



Standard Guide for Medical Surveillance Program for Workers with Occupational Exposure to Respirable Silicon Carbide Whiskers¹

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1. Scope

1.1 This guide covers a recommended medical surveillance program for workers with potential for routine occupational exposure to airborne respirable silicon carbide (SiC) whiskers at or above the exposure limits specified in Practices E 1435 and E 1437. Airborne respirable SiC whiskers are considered a potential health hazard.

1.2 The examinations recommended in this guide are not intended to replace existing medical examinations offered by an employer, but should supplement existing examinations in order to evaluate pulmonary function and disease.

1.3 The medical surveillance program is intended to establish baseline values prior to occupational exposure to airborne respirable silicon carbide whiskers and to establish periodic monitoring.

1.4 Application of this guide may be superseded by future governmental regulations.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

E 1435 Practice for Handling Densified Articles of Aluminum Oxide Reinforced with Silicon Carbide Whiskers²

E 1437 Practice for Handling Respirable Silicon Carbide Whiskers²

2.2 Other Documents:

U. S. Code of Federal Regulations (CFR), 29 CFR 1910.1001, Appendix D, Appendix E Occupational Safety and Health Standard for Asbestos³

Centers for Disease Control/National Institute for Occupa-

tional Safety and Health(CDC/NIOSH) CDC/NIOSH (M) 2.8 form⁴

International Labor Organization (ILO) ILO-U/C International Classification of Radiographs for Pneumoconioses, 1980⁵

3. Terminology

3.1 Definitions:

3.1.1 *aspect ratio, n*—ratio of whisker length to whisker diameter

3.1.2 *respirable silicon carbide whiskers, n*—a crystalline silicon carbide fiber, approximately cylindrical in shape, with a diameter less than 3.0 μm and an aspect ratio equal to or greater than 5:1.

4. Significance and Use

4.1 Workers may be exposed to respirable SiC whiskers during handling, processing, or use of SiC whiskers or powdered blends containing SiC whiskers. Exposure may also occur during (re)finishing of consolidated or densified articles when respirable SiC whiskers are released.

4.2 Workers with occupational exposure at or above the exposure limits specified in Practices E 1435 and E 1437 should be included in an ongoing medical surveillance program to ascertain what, if any, health effects may have occurred due to this exposure.

4.3 This guide provides recommendations for preplacement, periodic, and exit medical examinations for exposed workers. It also provides guidance for producing both initial and periodic medical questionnaires.

4.4 This guide is intended for use by human resources personnel as well as health and safety professionals who establish medical surveillance programs.

5. Medical Surveillance Program

5.1 A medical surveillance program should be established to determine what, if any, health effects a worker may have incurred due to occupational exposure to respirable SiC whiskers.

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² *Annual Book of ASTM Standards*, Vol 11.03.

³ Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

⁴ Available from U.S. HHS Centers for Disease Control/National Institute for Occupational Safety and Health, Cincinnati, OH.

⁵ Available from International Labour Office, Geneva, Switzerland.

5.2 This program is intended to provide a record of the medical condition of employees at the beginning, during, and at the end of their employment, and to provide early identification of medical problems which may be attributable to occupational exposures.

5.3 A medical surveillance program will normally include preplacement, periodic, and exit medical examinations.

5.4 All medical examinations and procedures should be done by or under the supervision of a licensed physician.

5.5 Medical examinations and procedures referred to in this guide should be provided at no cost to the employee and at a reasonable time and place.

5.6 Pulmonary function testing should be performed only by trained personnel.

6. Information to Be Provided to Physician

6.1 The following information should be provided to the examining physician:

6.1.1 A copy of the standard.

6.1.2 A description of the job duties as they relate to exposure to respirable SiC whiskers.

6.1.3 The personal exposure levels or anticipated exposure levels.

6.1.4 A description of any personal protective equipment (PPE) used or to be used.

6.1.5 Information from previous medical examination(s) which is (are) not readily available to the examining physician.

6.1.6 A completed initial medical questionnaire or periodic medical questionnaire, as appropriate.

7. Preplacement Examination

7.1 A preplacement examination should be conducted prior to assignment to a job involving exposure to airborne concentrations of respirable silicon carbide whiskers.

7.2 *Content of Preplacement Examination:*

7.2.1 Review of the initial medical questionnaire and any other relevant medical or work history.

7.2.2 Appropriate physical examination, with emphasis on the respiratory and cardiovascular systems and any attributes or limitations that may limit a worker's fitness for duty, including the ability to wear or use any required PPE.

7.2.3 Pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_{1.0}).

7.2.4 Chest roentgenogram. If previous work history indicates an absence of exposure to fibrous materials, a chest roentgenogram taken no more than two years previously is acceptable if readily available to the examining physician.

7.2.5 Any additional tests deemed necessary by the examining physician.

8. Periodic Examination

8.1 *Frequency of Examinations:*

8.1.1 Where routine job duties involve exposure to airborne concentrations of respirable SiC whiskers at or above the exposure limits specified in Practices E 1435 and E 1437, annual examinations should be made.

8.1.2 Where occasional job duties involve exposure to airborne concentrations of respirable SiC whiskers at or above

the exposure limits specified in Practices E 1435 and E 1437, periodic examinations should be made every two years.

8.2 *Content of Examinations:*

8.2.1 Review of the current periodic medical questionnaire and comparison to the initial medical questionnaire or the most recent periodic medical questionnaire, as appropriate, with emphasis on the respiratory and cardiovascular systems.

8.2.2 Review any other relevant medical and work history since last examination.

8.2.3 Appropriate physical examination, with emphasis on the respiratory and cardiovascular systems.

8.2.4 Pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_{1.0}).

8.2.5 Chest roentgenogram.

8.2.6 Any additional tests deemed necessary by the examining physician.

9. Exit Examination

9.1 An exit examination should be made available by the employer to any employee terminating employment who had occupational exposure to airborne respirable SiC whiskers above the exposure limits specified in Practices E 1435 and E 1437.

9.2 An exit examination may not be necessary if an initial or periodic examination was conducted within the previous six months.

9.3 Contents of the exit examination should duplicate those of the periodic examination, except that a chest roentgenogram need not be included if a chest roentgenogram was done within the previous 12 months.

9.4 The exit examination should be conducted within 30 days before or after termination of employment.

10. Chest Roentgenogram

10.1 The chest roentgenogram should be anterior-posterior, 14 to 17 in.

10.2 *Interpretation and Classification of Chest Roentgenograms:*

10.2.1 Chest roentgenograms shall be interpreted and classified in accordance with a professionally accepted classification system and recorded on an interpretation form following the format of the CDC/NIOSH (M) 2.8 form. As a minimum, the content within the bold lines of the CDC/NIOSH (M) 2.8 form (items 1 through 4) shall be included.

10.2.2 Roentgenograms shall be interpreted and classified only by a B-reader, a board eligible/certified radiologist, or an experienced physician with known expertise in pneumoconioses.

10.2.3 All interpreters shall have immediately available for reference a complete set of the ILO-U/C International Classification of Radiographs for Pneumoconioses, 1980.

11. Physician's Written Opinion

11.1 The examining physician should provide a written opinion based on the results of the medical examination.

11.2 *Contents of Written Opinion:*

11.2.1 The physician's opinion as to whether any detected medical conditions that would place the worker at an increased

risk of material health impairment from exposure to airborne respirable SiC whiskers.

11.2.2 Any recommended limitations on the worker or upon the use of personal protective equipment, such as respirators or clothing.

11.2.3 A statement that the physician has informed the worker of the results of the medical examination and of any medical conditions that could result from occupational exposure to airborne respirable SiC whiskers that require further explanation or treatment.

11.3 The written opinion should not include specific findings or diagnoses unrelated to occupational exposure to airborne respirable SiC whiskers. Such information should be submitted by the physician to the worker under separate cover.

11.4 The employer should provide a copy of the physician's written statement to the worker within 30 days from its receipt.

12. Questionnaire

12.1 Initial and periodic medical questionnaires can be patterned after the questionnaires provided at 29 CFR 1910.1001 Appendix D, Parts 1 and 2, respectively.

12.2 Questionnaires should include information about any occupational or non-occupational use of respiratory protection.

13. Keywords

13.1 ceramic; fiber; health hazard; man-made mineral fibers; medical surveillance; respirable; silicon carbide; whisker

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