopted health standards promulgated by OSHA or recommended by the American Conference of Government Industrial Hygienists (ACGIH), whichever is more stringent. In addition, NASA Headquarters may issue a NASA health policy to address exposure limits.

2.2.2 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 National Institute for Occupational Safety and Health (NIOSH) Criteria Documents, American National Standards Institute (ANSI) standards, National Academy of Sciences recommendations, American industrial Hygiene Association (AIHA) exposure guidelines, or chemical manufacturer recommended exposure limits.

2.2.3 Management policies and programs shall be developed to ensure employee exposures to such materials or agents are below the applicable exposure limit(s).

2.2.4 Policies and programs shall implement appropriate control measures (e.g., engineering controls, administrative or work practice controls, and/or PPE) when exposure levels exceed the "Action Level" for the hazardous material or agent of concern.

2.2.5 Where there are no published exposure criteria for hazardous materials, such as nanoparticles, control banding shall be used to determine appropriate controls.

2.3 Initial Hazard Assessment

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

a. Inspection of workplaces for potential health hazards.

b. Review of procedures or operations to identify hazardous materials or physical agents.

c. Investigation of complaints of illness or injury that may be work-related.

d. Employee reports of potential health hazards.

2.3.2 The organization's line management, safety committee, or safety and health organization will typically conduct this initial assessment.

a. 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.

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

(1) Identification of the processes involved.

(2) Information gathering (e.g. review SDS) 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 potential exposure routes.

(7) Identification of similar exposure groups.

c. An HHE shall be conducted where there is a reasonable potential for employee exposure to hazardous materials or conditions.

d. Line management organization or safety and health organizations may consult with the KSC IHO or the KEMCON IH Office to determine the need for an HHE. If it is determined that an HHE is required, it is the responsibility of the line management organization or safety and health organization to coordinate the HHE with the KEMCON IH Office and provide the information gathered during the initial assessment.

2.4 Health Hazard Evaluation

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

2.4.2 HHEs include the identification and assessment of exposures to chemical, physical, or biological agents. HHEs shall comply with the minimum requirements established below:

a. 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.

b. Personnel breathing zone measurements based on the applicable exposure limit (e.g. 8-hour Time-Weighted Average [TWA] or 15-minute TWA-Short Term Exposure Limit) shall be performed and documented using the sampling strategy.

c. 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.

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

e. Exposure monitoring results shall be compared to the applicable exposure standard to determine compliance.

f. HHEs shall represent the operations as they are typically performed.

2.4.3 Follow-up HHEs shall be performed:

a. To assess conditions after any modifications which may decrease or increase the potential for employee exposure or the implementation of hazard control measures are completed, or

b. At intervals specified in substance specific standards identified in 29 CFR 1910 and 29 CFR 1926.

2.4.4 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.

2.4.5 Whenever possible, samples representing the worst case employee exposure shall be obtained.

2.4.6 KSC KEMCON Workers Health at A Glance (WHAAG) Database

a. The WHAAG database is designed to provide NASA, the United States (U. S.) Air Force, and their contractors with a quick method of viewing HHE reports and data, such as potential health hazards, air monitoring results, health hazard ratings, similar exposure group profiles, and a follow-up status of required and recommended corrective actions.

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

c. The WHAAG provides:

(1) The ability to view individual employee exposure profiles to hazardous agents.

(2) Exposure profiles for similar exposure groups considered to be representative of data obtained for individual workers within the group.

(3) Customized queries and reports.

(4) Hazards identified during an evaluation and the status of hazard abatement actions.

2.4.7 Sampling Requirements

a. All IH sampling shall be performed in accordance with recognized NIOSH or OSHA methodologies.

b. The KSC IHO shall approve the selection of alternate sampling methodologies if no NIOSH or OSHA methodology exists.

c. Sampling equipment shall be operated according to the manufacturer's specifications.

d. Sampling pumps shall be calibrated before and after sampling usage.

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

f. Field and lot blanks shall be taken in accordance with applicable sampling procedures.

g. Bulk samples shall be collected in accordance with the analytical laboratory requirements.

h. Sampling data shall be recorded on a sampling data sheet that includes the following, as applicable:

(1) Sample identification.

(2) Employee names and UUPIC.

(3) Description and location of task being performed.

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

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

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

(7) Description of PPE used.

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

(9) Facility number, name, and room number.

(10) Contaminant or agent being sampled.

(11) Sampling method used.

(12) Contact name and organization.

(13) Name of individual performing the sampling.

(14) Work practice observations.

i. 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.

2.4.8 Analysis Requirements

a. Laboratories performing IH sample analysis shall be accredited by the AIHA except for the following:

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

(2) Analysis shall be performed in accordance with OSHA analytical methods, NIOSH analytical methods, Asbestos Hazard Emergency Response Act (AHERA), or, in their absence, documented standard laboratory analysis procedures.

b. The laboratory analysis results shall be reported on a document to include the following:

(1) Laboratory name, address, phone number.

(2) AIHA or NVLAP accreditation number.

(3) Sample number.

(4) Sampling date and time.

(5) Sample matrix.

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

(7) Date samples received.

(8) Date samples analyzed.

(9) Signature of laboratory manager.

(10) Name of analyst.

(11) Lab report identification and task identification number.

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

(13) Units of measure.

(14) Itemized results for each sample number.

2.4.9 Report Requirements

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

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

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

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

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

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

(6) 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.

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

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

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

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

(11) All hazard control measures used, such as engineering controls, administrative/work practice controls, or PPE.

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

(13) The contract employer of personnel monitored.

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

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

b. All reports which contain Personally Identifiable Information shall be covered with NASA Form 1534, in accordance with the Privacy Act of 1974.

c. Copies of all HHEs shall be provided to the KSC IHO and KSC Occupational Medicine, as applicable.

2.5 Instrument Selection, Calibration, and Use

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

2.5.1.1 Instrument Selection

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

b. The KEMCON IH Office shall provide consultation to user organizations on the selection and use of real-time monitoring equipment.

2.5.1.2 Instrument Calibration

a. Instrument calibration shall be performed to verify the proper function of the instrument prior to use.

b. The user organization shall 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 for no less than 30 years.

2.5.1.3 Instrument Use

a. Monitoring instruments shall be used in accordance with the manufacturer's instructions.

b. The user organization shall ensure the following:

(1) Operators are trained and qualified to properly operate the monitoring instruments.

(2) Training is documented in an auditable format.

(3) Instruments are not used beyond the calibration expiration date.

(4) A functional check of the instrument is performed prior to each use in accordance with manufacturer's instructions.

2.6 Health Hazard Controls

2.6.1 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.

2.6.1.1 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 of 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.

2.6.1.2 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, removal or reassignment for medical reasons, 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.

2.7 Personal Protective Equipment

2.7.1 PPE is used only when the combination of engineering and administrative control methods are not feasible or as interim controls while engineering and/or administrative controls are being implemented. 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. Refer to KNPR 8715.5, for selection, use, and care of PPE. 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. Respiratory protection.

2.8 Training

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

2.8.2 Employee Training

a. Employees shall be trained to both recognize potential health hazards and the signs and symptoms of potential exposure, and understand the means to protect themselves from such hazards in their workplace.

b. This training shall include:

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

(2) KSC-003-007, KSC Hazard Communication (SATERN) (Chemical Users)

(3) KSC-003-013, KSC Hazard Communication (SATERN) (Office Workers)

(4) QG320OSH, OSHA HazCom 2012 (KISS III) (Chemical Users)

(5) QG321OSH, OSHA HazCom 2012 Refresher (KISS III) (Chemical Users)

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

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

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

2.8.3 Supervisor Training

Training for management representatives supervising operations involving health hazards shall include:

a. Regulatory and KSC requirements for health hazard control measures.

b. Identification of potential health hazards and how to request an HHE.

c. Procedures for reporting employee exposures and accidents involving hazardous materials.

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

a. Identification of health hazards in the work area and recognition of potential exposures.

b. Procedures for requesting an IH evaluation for potential hazards that are identified.

c. Procedures for reporting employee exposures, mishaps, and accidents involving hazardous materials.

d. Use and care of required PPE.

e. Use and care of monitoring equipment, as required.

2.8.5 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.

2.8.6 Training described in this section shall be reviewed by the organization safety and health program representative. 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

2.9.1 IH Records

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

2.9.2 Employee Exposure Records and IH Surveys

a. 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, NPR 1441.1, and the Privacy Act of 1974.

b. Examples of IH surveys include local and general ventilation surveys, illumination surveys, hazardous noise surveys, employee complaint investigations, heat stress surveys, ergonomic evaluations, exposure incident investigations, and emergency response reports.

Chapter 3. Special Topics

3.1 Ventilation

3.1.1 This section provides requirements for the design, use, and testing of industrial ventilation and laboratory hood systems used to control the generation of toxic air contaminants.

3.1.1.1 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.

3.1.2 Use

a. Designated system owners, operators, and engineering and/or maintenance organizations shall ensure the proper installation, operation, and maintenance of industrial ventilation systems to ensure that:

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

(2) Fan belts are not slipping or broken.

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

(4) Ducts are free from leaks.

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

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

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

b. System use and/or configuration changes shall be reported to the KEMCON IH Office for re-evaluation prior to implementation and use.

c. 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 operator’s breathing zone.

d. Ventilation systems designed to control toxic air contaminants shall be tested upon initial installation and at least annually to determine proper operation.

e. The user organization shall contact the KEMCON IH Office to schedule evaluations of laboratory hoods and local exhaust ventilation systems and correct any deficiencies identified in the KEMCON IH Laboratory Hood or Local Exhaust Ventilation System Evaluation report.

f. Systems that meet recommended design criteria and/or provide acceptable levels of health protection shall be affixed with a decal approving its use, the date of inspection, and the date of the next scheduled evaluation.

g. The user organization shall ensure that employees are trained in the use of ventilation systems and are aware of the ventilation systems' capabilities and limitations.

3.1.3 Testing

a. The KEMCON IH Office shall provide evaluations for Industrial Ventilation Systems used for employee health protection.

b. Systems shall be evaluated in coordination with the system operator/owner using the recommended design criteria in the ACGIH Industrial Ventilation Manual, applicable OSHA regulations, ANSI, or other applicable consensus industry standards.

c. The KEMCON IH Office shall maintain an inventory of all registered Industrial Ventilation Systems and schedule all recurring evaluations.

3.1.4 Baseline Evaluation

a. The KEMCON IH Office shall perform an initial baseline evaluation of local exhaust and laboratory hood ventilation systems upon notification by the engineering or user organization.

b. 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.

c. The engineering or user organization shall effect repairs or redesign for systems that are not operating within generally accepted design and operating parameters.

3.1.5 Periodic Reevaluation

a. Local exhaust and laboratory hood ventilation systems listed in the KEMCON 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 KEMCON IH Office.

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

c. KEMCON IH Office shall notify users of systems that do not meet minimum design criteria or when systems are not operating effectively to have service/maintenance scheduled.

e. If continued operation of the system poses a hazard to personnel, the system shall be removed from use and tagged as "Out-Of-Service" (KSC Form 28-313) pending completion repair/replacement in coordination with the system owner/operator.

f. The KEMCON IH Office shall provide the user organization a written report with the results of the survey and recommendations for correcting identified deficiencies.

g. The user organization shall repair or replace systems that are not properly designed and/or operating within generally accepted parameters.

3.2 Facility Design and Modifications

3.2.1 This section defines IH facility design requirements that shall 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.

3.2.1.1 Requirements

a. 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 KSC IHO or the KEMCON IH Office.

b. Design packages shall be submitted during the normal design review cycles (typically 30, 60, and 90 percent) for review. Design packages should include the Document Release Authorization (KSC Form 21-68VS) with all available design data and task requirements. Examples of specific design applications that will be reviewed include the following:

(1) Systems or processes such as demolition, hot work, abrasive blasting, or surface coating application.

(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 equal to or greater than 80 decibels (dBA) on the A-weighted scale.

(5) Design or modifications that involve asbestos containing building materials (ACBM) or building materials and coatings containing lead, chromium, and/or silica.

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

3.2.2 Design

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

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

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

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

(3) 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.

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

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

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

(2) The procurement of equipment and design of facilities that emit sound levels equal to or greater than 80 dBA shall follow the Buy Quiet/Quiet by Design Program policy in accordance with KNPR 1820.3.

(3) Asbestos abatement project design shall be conducted in accordance with 29 CFR 1926.1101, 40 CFR 61 Subpart M, 49 CFR 171, 49 CFR 172, Florida Administrative Code Chapter 62-257, and Florida Statute (FS) Chapter 469.

(4) 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 Kennedy Space Center Asbestos Management Program

3.3.1 This section implements 29 CFR 1910.1001, 29 CFR 1926.1101 (Asbestos), 40 CFR part 61, 40 CFR part 763, FAC Rule 61E1-2, and FS Chapter 469. 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.

3.3.2 Material Identification **-** A list of suspect asbestos containing materials (ACM) is provided in Appendix D.

a. These materials shall be assumed to contain asbestos, regardless of age, or be tested prior to performing maintenance, renovation, or demolition activities at KSC.

b. Sampling and analysis of bulk asbestos materials shall be conducted under the direction of a Florida Licensed Asbestos Consultant (FLAC) IAW Florida Statues - Chapter 469.

3.3.3 An asbestos inspection (survey) shall be completed in accordance with the requirements of the National Emissions Standard for Hazardous Air Pollutants before any renovation or demolition activity begins, regardless of the age of the building or the building materials. This requirement also applies to buildings that are damaged by fire or water.

3.3.4 An asbestos survey shall include (but is not limited to) the following elements:

a. The name and license number of the FLAC under which the survey is conducted.

b. The locations and quantities of homogenous suspect ACM.

c. A description/photograph of the homogenous suspect ACM. The description must indicate the type of material (e.g., Thermal System Insulation, surfacing, miscellaneous) and visual description (e.g., color, appearance, use).

d. The condition (friable/non-friable), and a damage assessment (good, damaged, or significantly damaged) of the homogenous materials.

e. Collection of representative (i.e., AHERA 3-5-7 rule) bulk samples of homogenous materials.

f. Accredited laboratory analysis results of homogenous suspect ACM.

3.3.5 A FLAC shall perform all activities involving the removal or handling of ACM and/or Regulated Asbestos Containing Material (RACM). Licensure is not required if certain criteria are met for moving, removal, or disposal of asbestos containing roofing materials, resilient flooring materials, and exterior conduit or piping where required under FS Chapter 469.002.

3.3.6 Supervisors and/or workers involved in the removal or handling of ACM and/or RACM shall be trained in accordance with Florida Department of Business and Professional Regulation requirements.

3.3.7 All employers who have employees who are required to handle asbestos shall comply with OSHA asbestos regulations (29 CFR Part 1910.1001 or 29 CFR Part 1926.1101).

3.3.8 The project initiator shall follow KNPR 8500.1 for notification to the Florida Department of Environmental Protection (FDEP) for projects involving modifications or demolitions at KSC.

3.3.8.1 Copies of the FDEP asbestos notification shall be provided to the KSC CO. Include a copy of the asbestos inspection (survey) report with the notification submittal. Notification is required as soon as possible before, but not later than, the following working day for any emergency renovation operation or emergency demolition (if the building has been declared structurally unsound and in danger of imminent collapse by a state or local government agency). The asbestos NESHAP (National Emissions Standards for Hazardous Air Pollutants) requirements for a thorough asbestos inspection (survey) prior to the start of the demolition or renovation activity and disposal of waste debris in an appropriate landfill are still applicable for all emergency projects.

3.3.9 If a thorough asbestos inspection is not done prior to the start of the activity and a means of complying with this requirement is not possible, then all of the building waste materials shall be treated as RACM and disposed of in an appropriate regulated landfill per the provisions of 40 CFR 61.150.

3.3.10 Asbestos Management Information System

a. The Asbestos Management Information System (AMIS) database (http://amis.ksc.nasa.gov) is provided to facility managers, system engineers, worksite 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-owned facilities that is available to all employees inside the KSC firewall. To use the AMIS, enter a facility number to review and print specific room survey information.

b. Uses and Limitations of AMIS

(1) The AMIS database is limited in scope and may not include current quantities, conditions, or locations of all suspected asbestos materials.

(2) 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.

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

(4) The AMIS does not include any facilities built after 1988. While the use of ACBM was discontinued after this date, some ACBM like roof sealants and mastics may still be encountered.

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

(6) Printouts of AMIS inspection data are for routine operations and maintenance planning purposes only. The AMIS data by itself does not meet the Environmental Protection Agency's requirement for a current survey prior to demolition/renovation activities. AMIS users are responsible for verification of the accuracy and completeness of survey information at the time facility or system modifications actually occur. Send questions or comments to the KEMCON IH Office.

(7) Category I and Category II non-friable ACM and RACM shall be removed in accordance with OSHA Class 1 or 2 methods of compliance before any activity begins that would break up, dislodge, or similarly disturb the identified or suspected ACM.

3.3.11 Material Labels and Warning Signs

a. Facility managers are responsible for ensuring OSHA required asbestos warning signs/labels are posted on mechanical rooms and service areas containing ACM.

b. The KEMCON IH Office can provide consulting assistance to the facility manager or workplace supervisor in managing/posting warning signs and/or labels.

3.3.12 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 shall 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.

3.3.13 Employee Training and Licensure

a. Asbestos Awareness training in compliance with the OSHA Hazard Communication, Asbestos in General Industry, and Asbestos in Construction shall be provided by the employer as required.

b. 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).

c. Personnel who conduct activities that involve the identified asbestos disciplines, to include inspector, worker, supervisor, project designer, and project monitor, shall receive initial and annual refresher training as specified in 40 CFR part 763 and FAC, Rule 61E1-2.

d. Employers performing asbestos abatement shall be state licensed and certified as specified in FS 469.

3.3.14 Employee Medical Surveillance

The KSC KEMCON 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).

3.3.15 Operations and Maintenance Activities

Operations and maintenance activities shall be conducted in accordance with 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. Facility Management is responsible for maintaining ACM in a good and undamaged condition.

3.3.16 Employee Notification

a. The project manager or the designated construction management representative shall notify facility managers, the KEMCON IH Office, the Fire Department, and the affected safety and health organization of abatement operations.

b. Notification shall include:

(1) Estimated start date and times.

(2) Facility number and name.

(3) Work location(s) or room number(s).

(4) Project Identification Number.

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

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

c. Facility managers shall forward notifications of asbestos abatement to the facility's tenants' points of contact, as required by 29 CFR 1926.1101(d) and 29 CFR 1910.1001(j).

d. Placards, signs, or other notices shall be posted by the responsible operations or construction management organization at the perimeter of regulated areas in a location visible to other employees who work in the vicinity of the abatement operation.

e. In addition to posting requirements identified in 29 CFR 1926.1101, the notice shall 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.

3.3.17 PPE

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

3.3.18 Waste Disposal

a. All asbestos waste shall be disposed of in accordance with 40 CFR 61 and KNPR 8500.1 and handled in accordance with provisions established in 29 CFR 1926.1101, 29 CFR 1910.1001.

b. Friable asbestos waste shall not be disposed of in the KSC landfill.

c. Asbestos waste shall not be disposed of in any unauthorized waste container or location.

3.3.19 Emergency and Mishap Procedures

a. 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.

b. The Emergency Procedure Document (EPD) shall:

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

(2) Ensure notification of the KEMCON 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's Representative (COR) (fixed price contracts).

c. The operational organization responding to an asbestos related emergency shall coordinate corrective actions not addressed in the EPD with the KEMCON IH Office.

3.3.20 Project Management

a. When a project involving the modification or demolition of a facility is proposed, the project manager/designer shall consider the potential hazards associated with ACBM.

b. The Architectural and Engineering (A&E) Firms or project manager/designer shall determine the presence of ACBM and the need for its disturbance or removal in determining the project scope.

c. The A&E or project manager/designer shall ensure 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. A thorough asbestos inspection (survey) is required by a FLAC before any renovation or demolition activity begins, regardless of the age of the building or the building materials, in accordance with section 3.3a.

d. 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 A&E or project manager/designer shall coordinate the review and approval of the design package with the KEMCON IH Office.

3.3.21 Written Compliance Plans

a. Each fixed-price asbestos abatement contractor shall submit a written asbestos abatement plan to the CO that describes implementation of the applicable requirements of 29 CFR 1926.1101.

b. The CO shall provide the asbestos abatement plan to the KEMCON IH Office for review and concurrence prior to the start of the project.

c. Each resident contractor performing in-house facility operations and maintenance shall have a written policy that describes their implementation of the requirements of 29 CFR 1926.1101.

3.3.22 Project Monitoring

Each fixed-price asbestos abatement contractor and/or resident contractor performing asbestos abatement operations as part of in-house facility operations and maintenance activities shall ensure project monitoring in accordance with the applicable requirements of 29 CFR 1926.1101.

3.3.23 Pre-Work Asbestos Abatement Inspection

a. The KEMCON IH Office shall conduct all pre-work inspections for resident contractor work involving the establishment of regulated areas related to asbestos abatement at KSC, complete KSC Form 28-1230, and implement employee exposure monitoring in accordance with 29 CFR 1926.1101 requirements.

b. The Pre-work Inspection Checklist shall be provided to the contractor performing the work by the CO or the CO’s representative.

c. Pre-work inspections for all other NASA-direct contracted (i.e., fixed price construction contract) work is the responsibility of the selected general contractor. Asbestos abatement work shall not begin until the contractor completes a KSC Form 28-1230 and implements employee exposure monitoring in accordance with 29 CFR 1926.1101 requirements.

d. The Pre-work Inspection Checklist shall be submitted to the CO for approval and posted at the worksite. The CO will provide notice to proceed to the contractor.

3.3.24 Final Asbestos Abatement Clearance Inspection

The KEMCON IH Office shall perform all post-abatement workplace inspections for resident contractor work involving the establishment of regulated areas related to asbestos abatement at KSC and complete KSC Form 28-1231 and provide it to the contractor performing the work.

3.3.25 Clearance Inspections for All Other NASA-Direct Contracted (i.e., fixed price contract) Work

a. This work is the responsibility of the selected general contractor. A regulated area shall not be opened until the contractor completes a clearance inspection and submits the report to the CO. The CO will provide approval to re-open a regulated area for normal work. The Contractor may use KSC Form 28-1231 or equivalent report.

b. Airborne fiber levels shall be below a clearance criteria of 0.01 fibers per cubic centimeter for any abatement.

3.4 Hazardous Paints and Protective Coating

This section implements the requirements of 29 CFR 1910 and 29 CFR 1926 as they apply to general industry and construction operations. These provisions apply to occupational exposure to toxic metals (such as cadmium, chromium, lead, mercury, and hexavalent chromium) and polychlorinated biphenyls (PCB) that may be encountered during the demolition, maintenance, and repair of structures where protective coatings contain detectable levels of these agents.

3.4.1 All paints and protective coatings shall be handled in accordance with the requirements of this section.

3.4.2 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.

a. Where SDS for paints and protective coatings are available and indicate the presence of hazardous metals and/or PCBs, sampling is not required.

b. Where the presence of hazardous metals is not determined prior to work, it shall be assumed hazardous metals are present.

3.4.3 Bulk samples shall be collected according to the table below and in sufficient manner to characterize each homogenous area of protective coating. Sample locations will be randomly selected.

Table A – Sample Minimums

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

a. Bulk samples shall be taken in accordance with methods described in American Society for Testing and Materials (ASTM) E1729-99.

b. Laboratory analysis must be performed by an AIHA accredited laboratory.

c. X-ray fluorescence (XRF) may be used for screening, in lieu of bulk sampling and laboratory analysis, to determine the presence of toxic metals (i.e. cadmium, chromium, lead, etc.). If XRF results indicate toxic metals are present, bulk sampling is not required. If XRF results indicate no detectable levels of toxic metals, bulk sampling and laboratory analysis is required.

3.4.4 Analysis results or SDS information shall be obtained by the project designer for work involving the disturbance of these coatings.

a. Where work is to be competed for award to a fixed price contractor, the results shall be provided with the statement of work and specification documents.

b. Where work is to be performed by a KSC tenant organization, the results shall be provided to the tenant safety and health organization performing the work.

3.4.5 Safety and Health Plan

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

b. It is the responsibility of the COR to provide a copy of the plan to the KEMCON IH Office prior to the start of the project.

3.4.6 Notification

a. It is the responsibility of the project manager and/or the responsible construction management point of contact 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's tenants' points of contact and the KEMCON IH Office. Notification shall include:

(1) Estimated start date and times.

(2) Facility number and name.

(3) Work location.

(4) Project Identification Number.

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

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

b. Where a regulated control area is established, placards, signs, or other notices shall be posted by the site supervisor/project manager responsible for construction management at the perimeter of regulated areas 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 and 29 CFR 1926, the notice will identify the type of work in progress, Project Identification Number, and the name and phone number of a management point of contact for project information and for notification in the event of an emergency.

3.4.7 Waste Disposal

All waste streams shall be identified and disposed of in accordance with KNPR 8500.1.

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 KSC.

3.5.1 General

a. Confined spaces are spaces large enough and configured to allow an employee to bodily enter and perform assigned work, have limited or restricted means for exit, and are not designed for continuous employee occupancy.

b. 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.

c. 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, and KNPR 8715.7.

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

3.5.2 Atmospheric monitoring is a requirement of the pre-entry assessment where air contaminants may be present. Continuous monitoring is required where the authorized entrants will 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 not feasible because the space is large or part of a continuous system such as a sewer system.

3.5.3 For confined space entries that rely upon forced air ventilation to control hazardous atmospheres, the atmosphere within the space shall be continuously monitored unless the entry

employer can demonstrate that equipment for continuous monitoring is not commercially available and that periodic monitoring is sufficient.

3.5.4 Confined Space Entry Program Plan

a. 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, 1910.269, and 1926 Subpart AA, this KNPR, and KNPR 8715.3.

b. 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.

c. For fixed price construction contracts that involve working in confined spaces, COs shall require general contractors to provide a copy of their Confined Space Entry Program Plan as an attachment to their Safety and Health Plan.

3.5.5 Confined Space Hazard Evaluation (CSHE)

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

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

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

d. Payload customers are required to submit a confined space hazard assessment using KSC Form 28-1113 per the Launch Site Support Plan requirement at least 30 days prior to the arrival of the spacecraft or other flight hardware at KSC.

(1) The user organization shall submit the completed Payload Confined Space Hazard Assessment form to the Launch Site Support Engineer or other applicable point of contact. The relevant NASA Safety Office is responsible for coordinating the assessment and any requests for reclassification or additional hazard evaluation with KEMCON IH Office and Fire Services.

(2) When processing operations require entry into and work in confined spaces, 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 affecting the overall confined space hazard assessment and subsequent processing operations.

e. The user organization is responsible for developing and coordinating the CSHE with the organization safety and health office, KEMCON IH Office, and Fire Services. 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:

(1) Hazards within or near the space.

(2) Hazards associated with the operations within the space.

(3) Hazard controls.

(4) Entry requirements and procedures.

(5) Emergency rescue requirements.

f. Upon user organization request, the KEMCON IH Office will email the DRAFT CSHE summary to the user's Safety Office for review and approval prior to final report release.

g. The KEMCON IH Office shall issue a CSHE report that identifies:

(1) The representatives who participated in the evaluation.

(2) A description of the confined space.

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

(4) The health and safety hazards in the space and/or hazards associated with the operations performed within the space.

(5) Any hazard elimination and hazard control requirements.

(6) Atmospheric testing requirements for entry including required periodic or continuous monitoring.

(7) Requirements for employee training and certification, including medical certification, respirator use, etc. needed to perform work within the confined space. This shall be provided by the user organization and included in the CSHE report.

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

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

(10) Requirements for self-rescue, non-entry rescue, and entry rescue.

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

h. The KEMCON IH Office is responsible for maintaining a record of all confined space hazard assessment reports and maintaining the Confined Space Inventory.

i. The KEMCON IH Office is responsible for adding CSHE reports to the KSC Confined Space Web site.

j. Fire Services is responsible for developing and maintaining 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.

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

l. 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 KEMCON IH Office following the same procedures as the initial CSHE (see paragraph 3.5.5 c.). Submittals include:

(1) Specific reference to the previous CSHE report document.

(2) A review of permits and activities within the space since the previous evaluation.

(3) Specific reasons for and data to support a reclassification, if applicable.

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

3.5.6 Confined Space Permit System

a. 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 and/or hazard assessment performed at the time of entry.

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

(1) Permit Required Confined Space.

(2) Alternate Procedures Permit Space.

(3) Telecommunications Confined Space.

(4) Electrical Power Confined Space.

(5) Any temporary reclassification of a space.

c. Confined space entry permitting support can be obtained by contacting KEMCON Environmental Health (EH) at KSC-DL-EnvHealth@ndc.nasa.gov or 321-867-2400. Support should be requested no less than 24hours in advance of need.

d. The confined space must be dewatered and ventilated prior to issuance of the entry permit.

e. A written work-authorizing document that specifies entry requirements of the CSHE and meets the requirements of an entry permit may be used in lieu of KSC Form 16-287.

f. Where employees of more than one employer are required to work simultaneously as authorized entrants in a 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.

g. 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.

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

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

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

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

3.5.7 Prior to entry into a confined space the user organization shall ensure:

a. The hazard controls and procedures of the entry plan documented in the CSHE are implemented.

b. The confined space is tested for the atmospheric hazards identified within the space. Atmospheric testing is performed by personnel trained and certified by the user organization to perform the testing (section 3.5.9 below) or KEMCON IH Office.

c. Atmospheric testing is performed using calibrated monitoring equipment. Calibration records are current, available, and retained in accordance with manufacturer and OSHA requirements.

d. Continuous combustible gas monitoring is conducted when work in a confined space involves use of flammable liquids or gases.

e. Entry supervisors, entrants, and entry attendants have required training and certification.

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

g. The permit is signed by the entry supervisor to authorize entry.

h. 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.

i. The entry supervisor verifies the availability of Fire Services for emergency rescue support when rescue support is not on stand-by at the site of entry. In the event that Fire Services is called to an emergency and cannot support rescue for confined space operations, the confined space attendant shall suspend entry into the confined space until Fire Services is available for rescue.

j. The entry is terminated and permit cancelled when the task covered by the entry permit is complete or if a condition arises which is not allowed under the permit.

k. The Entry Permit Action field on the permit form is completed when a permit is cancelled.

3.5.8 An entry log is required for all permit required confined space entries. The entry log on KSC Form 16-287 or other equally effective format shall be used.

3.5.9 Confined Space Training

a. Confined space training and certification is required for all entrants, attendants, and entry supervisors of confined spaces, with the exception of spaces that are classified by OSHA as non-permit required spaces and controlled access areas. Training includes:

(1) Tank and Confined Space Attendant/Entrant QG103KSC

(2) Confined Space Entry (Supervisor) QG341OSH

(3) Confined Space Entry Refresher (CBT) QG102OSH

b. Confined space on-the-job-training (OJT) is required of all entrants, attendants, and entry Supervisors relevant to the confined spaces, tasks, assignments, and duties of the employer. OJT shall include training for authorized emergency rescue personnel and personnel assigned to configure engineering controls (forced air ventilation system, barriers, lighting, etc.) required for safe entry into the space. Entry Supervisors are responsible for ensuring entrants have completed OJT.

c. Medical clearance is required for all personnel entering confined spaces. The medical certification is titled CS. Medical clearance examinations can be schedule through the OHF Web site.

d. Training content shall include elements identified in the applicable standards 29 CFR 1910.146, 1910.268, 1910.269, and 1926 as well as this KNPR, and training must be documented in accordance with the same.

e. Additional training (e.g., fall protection, lock out/tag out) to address specific hazards or entry requirements associated with confined space entry operations may be required by the user organization and shall be listed on the CSHE report.

f. The user organization shall be responsible for implementing an OJT package for the user organization's confined space entrants, attendants, and entrant supervisors.

g. 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.

h. 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 the use of semi-permeable or impermeable protective clothing which are likely to cause heat stress among exposed workers.

3.6.1 Heat Illness Hazard Assessments

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

a. 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.

b. Worksite 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.

c. Workload Assessment – A metabolic workload assessment will be used to determine the workload category of each job being assessed. Guidelines for performing workload assessments are found in the ACGIH TLVs for Chemical Substances and Physical Agents and BEI.

d. 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.

3.6.2 Environmental Monitoring Measurements

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

b. The KEMCON IH Office is responsible for measurement and posting of WBGT measurements and notification to the Heat Stress Hazard website of affected operations' organizations.

3.6.3 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.

3.6.4 Control Measures

When required, an appropriate combination of acclimatization and fluid management, engineering control measures, administrative controls and work practices, and PPE shall be used to reduce risk of heat illness.

3.6.5 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. Hazardous operating procedures shall be in accordance with the KNPR 8715.3-1.

3.6.6 Acclimatization and Fluid Management

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

b. Fluid Replacement – Ample supplies of cool water or other appropriate liquid shall be readily available at the worksite. Employees must be provided frequent opportunities to drink fluids.

3.6.7 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:

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

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

c. Air-conditioning where feasible.

d. Cooling fans. Because this method does not actually cool the air, any increases in air speed must affect 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 (95°F) 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.

e. Shaded work areas.

f. Heat shields and insulation of hot surfaces in the workplace.

3.6.8 Administrative Controls and Work Practices

Examples of effective administrative and work practice controls include:

a. Scheduling hot jobs for the cooler part of the day.

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

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

d. Providing cool rest areas.

e. Using intermittent rest periods with water breaks.

f. Using relief workers.

g. Using worker pacing.

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

3.6.9 PPE

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

a. Commercially available cooling vests.

b. Reflective clothing.

c. Water-cooled garments.

d. Circulating air personal cooling systems, such as vortex coolers.

3.6.10 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. KEMCON IH Office shall determine appropriate worker monitoring requirements based on the heat illness hazard assessment.

3.6.11 Training

a. Employers shall ensure that heat stress awareness is provided for employees who:

(1) Perform work outdoors or in uninsulated shops and equipment sheds.

(2) Work around radiant heat sources.

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

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

3.7 Musculoskeletal Disorder 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.

3.7.1 Signs and Symptoms of Common MSD

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.

Table B - Common MSD

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) 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.

3.7.1.1 MSD Risk Factors

a. 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.

b. 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.

c. Awkward or static postures – Awkward postures often are significant contributors to MSDs because they increase the exertion and the muscle force 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.

d. 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.

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

f. 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).

g. 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 pre-existing condition.

3.7.1.2 MSD Hazard Assessment and Corrective Actions

a. 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 four hours each day.

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

(3) When work-related MSD injuries have occurred.

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

c. JHAs shall be reviewed when there is a significant change to the operation or worksite that could affect ergonomic risk factors or when an employee reports signs or symptoms of an MSD.

d. 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 shall ensure that the employee reports to the KSC clinic for medical evaluation.

e. Upon evaluation, the physician shall determine the necessity for the KEMCON IH Office to conduct an MSD Hazard Assessment.

f. The MSD Hazard Assessment shall identify ergonomic risk factors and provide recommendations for minimizing or abating those risk factors. A written report will be provided to the employee's employer, KEMCON Medical, and the KSC 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 KEMCON IH Office shall contact evaluated employees approximately three 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 KEMCON IH Office shall provide consultation services upon 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.

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

3.7.1.4 Reporting of MSD and Medical Assessment

a. Employees shall promptly report MSD signs and symptoms to their supervisors.

b. 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.

c. 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 KEMCON IH Office as required.

d. The physician's written opinion shall be on the KSC Form 6-2, or Form 16-261. 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.

3.7.1.5 MSD Case Management

a. Each employer is required to provide for MSD case management to include review of completed KSC Form 6-2 or 16-261, JHAs, or hazard assessments, as applicable. Where an employee presents a medical prescription or recommendation for work restrictions or other accommodations, the employer shall coordinate, as needed, with the health care provider to determine appropriate accommodations.

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

(1) 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.

(2) 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 worksite should be initiated by contacting the KEMCON IH Office.

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

3.7.2 The Ergonomics Working Group

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

a. Provide consultative services to KSC management and contractors on items related to ergonomics.

b. Provide a forum for the discussion and resolution of ergonomics issues.

c. Assist the KSC IHO in the development and maintenance of KSC MSD management policies.

d. Keep members abreast of current developments in ergonomics.

3.8 Indoor Air Quality

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 within their respective contracts.

Workers are often concerned that 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.

3.8.1 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:

a. Irritation of the eyes and upper respiratory tract.

b. Headache.

c. Fatigue or drowsiness.

d. Shortness of breath.

e. Sinus congestion.

f. Coughing and sneezing.

3.8.2 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.

a. 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.

b. 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.

c. 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.

3.8.3 Facility Design and New Construction

Facility design shall endeavor to maintain a comfortable working environment through procurement and design of building Heating, Ventilating, and Air Conditioning (HVAC) systems that meet American Society for Heating, Refrigeration, and Air Conditioning Engineers 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 KEMCON IH Office to assess the adequacy of controls planned for the management of air contaminant sources.

3.8.4 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 the migration of construction dust or chemical odors to occupied areas. Renovation plans will be reviewed by the KEMCON IH Office to assess the adequacy of controls planned for management of air contaminant sources.

3.8.5 Work area Inspection and Preventive Maintenance

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

(1) Visible water intrusion and water leaks.

(2) Visible water condensation on cold surfaces.

(3) Poor housekeeping and dust accumulation.

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

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

(6) Unpleasant or unexplained odors.

b. Facility HVAC and maintenance organizations are responsible for inspections to ensure the 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 shall be inspected for:

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

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

(3) Damaged or overloaded filters.

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

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

c. Mold remediation shall be in accordance with KSC-UG-1903.

d. Pest Control shall ensure that only water-based, low volatility pesticides are used inside occupied facilities.

e. Facility Managers are responsible for:

(1) Ensuring that 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.

(2) Ensuring smoking at a facility is in compliance with KNPD 1216.1.

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

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

f. Employees are responsible for ensuring that 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.

3.8.6 Reporting IAQ signs and symptoms

a. Employees shall report signs and symptoms that they believe may be related to IAQ to their supervisors.

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

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

3.8.7 IAQ Hazard Assessment

a. The KEMCON IH Office will perform an evaluation of the location(s) to identify possible causes of poor IAQ and recommend remedial or corrective actions.

b. 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.

c. When performing IAQ evaluations, IH personnel shall:

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

(2) Perform visual inspections and follow-on sampling as required to identify possible sources of poor IAQ.

(3) Inspect carpeting and furnishings to determine their condition and cleanliness.

(4) Inspect supporting HVAC (i.e. air handling equipment, plenums, distribution ductwork, etc.), as needed.

(5) Complete a Facility IAQ Assessment Score Sheet (KSC Form 28-1212).

(6) Review findings with representatives in the Facility Operations and Maintenance and Safety and Health Offices to develop a recommended corrective action plan.

(7) 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 and Facility Management copied on reports that have corrective actions that include maintenance and repair services.

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

3.8.8 IAQ Work Orders

a. Facility Management shall ensure that work orders are submitted for corrective actions requiring repair or maintenance services.

b. Work orders shall include a safety risk assessment code where required by the Institutional Services Contract.

c. A separate work order shall be submitted for each task required to satisfactorily resolve an IAQ corrective action where feasible.

d. The Industrial Hygiene Office will perform follow-up IAQ evaluations to validate that actions were sufficient to improve air quality in the facility as needed.

3.8.9 IAQ Working Group

The IAQ Working Group serves as a government and contractor forum, chaired by KEMCON, 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 working group shall:

a. Provide consultative services to KSC management and contractors on items related to facility IAQ.

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

c. Maintain an index of Facility IAQ Assessment Scores and facility locations ranked according to IAQ severity, in order to track the satisfactory resolution of work orders required to correct IAQ problems.

d. Review the status of corrective actions and work orders and, as appropriate, update Facility IAQ Assessment scores on their resolution.

e. Provide a forum for discussion and resolution of issues related to stakeholders for IAQ at KSC and CCAFS.

f. Assist the KSC IH Office in the development and maintenance of IAQ policies and requirements.

g. Keep members abreast of current developments in the management of IAQ.

3.9 Hazardous Material Procurement

Organizations procuring hazardous materials are required to have a procurement process which provides competent persons with the knowledge and skills to identify hazardous substances and articles who are responsible for reviewing procurements and authorizing procurements of hazardous materials.

3.9.1 The competent person shall:

a. Identify baseline hazards associated with the acquisition.

b. Determine safety and health requirements for the safe use of the material or equipment.

c. Coordinate implementation of safe use requirements with the procurement originator.

3.9.2 Where feasible the procurement shall:

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

b. Procure the smallest quantity required to perform the required work.

3.10 Laboratory Operations

3.10.1 Safety and Health Management Policy

This section establishes Safety and Health management policy for laboratory operations in chemical, biological, and physical science laboratories operated by NASA KSC Civil Service employees and support contractors.

a. For the purposes of this section, Laboratory Operations means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. This includes work that would normally be conducted within a laboratory, but may also include associated work in field settings.

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

c. Each organization shall appoint a laboratory point of contact who will be responsible for developing, implementing, and updating Chemical Hygiene or Laboratory Safety Plan(s) that satisfy the requirements of 29 CFR 1910.1450, where applicable, and for reviewing procurements of chemicals and equipment used in the laboratory. The point of contact 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, written plans for the management of chemical and physical hazards 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 employees or contractors act as the controlling employer with operational control over a laboratory, the written plans shall incorporate procedures to coordinate operations with other employers participating in the laboratory operations (e.g. hazardous operations, required PPE, employee training) which apply to all permanent laboratory staff as well as authorized guests (i.e. subcontractors, visiting scientists, and student interns) with access to laboratory facilities.

f. Task-specific safety and health requirements shall be in the form of an auditable business record and will identify associated hazards and special precautions for the safe use of the equipment or completion of the operation. 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 or to document project-specific hazards in Research and Development laboratory settings. KSC Form 50-211 NS may be used.

(2) Operating procedures used for repetitive laboratory operations.

(3) Manufacturer's operating instructions or laboratory-developed operating instructions.

g. Chemical Hygiene and Laboratory Safety Plans, JHAs, operating procedures, and laboratory-developed operating instructions shall be maintained as auditable business records.

h. Laboratory Management is responsible for ensuring that JHAs or written operating procedures are available for operation of 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. JHAs or an equivalent method shall be used for the development of operating procedures and laboratory-developed operating instructions.

i. Chemical Hygiene and Laboratory Safety Plans, JHAs, operating procedures, and laboratory-developed operating instructions shall be provided to the responsible safety organization and KEMCON IH for review. Laboratory Management is responsible for coordinating this safety review and resolving safety and IH comments.

j. Upon completion of the review, Laboratory Management is responsible for incorporating the safe use requirements into the appropriate JHAs, operating procedures, and laboratory-developed operating instructions before authorizing work to proceed.

k. Where Safety or EH identifies work packages that require approval of the Ground Risk Review Panel or higher authority, Laboratory Management is responsible for coordinating review and approval of the procedure.

3.10.2 Training

a. All laboratory employees working in laboratories meeting the requirements of 29 CFR 1910.1450 are required to complete Laboratory Safety (QG216KSC).

b. All laboratory employees are required to complete QG320OSH, OSHA HazComm 2012, QG321 OSHA HazComm 2012 Refresher (when appropriate), or KSC-003-007 Hazard Communication for Chemical Users.

c. 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.

d. Laboratory supervisors are responsible for ensuring laboratory personnel have reviewed and demonstrated understanding of 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

3.11.1 The project manager/designer shall ensure that the A&E contract statement of work requires A&Es to identify potential hazards (e.g., asbestos, hazardous coatings) associated with the project. It is the responsibility of the project designer to ensure that all identified hazards are

communicated in any statement of work or other work control package provided to fixed-price or resident contractor organizations who will be performing the work.

3.11.2 It is the responsibility of the project's CO to ensure that the safety and health requirements identified in the 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.

3.11.3 Designs or modifications to 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 KSC IHO or the KEMCON IH Office. Examples of specific design applications are discussed in Section 3.2 of this document.

a. Design packages must be submitted to KEMCON IH Office for review during the normal design review cycles (typically 30, 60, and 90 percent) for review. Design packages should include the Document Release Authorization (KSC Form 21-68V2) with all available design data and task requirements.

b. The project designer must determine if hazardous materials may be involved during the project. Evaluation and testing of suspect hazardous materials potentially involved in a project must be conducted during the project design. If suspect asbestos materials may be involved in the project, an asbestos survey report, per requirements in Section 3.3, shall be included in the design package. Potential hazards can be assumed to be present and applicable requirements met in the project.

c. The final design package must include all potential hazards (e.g. asbestos or hazardous coatings) associated with the project.

3.11.4 Design Review process

a. KEMCON Environmental Point of Contact shall attend design review meetings and identify plans involving health protection requirements for review by KEMCON IH.

b. KEMCON IH shall review project designs and submittals to ensure compliance with applicable health protection requirements. KEMCON will provide engineering design review comments to the project manager/designer.

3.11.5 Site Specific Safety and Health Plan Submittals

a. The COR shall forward SSSHP submittals for review by KEMCON IH to KEMCON Work Control at KSC-DL-EnvHealth@ndc.nasa.gov or IMSS-022.

b. Where required by OSHA, the SSSHP shall include, but not be limited to, the contractor's written compliance plans for asbestos abatement, respiratory protection, confined space entry, hazard communication, and JHAs.

c. It is the responsibility of the CO to ensure the SSSHP includes the additional OSHA-required written compliance plans and is provided to KEMCON IH for review prior to approval and commencement of subcontractor work.

3.11.6 Pre-work meetings

It is the responsibility of the CO or the COR to notify the KEMCON IH work control of pre-work meetings with construction contractors. KEMCON IH shall attend pre-work meetings as necessary to review health protection requirements for work at KSC.

3.11.7 On-site Safety “Nuts and Bolts” meetings

It is the responsibility of the CO or the COR to ensure that KEMCON IH work control is notified of Nuts and Bolts meetings with construction contractors. Nuts and Bolts meetings will be scheduled as needed to address environmental health support requirements or scheduling issues related to the project.

3.11.8 Inspections and Audits

a. KEMCON IH shall perform unscheduled construction worksite audits for health program compliance.

b. It is the responsibility of the COR to notify KEMCON IH Work Control of construction project start/implementation dates and schedules.

c. KEMCON IH shall coordinate site audits with the site superintendent or site supervisor and the Government construction management representative and obtain worksite hazardous operation conditions and entry/PPE requirements.

d. The site superintendent or site supervisor as well as the Government construction management representative shall be provided an opportunity to accompany the IH during the site audit or inspection.

e. KEMCON IH is authorized to issue a stop work order (SWO) if an Imminent Danger/hazard situation is identified. The CO, COR, and Government construction management representative shall be immediately notified of any SWO issued by KEMCON IH.

f. 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 Government construction management representative, when available, and a written summary of the findings to the CO, COR, and Government construction management representative.

g. It is the responsibility of the CO to coordinate corrective actions or satisfactory resolution of the findings with the prime contractor.

3.12 Oxygen Deficiency Hazard Assessment

Oxygen deficiency hazards (ODH) exist wherever there is a potential for the displacement or depletion of atmospheric oxygen. Assessment of ODH in confined spaces is described in Section 3.5. Hazard assessments for oxygen enriched atmospheres are not addressed in this document. Contact the Fire Services authority having jurisdiction for guidance on oxygen enriched atmospheres.

3.12.1 General

a. Oxygen Deficiency Hazard Assessments (ODHA) shall be performed to evaluate and document employee exposures to oxygen hazards.

b. ODHAs shall be based on the worst case credible scenario(s) for creation of hazardous oxygen atmospheres.

c. The requesting organization will be responsible for providing information, such as sources of hazard, credible leak rate, volume of space, etc., and assistance to the KEMCON IH office for completion of the assessment.

d. Upon completion of the assessment, a written report shall be provided. KEMCON IH will identify requirements and recommend mitigating actions, as needed.

3.12.2 Oxygen Hazard Risk Classification

As a part of the ODHA, a risk assessment shall be completed using the probability and severity rankings in the tables below to determine the risk classification using the 5x5 Probability/ Severity risk matrix described in the Oxygen Deficiency Risk Matrix Table.

Table C: Oxygen Deficiency Risk Classification Table

Oxygen Deficiency Risk Probability			
Level	**Probability**	**Qualitative Criteria**	**Quantitative Criteria**
			Safety
5	Very High	Highly likely. Existing controls have little or no effect and cannot prevent this risk scenario; no alternative controls are available. Includes planned events using inert atmospheres and operations with history of oxygen deficient atmospheres.	$P > 10^{-1}$
4	High	Likely. Existing controls have significant limitations and/or uncertainties and cannot prevent this risk scenario; additional actions will be required. Includes operations with history of oxygen deficient atmospheres.	$10^{-2} < P \leq 10^{-1}$
3	Moderate	Could happen. Existing controls have some limitations and/or uncertainties and may prevent this risk scenario; additional actions may be required.	$1\,0^{-3} < P \leq 10^{-2}$
2	Low	Unlikely. Existing controls have minor limitations and/or uncertainties and usually are sufficient to prevent this risk scenario; some additional actions may be required.	$10^{-6} < P \leq 1\,0^{-3}$
1	Very Low	Highly unlikely. Existing controls are strong and are expected to prevent this risk scenario.	$P \leq 10^{-6}$

Table D: Oxygen Deficiency Severity Classification Table

Oxygen Deficiency Severity		
Level	**Severity**	**Qualitative Criteria**
5	Very High	Oxygen (O_2) content is less than 6%, spasmodic breathing, and convulsive movements, death within 5 to 8 minutes. This level of O_2 content may cause loss of life.
4	High	O_2 content between 12% and 6%, nausea, vomiting, loss of consciousness, brain damage, coma. These levels of O_2 may cause permanent, severe injury, impairment, or incapacitation.
3	Moderate	O_2 content between 16% and 12%, faulty judgment, rapid fatigue, very poor coordination, loss of consciousness. These levels of O_2 content may cause long-term, severe injury, impairment, or incapacitation.
2	Low	O_2 content between 19.5% and 16%, dizziness, impaired judgment, impaired coordination, increased breathing, reaction time doubled. These levels of O_2 content may cause short-term, minor injury or incapacitation.
1	Very Low	O_2 content between 20.9% and 19.5%, normal working conditions. No physiological impairment

Table E: Oxygen Deficiency Risk Matrix Table

Probability	Very High	**5**	***0***	***3***	***4***	***4***	***4***
	High	**4**	***0***	***3***	***4***	***4***	***4***
	Moderate	**3**	***0***	***3***	***4***	***4***	***4***
	Low	**2**	***0***	***2***	***2***	***2***	***2***
	Very Low	**1**	***0***	***1***	***1***	***1***	***1***
			1	**2**	**3**	**4**	**5**
Green	Yellow	Red	Very Low	Low	Moderate	High	Very High
		Severity					

3.12.3 Oxygen Hazard Mitigations

Based upon the oxygen deficiency hazard control (ODHC) level, the following mitigations are required:

Table F: ODHC Mitigations Required

	ODHC				
Hazard Controls	**0**	**1**	**2**	**3**	**4**
1. Warning Signs		X	X	X	X
2. Ventilation			X	X	X
3. Controlled Access Area		X	X	X	X
4. Written Hazardous Operating Procedure				X	X
5. Oxygen Deficiency Hazard (ODH) Awareness Training (On the job training)		X	X	X	X
6. Oxygen Deficiency Monitoring		X	X	X	X
7. Breathing Escape Unit per KNPR 1820.4(*)			X	X	X
8. Prohibited entry into inerted spaces					X
9. Attended Entry*					X
10. Self-Contained Breathing Apparatus (SCBA)*					X

X = Required
**=requirements will vary according to location*

3.12.4 Key to ODHC Control Measures

a. Warning Signs – Entries posted with Warning (Hazard Class 0-2) or Danger (Hazard Class 3-4) signs. For inerted spaces.

b. Ventilation – The minimum ventilation rate during occupancy shall be at least one volume change per hour. This may be accomplished by any reliable means.

c. Controlled Access Area – Operations organization shall provide access controls to prevent unauthorized entry.

d. Written Hazardous Operating Procedure - as required by KNPR 8715.3-1.

e. ODH Training – Potentially affected individuals shall receive training in oxygen deficiency hazards and safety measures associated with their operations.

f. Oxygen Monitoring – Oxygen monitoring is required for entry into Class 1-4 areas. Selection of oxygen monitoring device will be determined by the controlling employer in coordination with Environmental Health. OJT on the use of oxygen monitoring devices shall be provided to individuals who are issued this equipment.

g. Breathing Escape Unit – Breathing Escape Units shall be deployed per KNPR 1820.4.

h. Prohibited entry – Entry into inerted atmospheres is prohibited.

i. Attended Entry – ODH trained personnel shall maintain continuous communication with an observer who is not exposed to the oxygen deficient environment. This person must be responsible for summoning Emergency Service should the need arise.

j. Self-Contained Breathing Apparatus (SCBA) – ODH trained/qualified personnel shall wear SCBA during the operation or task when required by the EH ODHA. Entry into known or potential IDLH (Immediately Dangerous to Life and Health) atmospheres is permitted only under certain conditions. When such entries are made, they must utilize SCBA and have equally equipped standby backup personnel. All entries into such environments will have an attendant and require concurrence from the KEMCON IH office.

3.13 Biological Safety Program

3.13.1 This section establishes the roles, responsibilities, and procedures for implementing a biosafety program as required by NPR 1800.1D. These requirements address the use of infectious agents; biological materials, whether modified/not modified, progeny, or derivatives; or other biological substances that can pose a threat to living organisms such as specimens, cultures, viruses, toxins from biological sources in research or clinical labs. These requirements also address activities involving plant, animal or human specimens in support of NASA research operations. This section provides Center direction that will be used in conjunction with applicable statutory, regulatory, and NASA agency requirements.

3.13.2 Biological Safety Officer

Directors of organizations responsible for the operation of facilities that use biological agents shall appoint a common Biological Safety Officer to act as a point of contact for biological safety and who will be responsible for developing, implementing, and updating Biological Safety Plan(s) that meet the requirements of NPR 1800.1D and this KNPR. Personnel assigned as Biological Safety Officer are required to have training in the life sciences in order to have an understanding of laboratory and clinical practices, regulatory and consensus body knowledge on how to properly manage the material(s), the physiological action of biologically hazardous materials, and the means to recognize, evaluate, and control those hazards.

a. General Requirements

(1) Materials that require Animal Biosafety Level (ABSL) ABSL-3, ABSL-4, Biosafety Level (BSL) BSL-3/3P, or BSL-4/4P control practices and facilities are prohibited on site.

(2) Materials that require ABSL-2 or BSL-2/2P control practices and facilities shall be used only after receiving approval of the organization biological safety officer (BSO).

(3) Materials that require ABSL-1 or BSL-1/1P control practices and facilities shall be used in accordance with a Laboratory Safety Plan approved by the organization biological safety officer or NASA BSO.

(4) Ensure all of the elements of this biological safety program are developed and in-place (appropriate for the material and the potential hazards the material presents) *prior* to receipt of the material on-site. KEMCON IH Office is available to assist with the development of health and safety protocols/procedures if needed.

b. Biological Safety Officers shall:

(1) Ensure that all biohazardous work is conducted in accordance with NASA policies, World Health Organization and Center for Disease Control Guidelines, and all other applicable regulations as they pertain to the operation and management of the material.

(2) Ensure that all biohazardous work involving human subjects is reviewed and approved by the appropriate Institutional Review Board.

(3) Prepare Biological Safety Plans that document the hazards, risk assessment, hazard controls, medical monitoring, waste disposal methods, and training to be provided where genetically-modified or pathogenic agents are used.

(4) Review and approve the use of biological agents used within their Organization.

(5) Validate that applicable medical monitoring and clearance requirements are maintained for employees, visitors, and visiting researchers who handle genetically-modified or potentially pathogenic agents. Human body fluids and tissues, blood borne pathogens, and other potentially infectious material are covered under the Organization's Blood Borne Pathogen Plan.

(6) Validate that employees, visitors, and visiting researchers who work with, or could be exposed to any of the materials addressed in this section receive appropriate training.

(7) Maintain an list of all organisms in the facility (whether being actively used or in storage). Information in this inventory shall include: Organism type; organism genus, species, and strain; organism identification number (if available); organism growth media and temperature; and organism storage location including building and room number.

(8) Maintain a list of all ongoing projects involving microorganisms that includes Principle Investigator name, project name, project location, and procedure numbers.

3.14 Reproductive and Developmental Health

Reproductive and developmental hazards (e.g. chemicals or physical hazards that affect the health of reproductive organs, fertility, or embryonic and fetal development) will be evaluated within the scope of health hazard assessments described in Chapter 2 of this KNPR and the Radiation Use Authorization assessment in Chapter 3 of KNPR 1860.1. This section is provided to provide additional detail for implementing Reproductive and Developmental Health policy for the Kennedy Space Center.

3.14.1 Assessment and Management of Reproductive and Developmental Health Hazards

a. As described in Chapter 2, it is the responsibility of the employer to initiate an initial HHE to determine the existence of reproductive and developmental hazards in the workplace and identify tasks that require further evaluation.

(1) OSHA Standards that include consideration of reproductive hazards include ethylene oxide (ETO) (29CFR 1910.1047), lead (Pb) (29CFR 1910.1025 and 1926.62), 1,2-dibromo-3-chloropropane (DBCP) (29CFR 1910.1044 and 1926.1144), and cadmium (Cd) (1910.1027).

(2) Lists of chemical (including pharmaceutical), biological, and physical agents that are known to cause adverse reproductive and developmental toxicity in humans or in animals by mechanisms directly applicable to humans are listed in the below references. (1,2,3)

b. Where an HHE report or other hazard assessment identifies a reproductive or developmental hazard, it is the responsibility of the employer to notify their affected employees of the hazard and implement appropriate exposure controls. Employee training on reproductive and developmental hazards in their workplace shall be consistent with the requirements of the OSHA Hazard Communication Standard.

c. Where an HHE identifies a reproductive or developmental health hazard, the KEMCOM IH or Health Physics office, as appropriate, shall coordinate with affected employer(s) to determine feasible hazard control measures necessary to keep exposures as low as reasonably achievable.

d. Where a Radiation Use Authorization determines that potential exists for ionizing radiation exposure, KEMCON HP will provide female workers information on the occupational exposure limits implemented to further protect an embryo or fetus (See reference document [3] below). After KEMCON HP consultation and upon formal declaration of pregnancy, occupational radiation dose reduction limits to an embryo or fetus will be applied.

3.14.2 Employee Consultation on Reproductive and Developmental Health Hazards

a. Employees may consult with OHF physicians to discuss information about reproductive and developmental hazards. Consultation can include the Center policy, discussion of workplace hazards of concern, and work practices that may be followed that can reduce the hazard exposure. It is acknowledged that some employees may choose to maintain their pregnancy status as confidential for a time. However, the involvement of their employer is essential in managing exposures to potential Reproductive and Developmental Health Hazards. Every employee is encouraged to involve her supervisor in all work-related discussions.

b. Female employees who wish to declare an actual, suspected, or intended pregnancy, or others with concerns regarding potential exposure to reproductive or developmental hazards in the workplace, shall complete the Reproductive and Developmental Health Hazard Questionnaire (KSC Form 28-1908V2). It is the responsibility of the employee to provide copies to the employee's supervisor and to the OHF.

c. An OHF physician will review the Questionnaire and past Environmental Health reports and, where appropriate, request the KEMCOM IH office conduct an HHE to determine if there is potential exposure to a reproductive or developmental hazard, and, if there is, to what extent that exposure might occur (amount, concentration level, frequency, and duration).

d. It is the responsibility of the employee to provide the Reproductive and Developmental Health Hazard Questionnaire, applicable HHE, and pertinent SDS to the employee's personal physician for review.

e. The OHF Physician shall, in consultation with the employee and the employee's physician, determine any special conditions and limitations, including a temporary change of duties or assignment. This consultation should describe what duties she can perform, and under what conditions these duties can be performed.

f. It is the responsibility of the employee to provide the physician's written limitations to their supervisor. The work restrictions or limitations shall be implemented in accordance with the employer's safety and personnel policies.

g. For Civil Service employees, the Aerospace Medicine and Occupational Health Branch will coordinate with the employee's supervisor and Human Resources to make every reasonable effort to accommodate these requests.

(1) Reproductive and Developmental Hazards: A Guide for Occupational Health Professionals, Navy and Marine Corps Public Health Center Technical Manual NMCPHC-TM-OEM 6260.01C April 2010

(2) Workplace Hazards to Reproduction and Development: A Resource for Workers, Employers, Health Care Providers, and Health & Safety Personnel Washington State Department of Labor and Industries Technical Report Number: 21-3-1999, August 1999

(3) Instruction Concerning Prenatal Radiation Exposure, U.S. Nuclear Regulatory Commission Regulatory Guide 8.13, Revision 3, June 1999

APPENDIX A. DEFINITIONS

Action Level – The concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight-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 potentially 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.

Animal Biosafety Level – Four standard biosafety levels described for activities involving infectious disease work with commonly used experimental animals.

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

Biological Agent – Materials including bacteria, viruses, fungi, other microorganisms, plants, animals, and their associated toxins, that have the ability to adversely affect human health.

Biological Hazard – A threat to the health of living organisms posed by a biological agent.

Biosafety Level – Descriptions of combinations (levels 1 through 4) of laboratory practices and techniques, safety equipment, and laboratory facilities. Each combination is specifically appropriate for the operations performed, the documented or suspected routes of transmission of the infectious agents, and the laboratory function or activity.

Breathing Zone – OSHA defines the breathing zone as “a hemisphere forward of the shoulders with a radius of approximately six to nine inches of the nose or mouth.” The breathing zone sample represents the atmosphere in which the employee would inhale and be exposed to during normal working conditions. Sampling in this area would constitute “personal sampling/monitoring.”

Chemical Agent – A dust, gas, vapor, fume, or liquid that acts on or reacts with the human physiological system.

Chemical Hazard – A threat to the health of living organisms posed by a chemical agent.

Control Banding – A qualitative risk management process where the assessment of toxicity and a limited number of exposure factors leads to an exposure control scheme for a particular substance, as described by the AIHA Control Banding Working Group in Guidance for Conducting Control Banding Analyses or the UK Health and Safety Executive Control of Substances Hazardous to Health.

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, preventing the escape of hazardous materials or physical agents into the workplace, or controlling them after release so as to limit or prevent occupational exposures.

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 of 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/or decreased temperature.

Hazardous Chemical or Hazardous Material – Any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified.

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.

Immediately Dangerous to Life or Health – An atmosphere that poses an immediate threat to life would cause irreversible adverse health effects or would impair an individual's ability to escape from a dangerous atmosphere.

Imminent Danger – Any condition or practice which could reasonably be expected to cause death or serious physical harm.

Industrial Hygiene (IH) – Industrial hygiene is the science of protecting and enhancing the health and safety of people at work and in their communities as well as the prevention of occupational illness or disease associated with exposures to chemical, physical, biological, and ergonomic stressors by anticipating, recognizing, evaluating, and controlling those hazards.

Inerted Atmosphere – A gaseous mixture that contains little or no oxygen and primarily consists of non-reactive gases or gases that have a high threshold before they react. Nitrogen, argon, helium, and carbon dioxide are common components of inert gas mixtures.

Job Hazard Analysis (JHA) – A written assessment of the safety and health hazards associated with job tasks before they occur, focusing on the relationship between the worker, the task, the tools, and the work environment.

Laboratory Hood – Systems designed to enclose or capture and remove contaminated air at the source. They are not HVAC systems.

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 (MSD) – Injuries and disorders that affect the human body's movement or musculoskeletal system (i.e. muscles, tendons, ligaments, nerves, discs, blood vessels, etc.)

National Voluntary Laboratory Accreditation Program (NVLAP) – A program administered by the U. S. 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 U. S. Department of Labor regulatory and enforcement agency created for implementation of the Williams-Steiger 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 and 1926.

Physical Agent – 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 – Different from the physical agent because a physical hazard is 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.

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

Regulated Asbestos Containing Material (RACM) – Is friable ACM, or Category I or category II nonfriable ACM that has become or has a high probability of becoming friable.

Stop-Work-Order (SWO) – A recommendation issued to stop work upon observing an Imminent Danger situation at a worksite. An SWO must be immediately coordinated with the NASA Contracting Officer, COR, and/or Safety Office.

Thermal System Insulation (TSI) – Insulation material applied to pipes, fittings, boilers, breeching, tanks, ducts, or other interior structural components to prevent heat loss or gain.

Threshold Limit Value (TLV) – Established by the ACGIH as a reference to airborne concentrations of substances and representing conditions under which it is believed that nearly all workers may be repeatedly exposed day after day, over a working lifetime, without experiencing adverse health effects. The TLVs are published periodically in the TLVs for Chemical Substances and Physical Agents in the Work Environment.

Time-Weighted Average (TWA) – The average concentration of a contaminant in air during a specific time period. The typical TWA concentration is provided for an 8-hour day and a 40-hour workweek although exposure times can be adjusted to reflect longer work hours, if needed.

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

ABSL	Animal Biosafety Level
A&E	Architectural and Engineering
ACBM	Asbestos Containing Building Materials
ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos Containing Material
AHERA	Asbestos Hazard Emergency Response Act
AIHA	American Industrial Hygiene Association
AMIS	Asbestos Management Information System
ANSI	American National Standards Institute
BEIs	Biological Exposure Indices
BSO	Biological Safety Officer
CAS	Chemical Abstract Service
CFR	Code of Federal Regulations
CO	Contracting Officer
CoF	Construction of Facilities
COR	Contracting Officer Representative
CSHE	Confined Space Hazard Evaluation
dBA	Decibel
EH	Environmental Health
EPA	Environmental Protection Agency
EPD	Emergency Procedure Document
FAC	Florida Administrative Code
FAR	Federal Acquisition Regulation
FDEP	Florida Department of Environmental Protection
FLAC	Florida Licensed Asbestos Consultant
FS	Florida Statute
HHE	Health Hazard Evaluations
HVAC	Heating, Ventilating, and Air Conditioning
IAQ	Indoor Air Quality
IAQWG	IAQ Working Group
IAW	In Accordance With
IDLH	Immediately Dangerous to Life and Health
IH	Industrial Hygiene
IHO	Industrial Hygiene Officer
JHA	Job Hazard Analysis
KISS	Kennedy Institutional Support Services
KNPD	Kennedy NASA Policy Directive
KNPR	Kennedy NASA Procedural Requirements
KSC	Kennedy Space Center
KEMCON	Kennedy Environmental and Medical Contract
MSD	Musculoskeletal Disorder
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 Program
ODH	Oxygen Deficiency Hazard
ODHA	Oxygen Deficiency Hazard Assessments

ODHC	Oxygen Deficiency Hazard Control
OJT	On-the-Job-Training
OHF	Occupational Health Facility
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated biphenyls
PPE	Personal Protective Equipment
RACM	Regulated Asbestos Containing Material
SCBA	Self-Contained Breathing Apparatus
SDS	Safety Data Sheets
SSSHP	Site Specific Safety and Health Plan
SWO	Stop Work Order
TLV	Threshold Limit Values
TWA	Time-Weighted Average
UUPIC	Universal Uniform Personal Identification Code
WBGT	Wet Bulb Globe Temperature
WHAAG	Worker Health at a Glance
XRF	X-ray Fluorescence

APPENDIX C. TABLES

Table G – 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. • Repetitively using a stapler, hole-puncher, or other document preparation device for more than 2 hours a day. • Repetitively performing any task for more than 2 hours a day.		• Take short (5 min) breaks away from repetitive tasks. • Use automated equipment, such as an electric stapler. • Alternate keyboard work with other tasks. • Try using keyboard commands instead of using the mouse. • Try switching hands to operate a mouse.
Awkward or Static Posture		
Back	• Back is awkwardly bent or twisted. • Lower and upper back not fully supported by workstation chair. • Chair is not comfortable.	• Position computer monitor and keyboard directly in front of operator. • Adjust chair in order to sit in an upright or slightly reclining position with lower and upper back supported by chair. • 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. • Upper arms are held away from the body. • Upper arms and forearms are held at an acute (<90 degree) angle. • Over-reaching with an arm to operate the mouse. • 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. • 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. • Move frequently used items within reach. • Keep mouse adjacent to keyboard. If necessary: ▪ use a retractable keyboard tray if desk surface does not have adequate room or if chair cannot be raised to desk height. ▪ use an alternative mouse such as a trackball, or roller mouse ▪ 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. • Adjust keyboard slope to a flat or negative tilt position to achieve neutral wrist posture. • Use an alternative style keyboard or mouse, if necessary to keep wrists from being deviated (positioned inward or

		outward) or to reduce contact stress with desk.
Legs Knees Feet	• Inadequate legroom. • 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. • If a computer is used in the corner of an L shape workstation, try using a corner piece to bring the keyboard closer to the body. If necessary, obtain another desk or use a retractable keyboard tray. • After adjusting chair height, use a footrest if necessary.
Neck	• Employee must twist neck to view computer monitor while keyboarding. • Employee must bend neck to view monitor. • Employee must bend/twist neck to view documents being copied. • 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. • Raise or lower the computer monitor so that top of monitor is approximately at eye level. • For employees with bifocals lower monitor to point where it can be viewed with neutral neck posture. • Use an adjustable document holder to hold documents at eye-level and next to or in front of the computer monitor. • Dual monitors should be positioned at the same height with keyboard centered in front. • Use a speakerphone or headset.
Static Posture	• Operator sits at computer workstation without interruption.	• Alternate keyboard work with other tasks to allow moving around. • Change positions frequently and if able perform stretching exercises. • 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. • 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. Do not use hard or firm wrist rests. • “Float” wrists above keyboard while typing. • Use a footrest to raise thighs and keep feet stable. • Use a chair that has a seat pan (width and depth) that accommodates the user. • Use a chair that has cushioned and rounded (“waterfall”) front. • 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. • Use soft padded gripping devices with writing instruments. • Use a mouse that adequately fits hand or use alternate device (trackball, roller mouse, upright mouse, etc.) • Ensure that ball on the bottom of the mouse is clean. • Ensure that the area used in operating the computer mouse is large enough. • 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. • The VDT has excessive glare. • Low illumination levels are present where the operator views documents.	• Place monitor just past arm’s length (18” to 30”). • If necessary, use a retractable keyboard tray to increase monitor viewing distance. • Minimize monitor glare by using a visor around the monitor, a glare screen, or by adjusting monitor away from light sources. • Adjust the color, brightness and contrast on VDT to minimize eye-strain. • 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.

Table H – 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. • 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. • Use tools with multiple finger triggers. • Use automated equipment, when able. • See recommendations for keyboard and mouse use in Table G.
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. • Prolonged sitting without lower and/or upper back not fully supported by workstation chair. • Chair is not comfortable.	• Perform task in a location, which minimizes bending and twisting. • If necessary, elevate item on workbench or lower workbench. • Adjust chair in order to sit in an upright position. • 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. • If applicable, consider using a sit/stand chair. • Consider designing tools to enable work to be performed with a neutral back posture.
Arms	• Forearms are not parallel to floor. • Forearms are not supported. • Upper arms are not vertical and close to the body. • Elbows are not at a 90^{o} angle. • Over-reaching with an arm to reach for an object. • 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. • Use chair armrests, forearm support devices or a forearm support board for forearm support. • Move frequently utilized items within arm's reach and at waist height. • 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 Knees Feet	• When sitting thighs are not parallel to floor. • When sitting knees are not at a 90^{o}-110^{o} angle.	• Adjust chair height to keep thighs parallel to floor. • Use a footrest to raise thighs and keep feet flat on the floor.

	• When sitting feet are not flat on the floor or on a footrest. • Inadequate legroom. • Kneeling or squatting for more than 2 hours total per day. • Bending of ankle.	• Remove objects or drawer from under the workbench to allow for sufficient legroom. • If necessary, perform task at another workbench. • If able, move task to another location that eliminate the need to kneel, squat or bend ankle. • Take frequent micro-breaks from extensive kneeling, squatting or bending ankle. • 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. • 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. • Alternate tasks to allow for sitting and standing throughout work day. • Use anti-fatigue mats. • Use a sit/stand chair.
Contact Stress		
• Wrists, palms, legs, forearms, knees or elbows rest on sharp or hard surfaces. • 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. • Use a chair with soft padded armrests. • Use a chair that has a seat pan (width and depth) that accommodates the user. • Use a chair that has cushioned and rounded ("waterfall") front. • If needed, rearrange workstation to avoid contact stress to legs.
		• Use tools that have padded handles or add grip tape. • Avoid tools with sharp edges. • Avoid tools with handles that are too short; instead use long-handled tools. • Use padded gloves. • Use knee or elbow pads or padded mats. • 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. • Pushing/pulling more than 20 pounds initial force for more than 2 hours total per day. • Pinching an unsupported object weighing 2 or more pounds per hand for more than 2 hours total per day.		• Take frequent micro-breaks away from excessively gripping or pinching. • Use tools with padded handles. • Use tools with proper grip span (between 50-67 mm). • Use tools with adequate diameter handles.

• Gripping force of more than 10 pounds for more than 2 hours total per day.		• If possible, choose tools that require a power grip verses a pinch grip. • Avoid tools that are too heavy or bulky. • Use padded gloves. • Use automated tools, when able, to minimize forceful exertions. • If possible, use counter-balancing harness for heavier tools.
• Lifting more than 75 pounds even once. • Lifting more than 55 pounds more than 10 times a day. • Lifting more than 25 pounds below knees, above shoulders, or at arms' length more than 25 times a day. • Lifting with a twisted torso. • Lifting one-handed. • Lifting un-stable loads. • Lifting above shoulder. • Lifting below the knuckle. • Carrying objects for an extended distance. • Lifting while seated or kneeling.		• Use two people to lift items. • Use a lifting device (hoists, robotics, forklifts, dollies, etc.). • Use a cart to carry object extended distances. • Put less amount of weight in containers. • Make loads more compact and easier to handle. • Put items in containers with handles. • Try to lift items from waist height and close to body. • Carry items at waist height and close to body. • Use administrative controls and job rotation to alternate personnel to perform tasks that do not involve manual handling. • Take adequate breaks away from lifting tasks.
Vibration		
• Performing tasks with localized vibration or whole-body vibration for more than 2 hours a day. • Using vibrating tools with high vibration levels, such as chainsaws or percussive tools, for more than 2 hours total per day. • Using tools with moderate vibration levels such as grinders or sanders, for more than 2 hours total per day.		• Perform routine maintenance on tools to reduce vibration. • Use vibration dampening material, where feasible. • Use anti-vibration gloves • Consider using tools that emit less vibration. • Look for tools with variable torque control. • 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^{o}F for sedentary work, 40^{o}F for light work, 20^{o}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
Mastics
Pipe Insulation (corrugated air-cell, block, etc.)
Roofing Shingles Roofing Felt
Spray-Applied Insulation
Taping Compounds
Textured Paints and Coatings
Thermal Paper Products
Transite
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

E.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.

E.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 2.3.]*

E.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 EH contacted to evaluate the discovered material and assess the potential for a health hazard.

E.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.

E.2.3 ***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 (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 filters and cartridges must be worn during the initial access above the ceiling. PPE to include disposable protective coveralls (e.g. Tyvek), 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 (i.e., 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.

E.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.