Glenn Research Center, Environmental Programs Manual

Chapter 10 - SYNTHETIC INORGANIC FIBER PROGRAM

NOTE: The current version of this Chapter is maintained and approved by the Environmental Management Office (EMO). The revision date for this chapter is February 2003. If you are referencing paper copies, please verify that it is the most current version before use. The current version is maintained on the Glenn Research Center intranet at http://osat-ext.grc.nasa.gov/emo/pub/epm/epm-contents.pdf. Approved by: EMO Chief, Michael Blotzer {mailto: Michael.J.Blotzer@grc.nasa.gov}

PURPOSE

This chapter describes the GRC Synthetic Inorganic Fiber Program and establishes the minimum requirements to reduce the risk of occupational illness resulting from exposure to respirable airborne synthetic fibers. To provide an environment free from excess fibers, priority will be given to the use of engineering controls such as, local exhaust ventilation for employees working with synthetic fibers.

APPLICABILITY

The chapter is applicable to all personnel at GRC and Plum Brook Station, including but not limited to, civil servants, contractor personnel, and students who may be exposed to SIF.

DEFINITIONS

8-hour TWA
The Average concentration to which an employee is actually exposed over as 8-hour day.

Action Level
This is the concentration or level of an agent at which it is deemed that some specific action should be taken. The action can range from more closely monitoring the exposure atmosphere to making engineering adjustments. In general the action level is set at one half of the adopted occupational exposure limit.

Carcinogen
A substance or agent capable of causing or producing cancer in mammals, including humans. A chemical is considered to be a carcinogen or potential carcinogen if; a) it has been evaluated by IARC and found to be a carcinogen or potential carcinogen; b) it is listed as a carcinogen or potential carcinogen in the annual report on carcinogens published by the National Toxicology Program (NTP); or c) it is regulated by OSHA as a carcinogen.

Epidemiology
The science that deals with incidence distribution and control of disease in a population.

Excursion Limits
Are criteria for substances that have 8-hour TLV-TWA but no TWA-STEL or TLV-C, due to the lack of sufficient toxicological data. These limits are based on the maximum concentration above the established 8-hour TLV-TWA that short-term exposure events can occur during the working day without exceeding the accepted occupational exposure limit. Excursions in a worker exposure levels may exceed 3 times the TLV-TWA for no more than 30 minutes during the workday, and under no circumstances should they exceed 5 times the TLV-TWA, provided that the 8-hour TLV-TWA is not exceeded.

Fiber
An elongated particle having an aspect ratio (i.e., a ratio of length to width) of greater than 3:1. A fiber may be naturally occurring (such as plant fibers and asbestiform silicate minerals) or synthetic (such as vitreous or graphite fibers).

Mesothelioma
Cancer of the membranes that line the chest and abdomen.

Permissible Exposure Limit (PEL)
Established by OSHA, The permissible concentration in air of a substance to which nearly all workers may be repeatedly exposed 8 hours a day, 40 hours a week, for 30 years without adverse effects.

Possibly Carcinogenic to Humans
Chemical agents, mixtures, and exposure circumstances for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals.
Respirable Fiber Fibers with a diameter less than 3 microns, and a length greater than 5 microns.

Suspect Human Carcinogen
Human data are accepted as adequate in quality but are conflicting or insufficient to classify the agent as a confirmed human carcinogen; or, the agent is carcinogenic in experimental animals at dose(s), by route(s) of exposure, at site(s), of histologic type(s), or by mechanism(s) considered relevant to worker exposure. This classification is used primarily when there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals with relevance to humans.

Threshold Limit Value (TLV)
Used by the American Conference of Governmental Industrial Hygienist (ACGIH) to designate degree of exposure to contamination and expressed as parts of vapor or gas per million parts of air by volume at 25oC and 760 mmHg pressure, or as approximate milligrams of particles per cubic meter of air (mg/m3). An exposure level under which it is believed most people can work consistently for 8 hours a day, day after day, with no harmful effects.

Threshold Limit Value
Time Weighted Average (TLV-TWA) – The time-weighted average concentration for a normal 8 hour workday and a 40 hour workweek to which nearly all workers may be exposed repeatedly, day after day, without adverse effects.

Threshold Limit Value – Ceiling (TLV-C)
The concentration, of a contaminant, that should not be exceeded at any time.

Threshold Limit Value
Short-Term Exposure Limit (TLV-STEL) – A 15-minute TWA exposure that is not to be exceeded at any time during a workday even if the 8-hour TWA is within the TLV-TWA. Exposures above the TLV-TWA up to the STEL should not be longer than 15 minutes and must not occur more than 4 times per day. There must be at least 60 minutes between successive exposures in this range.

Time Weighted Average
Average exposure for an individual over a given work period, as determined by sampling at given times during the period.

Time Weighted Average Exposure
Average over a given working period of a person’s exposure, as determined by sampling at given times during the period.

Toxicology
Scientific study of poisons, their actions, their detection, and the treatment of conditions produced by them.

BACKGROUND

Synthetic inorganic fibers (SIF), which include fiberglass, mineral wool, and refractory ceramic fibers (RCF), have been under review by the scientific community to determine health effects of these fibers. Based on animal toxicology and on some human epidemiological studies, the International Agency for Research on Cancer classified these materials as "possibly carcinogenic to humans". Of particular concern among industry health and safety professionals are the animal toxicology studies of refractory ceramic fibers, which have indicated the development of lung cancers and mesothelioma, a rare cancer of the pleura. For this reason, the GRC permissible exposure limit (PEL) for RCF has been set to a lower level than either fiberglass or mineral wool. Refractory ceramic fiber that has been exposed to temperatures above 1800 F may form crystalline silica, a suspect human carcinogen. Synthetic inorganic fiber materials are available in various forms, including loose fill bulk insulation, blanket insulation, paper type wrap insulation, and compressed products such as gaskets.

POLICY

The Occupational Safety and Health Administration (OSHA) has proposed an eight-hour average permissible exposure limit (PEL) of 1 fiber per cubic centimeter of air (1 f/cm3) for continuous filament and glass wool fibers. Furthermore,

the American Conference of Governmental Industrial Hygienists (ACGIH) and product manufacturers have also set recommended exposure limits for these and other synthetic inorganic fibrous materials (see table in Procedures Section). It is NASA official policy to adhere to OSHA or ACGIH exposure limits (whichever is more restrictive) to ensure worker protection. (See table in Procedures section for specific exposure limits).

RESPONSIBILITIES

All employees and their supervisors shall be cognizant of the Synthetic
Inorganic Fiber Program and conform to the requirements of the program. Specific responsibilities are as follows:

Industrial Hygiene Team (IHT)

The IHT is responsible for the administration, maintenance, and surveillance of this program including

- Conducting baseline and routine surveys of operations, jobs, or procedures that require the use of SIF.
- Recommending appropriate controls.
- Maintaining a record of all air or wipe sampling data.
- Providing employee access to exposure data.
- Notifying employee supervisors and the Occupational Medical Services
- Office of employees who require medical surveillance based on exposure assessments.

Occupational Medical Services

- Maintains records of persons included in the medical surveillance program.
- Provides medical evaluations.
- Notifies employees of medical surveillance results.
- Notifies IHT of employees who may require exposure evaluation based on clinical findings.

Project Managers and Facilities Engineers and Operators

- Notifies IHT of facility renovations, modifications, and operations that require the use of SIF.
- Ensures that bid requests identify any SIF involved in the project.
- Implements appropriate controls and work practices for the control of excess fiber exposure

Plum Brook Management Office (PMBO)

Manages and oversees the proper use of SIF's at Plum Brook in accordance with the guidelines of this chapter.

Researchers

Must note on safety permit applications the use of synthetic fibers and, for operations for which a safety permit is not required, must notify IHT of the use of SIF.

Supervisors

- Ensure their employee Hazard Communication Training includes specific training on the hazards of SIF and how to minimize exposures.
- Request SIF hazard evaluations.
- Enforce the use of engineering and administrative controls including personal protective equipment.

Chemicals Management Team (CMT)

- Includes SIF's used in research applications in the Center's hazardous chemical inventory.
- Provides updated copies of MSDS to the users.
- Ensures that labeling requirements under the GRC Hazard Communication Program are met.
- Conducts hazard communication training specific for SIF.

Environmental Compliance Team (ECT)

- Provides information on the disposal of the various SIF's.
- Provides information on any air, water, or soil pollution issues.

PROCEDURES

This document specifies the procedures to reduce and control exposure to SIF. Copies of this program are maintained by IHT and are available on request.

Permissible Exposure Limits
The following OSHA table lists the GRC exposure limits.

Exposure limits for Synthetic Mineral Fibers	
AGENCY/SUBSTANCE	STANDARD LEVEL
OSHA PEL - TWA	
**Mineral fibers are currently only regulated as nuisance dust*	
General Industry Inert or Nuisance Dust (1910.1000, Table Z-3) Respirable fraction Total dust	 5 mg/m^3 15 mg/m^3
Shipyard Fibrous Glass (1915.1000, Table Z) Respirable fraction Total dust	 5 mg/m^3 15 mg/m^3
Shipyard Mineral Wool (1915.1000, Table Z) Respirable dust Total dust	 5 mg/m^3 15 mg/m^3
ACGIH TLV - TWA	
Synthetic Vitreous Fibers (1999 Adopted TLV's) Continuous filament glass fibers**, A4	 5 mg/m^3
Continuous filament glass fibers*, A4	1 f/cc
Glass wool fibers*, A3	1 f/cc
Rock wool fibers*, A3	1 f/cc
Slag wool fibers*, A3	1 f/cc
Special purpose glass fibers*, A3	1 f/cc
Synthetic Vitreous Fibers (1999 TLV - Notice of Intended Change) Continuous filament glass fibers*, A4 Refractory ceramic fibers*, A2	 0.1 f/cc 0.1 f/cc
* Fibers longer than 5 µm; diameter less than 3 µm; aspect ratio greater than 5:1 as determined by the membrane filter method at 400-450X magnification (4-mm objective) phase contrast illumination. ** Inhalable fraction. The concentration of inhalable particulate for the application of this TLV is to be determined from the fraction passing a size-selector with characteristics defined in the "A" paragraph of Appendix D. A2 Suspected Human Carcinogen. A3 Confirmed Animal Carcinogen with Unknown Relevance to Humans. A4 Not Classifiable as a Human Carcinogen.	
NIOSH REL - TWA	
Fibrous Glass Dust (1977 Proposal) Total dust Fibers with diameter equal or less than 3.5 um, and length equal to or greater than 10 um	 5 mg/m^3 3 f/cc

- **Notes:**

a. Limit for an 8-hr workday.
b. Level that triggers employee inclusion in a medical surveillance program.
c. Over a 30-min time period.

Engineering/Administrative Controls

To the extent feasible, priority shall be given to reducing employee exposure by the use of engineering controls such as using local exhaust ventilation for activities involving SIF such as cutting, grinding, sawing, etc., which generate airborne dust.

Where SIF materials are in place, they should be enclosed, and/or encapsulated so as to prevent the release of airborne fibers that may result from physical disturbance or air moving across the exposed SIF surface. Where possible, alternative materials shall be considered for RCF.

Personal Protective Equipment

Where engineering controls cannot be used to control exposures below the action level, the following personal protective equipment shall be used to prevent occupational exposure to SIF.

- Disposable protective coveralls and head coverings
- Protective booties
- Respiratory protection an air-purifying respirator equipped with high efficiency particulate air (HEPA) filters. NOTE: Contact the IHT for advice on the selection of an appropriate respirator.
- Cotton gloves may be worn
- Safety eyewear.

Air monitoring

Air sampling shall be conducted by IHT or contractor representative as a result of a preliminary hazard assessment, recommendation from Occupational Medical Services Office, employee request, safety permit review, facility renovation or maintenance activity, or emergency response such as a spill of SIF.

Requests for assistance shall be directed to IHT using a Work Request Form (C-709) through EMO.

The NIOSH 7400 method for fibers will be used to assess worker exposures. Area monitoring shall be conducted using either the NIOSH method or a real time fibrous aerosol monitor.

Where possible, sampling should be conducted before, during, and after operations. Sampling conducted during a particular work activity should reflect worst-case exposures for the employee. Supervisors, employees, and, when necessary, Occupational Medical Services Office shall be notified of the sample results.

Occupational Medical Surveillance

Employees, who may be exposed at the action level for 30 or more days per year, shall be recommended for inclusion in a medical surveillance program.

Safe Work Practices

Work involving SIF should be planned to control and prevent employee exposure and the contamination of work surfaces and equipment. The plans should include IHT review to determine the required air sampling and ventilation controls. For operations that cannot be accomplished using local exhaust ventilation, workers must use personal protective equipment, as listed in the "Personal Protective Equipment" section (above).

Facility and equipment work surfaces will be protected from contamination by the use of plastic sheeting. The area in which work is to be done shall be secured by the use of warning signs and tape to prevent entry the of unprotected persons in accordance with the Glenn Safety Manual.

A HEPA vacuum cleaner will be used to clean any debris once a task is completed.
Wet wiping will follow the vacuuming.
Disposal

Substances containing SIF will be handled and disposed of using the same procedures that are currently being used by GRC for the disposal of asbestos containing materials (ACM). Although the U.S. EPA does not now regulate SIF's, they are currently under study. It is prudent for GRC to follow the most conservative methods for disposing of these materials in anticipation of their becoming regulated.

Training

As required by the with the OSHA Hazard Communication Standard, employees working with SIF shall be trained regarding the health hazards, routes of exposure, exposure limits, safe work practices, air sampling requirements, the proper use of personal protective equipment, engineering controls, first aid, emergency response procedures for spills, and disposal requirements.

Employees shall also be made aware of the contents and location of the written program.

Record Keeping

In accordance with the requirements of the 29 CFR 1910.20 OSHA Employee Access to Medical and Exposure Records Standard, both medical and industrial hygiene sampling records will be made available to affected employees or their representatives. The Occupational Medical Services Office and IHT will maintain copies of these records.

RECORDS

- . Exposure Assessments
- Industrial Hygiene Monitoring Data Sheet

Safety and Assurance Technologies Directorate (SATD)
Environmental Management Office Chief: Michael Blotzer
Chapter Lead: Eugene M. DiSanto, SAIC {mailto:Eugene.DiSanto@grc.nasa.gov}
Web Curator: Sandra Jacobson, SAIC {mailto:Sandra.Jacobson@grc.nasa.gov}
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