

**SUPPORTING STATEMENT FOR THE  
INFORMATION COLLECTION REQUIREMENTS IN THE  
ACRYLONITRILE STANDARD (29 CFR 1910.1045)<sup>1</sup>  
OFFICE OF MANAGEMENT AND BUDGET (OMB)  
CONTROL NO. 1218-0126 (October 2024)**

The agency is requesting the extension of a currently approved data collection.

**A. JUSTIFICATION**

- 1. Explain the circumstances that make the collection of information necessary. Identify any legal or administrative requirements that necessitate the collection. Attach a copy of the appropriate section of each statute and regulation mandating or authorizing the collection of information.**

The main objective of the Occupational Safety and Health Act ("OSH Act" or "Act") is to "assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources" (29 U.S.C. 651). To achieve this objective, the OSH Act specifically authorizes "the development and promulgation of occupational safety and health standards" (29 U.S.C. 651). The Act states further that "[t]he Secretary . . . shall prescribe such rules and regulations as [he/she] may deem necessary to carry out [his/her] responsibilities under this Act, including rules and regulations dealing with the inspection of an employer's establishment" (29 U.S.C. 651).

To protect employee health, the OSH Act authorizes the Occupational Safety and Health Administration ("OSHA" or "Agency") to develop standards that provide for "monitoring or measuring employee exposure" to occupational hazards and "prescribe the type and frequency of medical examinations and other tests which shall be made available [by the employer] to employees exposed to such hazards . . . to most effectively determine whether the health of such employees is adversely affected by such exposure" (29 U.S.C. 655). Moreover, the Act directs the agency to "issue regulations requiring employers to maintain accurate records of employee exposures to potentially toxic materials or other harmful physical agents which are required to be monitored and measured," and further specifies that such regulations provide "for each employee or former employee to have access to such records as will indicate [their] own exposure to toxic materials or harmful physical agents" (29 U.S.C. 657). In addition, the OSH Act mandates that "[e]ach employer shall make, keep and preserve, and make available to the Secretary [of Labor] . . . such records regarding [his/her] activities relating this Act as the Secretary . . . may prescribe by regulation as necessary or appropriate for the enforcement of this Act or for developing information regarding the causes and prevention of occupational accidents and illnesses" (29 U.S.C. 657).

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<sup>1</sup> The purpose of this Supporting Statement is to analyze and describe the burden hours and costs associated with provisions of this Standard that contain paperwork requirements; it does not provide information or guidance on how to comply with, or how to enforce, the Standard.

Under the authority granted by the OSH Act, the agency published a standard for general industry that regulates Acrylonitrile (AN) exposure of employees (§1910.1045; "the Standard"). OSHA based the Standard on a determination that occupational exposure to AN poses a hazard to employees. In this regard, research demonstrates that AN exposure causes cancer in laboratory animals, and results in a higher-than-expected incidence of cancer in humans. Repeated or prolonged skin exposure to AN may also cause irritation and dermatitis in humans. Items 2 and 12 below describe in detail the specific information collection requirements of the Standard.

**2. Indicate how, by whom, and for what purpose the information is to be used. Except for a new collection, indicate the actual use the agency has made of the information received from the current collection.**

**A. Exposure monitoring (§1910.1045(e))**

*Initial monitoring §1910.1045(e)(2)* – Each employer who has a place of employment in which AN is present shall monitor each such workplace and work operation to accurately determine the airborne concentrations of AN to which employees may be exposed.

**Purpose:** Monitoring allows employers to identify areas and operations that may require additional reduction in airborne AN to meet the permissible exposure limit (PEL). The results of initial exposure monitoring also assist employers in determining the need for engineering controls, instituting or modifying work-practice controls, and in selecting appropriate respiratory protection to prevent workers from overexposure.

*Frequency §1910.1045(e)(3)(ii)* - If the monitoring required by this section reveals employee exposure to be at or above the action level but at or below the permissible exposure limits, the employer must repeat such monitoring for each such employee at least every 6 months.

*Frequency §1910.1045(e)(3)(iii)* - If the monitoring required by this section reveals employee exposure to be in excess of the permissible exposure limits, the employer must repeat these determinations for each such employee at least quarterly. The employer must continue these quarterly measurements until at least two consecutive measurements, taken at least seven (7) days apart, are at or below the permissible exposure limits, and, thereafter, the employer must monitor at least every 6 months.

**Purpose:** Periodic monitoring allows employers to determine if changes in processes, materials, or environmental conditions result in increased concentrations of airborne AN, and to evaluate the effectiveness of control methods selected to decrease these exposures. In addition, periodic exposure monitoring reminds both the employer and workers of the continuing need to protect against the hazards that could result from worker overexposure to AN. The results of exposure monitoring also provide examining physicians with information that may be useful in determining the etiology of an occupationally-related disease.

*Additional monitoring §1910.1045(e)(4)* - Whenever there has been a production, process, control, or personnel change which may result in new or additional exposures to AN, or

whenever the employer has any other reason to suspect a change which may result in new or additional exposures to AN, additional monitoring which complies with this paragraph shall be conducted.

**Purpose:** Additional monitoring ensures that the workplace is safe, or notifies the employer of the need to increase worker protection.

***Employee notification §1910.1045(e)(5)***

*§1910.1045(e)(5)(i)* - The employer must, within 15 working days after the receipt of the results of any monitoring performed under this section, notify each affected employee of these results either individually in writing or by posting the results in an appropriate location that is accessible to employees.

*§1910.1045(e)(5)(ii)* - Whenever the results indicate that the representative employee exposure exceeds the permissible exposure limits, the employer shall include in the written notice a statement that the permissible exposure limits were exceeded and a description of the corrective action being taken to reduce exposure to or below the permissible exposure limits.

**Purpose:** Written notices assure that workers receive accurate exposure data, and; in addition, provides them with information regarding the specific action the employer is taking to lower their exposure and furnish them with a safe and healthful workplace.

**B. Compliance program (§1910.1045(g)(2))**

*§1910.1045(g)(2)(i)* - The employer shall establish and implement a written program to reduce employee exposures to or below the permissible exposure limits solely by means of engineering and work practice controls, as required by paragraph (g)(1) of this section.

*§1910.1045(g)(2)(ii)* - Written plans for these compliance programs shall include at least the following:

§1910.1045(g)(2)(ii)(A) - A description of each operation or process resulting in employee exposure to AN above the permissible exposure limits;

§1910.1045(g)(2)(ii)(B) - An outline of the nature of the engineering controls and work practices to be applied to the operation or process in question;

§1910.1045(g)(2)(ii)(C) - A report of the technology considered in meeting the permissible exposure limits;

§1910.1045(g)(2)(ii)(D) - A schedule for implementation of engineering and work practice controls for the operation or process, which shall project completion no later than November 2, 1980; and

§1910.1045(g)(2)(ii)(E) - Other relevant information.

*§1910.1045(g)(2)(iv)* - Written plans shall be submitted upon request to the Assistant Secretary and the Director, and shall be available at the worksite for examination and copying by the Assistant Secretary, the Director, or any affected employee or representative.

Note: OSHA has determined that the requirement for employers to make information available upon request to the Assistant Secretary is not a collection of information; OSHA typically requests access to information during an inspection, and information collected by the agency during the investigation is not subject to the PRA under 5 CFR 1320.4(a)(2). While NIOSH may use information collected from employers for research purposes, the agency does not anticipate that NIOSH will request employers to make this information available during the approval period. Therefore, the burden for the employer to make this information available to NIOSH is zero.

*§1910.1045(g)(2)(v)* - The plans required by this paragraph must be revised and updated at least annually to reflect the current status of the program.

**Purpose:** This requirement commits the employer to evaluating worker exposures and establishing an organized and comprehensive program for reducing worker exposures to or below the PEL. Revising and updating the written program serves to remind employers to implement and maintain the exposure-control methods required by the Standard.

### **C. Respirator program (§1910.1045(h)(2))<sup>2</sup>**

*§1910.1045(h)(2)(i)* - The employer must implement a respiratory protection program in accordance with §§1910.134(b) through (d) (except (d)(1)(iii), (d)(3)(iii)(b)(1), and (2)), and (f) through (m), which covers each employee required by this section to use a respirator.

**Purpose:** Developing a respirator program will ensure that employers establish a standardized procedure for selecting, using, and maintaining respirators for each workplace requiring respirator use. Developing written procedures assures that employers implement a respirator program that meets the needs of their workers.

### **D. Emergency situations (§1910.1045(i))**

*Written plans §1910.1045(i)(1)(i)* - A written plan for emergency situations shall be developed for each workplace where liquid AN is present. Appropriate portions of the plan shall be implemented in the event of an emergency.

*§1910.1045(i)(1)(ii)* - The plan shall specifically provide that employees engaged in correcting emergency conditions shall be equipped as required in paragraph (h) of this section until the emergency is abated.

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<sup>2</sup> The agency accounts for the burden hours and cost resulting from the respiratory protection requirements under the ICR for the Respiratory Protection Standard, OMB Control Number 1218-0099.

*§1910.1045(i)(1)(iii)* - Employees not engaged in correcting the emergency shall be evacuated from the area and shall not be permitted to return until the emergency is abated.

**Purpose:** Emergency plans provide workers with information (e.g., evacuation routes, appropriate respirators) for responding appropriately to an unexpected release of AN, thereby minimizing their AN exposures under these conditions.

#### **E. Cleaning and replacement (§1910.1045(j)(2))**

*Informing laundry personnel §1910.1045(j)(2)(v)* - The employer shall inform any person who launders or cleans protective clothing or equipment of the potentially harmful effects of exposure to AN.

**Purpose:** This information allows laundry personnel to protect themselves from AN exposure.

#### **F. Medical surveillance (§1910.1045(n))**

***General §1910.1045(n)(1)(i)*** - The employer shall institute a program of medical surveillance for each employee who is or will be exposed to AN at or above the action level, without regard to the use of respirators. The employer shall provide each such employee with an opportunity for medical examinations and tests in accordance with this paragraph.

*§1910.1045(n)(1)(ii)* - The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and that they shall be provided without cost to the employee.

***Initial examinations §1910.1045(n)(2)*** - At the time of initial assignment, or upon institution of the medical surveillance program, the employer shall provide each affected employee an opportunity for a medical examination, including at least the following elements:

*§ 1910.1045(n)(2)(i)* - A work history and medical history with special attention to skin, respiratory, and gastrointestinal systems, and those nonspecific symptoms, such as headache, nausea, vomiting, dizziness, weakness, or other central nervous system dysfunctions that may be associated with acute or with chronic exposure to AN;

*§1910.1045(n)(2)(ii)* - A complete physical examination giving particular attention to the peripheral and central nervous system, gastrointestinal system, respiratory system, skin, and thyroid;

*§1910.1045(n)(2)(iii)* - A 14- by 17-inch or other reasonably-sized standard film or digital posterior-anterior chest X-ray; and

*§1910.1045(n)(2)(iv)* - Further tests of the intestinal tract, including fecal occult blood screening, for all workers 40 years of age or older, and for any other affected employees for whom, in the opinion of the physician, such testing is appropriate.

***Periodic examinations (§1910.1045(n)(3)(i))*** - The employer shall provide the examinations specified in paragraphs (n)(2)(i)-(n)(2)(ii) and (n)(2)(iv) of this section at least annually for all employees specified in paragraph (n)(1) of this section.

*§1910.1045(n)(3)(ii)* - If an employee has not had the examination specified in paragraph (n)(2)(i)-(n)(2)(ii) and (n)(2)(iv) of this section within 6 months preceding termination of employment, the employer shall make such examination available to the employee prior to such termination.

***Additional examinations §1910.1045(n)(4)*** - If the employee for any reason develops signs or symptoms which may be associated with exposure to AN, the employer shall provide an appropriate examination and emergency medical treatment.

**Purpose:** Documentation and maintenance of the medical-examination results provide a continuous record of worker health. Physicians use these records to determine the extent to which workers, since their last examination, experience health effects related to their AN exposure. Further, if symptoms of organic damage appear, the physician often needs information about a worker's previous medical conditions to make an accurate diagnosis of the new condition, ascertain its apparent cause, and identify a course of treatment.

***Information provided to the physician (§1910.1045(n)(5))*** - The employer shall provide the following information to the examining physician:

§1910.1045(n)(5)(i) - A copy of this standard and its appendixes;

§1910.1045(n)(5)(ii) - A description of the affected employee's duties as they relate to the employee's exposure;

§1910.1045(n)(5)(iii) - The employee's representative exposure level;

§1910.1045(n)(5)(iv) - The employee's anticipated or estimated exposure level (for replacement examinations or in cases of exposure due to an emergency);

§1910.1045(n)(5)(v) - A description of any personal protective equipment used or to be used; and

§1910.1045(n)(5)(vi) - Information from previous medical examinations of the affected employee, which is not otherwise available to the examining physician.

**Purpose:** Making this information available to the physician assists the physician in evaluating the worker's health and fitness for specific job assignments involving AN exposure. Additionally, if symptoms of an occupationally-related disease appear, the physician often needs information about a worker's previous medical conditions to make an accurate diagnosis of the new condition, its apparent cause, and the course of treatment required. Medical records also

ensure that workers can determine whether they require treatment, or to evaluate the effectiveness of the employer's exposure-reduction program.

***Physician's written opinion §1910.1045(n)(6)(i)*** - The employer shall obtain a written opinion from the examining physician which shall include:

§1910.1045(n)(6)(i)(A) - The results of the medical examination and test performed;

§1910.1045(n)(6)(i)(B) - The physician's opinion as to whether the employee has any detected medical condition(s) which would place the employee at an increased risk of material impairment of the employee's health from exposure to AN;

§1910.1045(n)(6)(i)(C) - Any recommended limitations upon the employee's exposure to AN or upon the use of protective clothing and equipment such as respirators; and

§1910.1045(n)(6)(i)(D) - A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

**Purpose:** Requiring the employer to obtain a physician's written opinion is to provide the employer with medical information to aid in determining the initial placement of workers, and to assess the worker's ability to use protective clothing and equipment. The physician's written opinion also provides information to the employer about whether or not the worker has a condition indicating overexposure to AN. The requirement that the physician's opinion be in writing permits retention of the information for later reference. Providing workers with a copy of the physician's written opinion informs them of the medical-examination results so that they can assist in determining the need for, and evaluate the effectiveness of, treatment or other interventions.

### **G. Employee information and training (§1910.1045(o))**

Upon further consideration, the requirements that employers provide training to workers under paragraphs (o)(1)(i), (ii), (iii), (iv) are not considered to be collections of information. OSHA is not taking burden for this activity under Item 12 of this Supporting Statement.

### **H. Communication of Hazards (§1910.1045(p))<sup>3</sup>**

*Hazard communication—general.* §1910.1045(p)(1)(iii) - The employer shall include AN and AN-based materials in the program established to comply with the Hazard Communication Standard (HCS) (§1910.1200). The employer shall ensure that each employee has access to labels on containers of chemicals and substances associated with coke oven processes and to

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<sup>3</sup> The provisions containing the paperwork requirements associated with signs and labels specify the design, format, and specific language for these materials. Therefore, OSHA is taking no burden for these provisions because it is providing the information needed by employers to meet these requirements. (See "Controlling Paperwork Burden on the Public," 5 CFR 1320.3(c)(2).)

safety data sheets, and is trained in accordance with the provisions of HCS and paragraph (k) of this section. The employer shall ensure that at least the following hazard is addressed: Cancer.

§1910.1045(p)(2)(i) - The employer shall post signs to clearly indicate all workplaces where AN concentrations exceed the permissible exposure limits. The signs shall bear the following legend:

DANGER  
ACRYLONITRILE (AN)  
MAY CAUSE CANCER

RESPIRATORS PROTECTION MAY BE REQUIRED IN THIS AREA

AUTHORIZED PERSONNEL ONLY

**Purpose:** These signs serve to warn workers that they are in or near a hazardous area. Warning signs also supplement the training workers receive under the Standard.

§1910.1045(p)(2)(ii) - The employer shall assure that signs required by this paragraph (p)(2) are illuminated and cleaned as necessary so that the legend is readily visible.

§1910.1045(p)(2)(iii) - Prior to June 1, 2016, employers may use the following legend in lieu of that specified in paragraph (p)(2)(i) of this section:

*DANGER  
ACRYLONITRILE (AN)  
CANCER HAZARD  
AUTHORIZED PERSONNEL ONLY  
RESIRATORY MAY BE REQUIRED*

*Labels §1910.1045(p)(3).*

§1910.1045(p)(3)(i) - The employer shall ensure that precautionary labels are in compliance with paragraph (p)(1)(i) of this section and are affixed to all containers of liquid AN and AN-based materials not exempted under paragraph (a)(2) of this section. The employer shall ensure that labels remain affixed when the materials are sold, distributed, or otherwise leave the employer's workplace.

§1910.1045(p)(3)(ii) - Prior to June 1, 2015, employers may include the following information on precautionary labels required by this paragraph (p)(3) in lieu of the labeling requirements in paragraph (p)(1) of this section:

DANGER  
CONTAINS ACRYLONITRILE (AN)  
CANCER HAZARD



*§1910.1045(p)(3)(iii)* - The employer shall ensure that the precautionary labels required by this paragraph (p) (3) are readily visible and legible.

**Purpose:** Warning labels inform downstream employers and workers of the hazards associated with AN, and that they may need to implement special practices to ensure against AN exposure. Furthermore, warning labels alert employers who, in the absence of such labels, may not know that AN is present in their workplace and, consequently, that they must comply with the Standard.

## **I. Recordkeeping (§1910.1045(q))**

*Objective data for exempted operations §1910.1045(q)(1)(i)* - Where the processing, use, and handling of materials made from or containing AN are exempted pursuant to paragraph (a)(2)(ii) of this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

*§1910.1045(q)(1)(ii)* - This record shall include at least the following information:

§1910.1045(q)(1)(ii)(A) - The material qualifying for exemption;

§1910.1045(q)(1)(ii)(B) - The source of the objective data;

§1910.1045(q)(1)(ii)(C) - The testing protocol, results of testing, and/or analysis of the material for the release of AN;

§1910.1045(q)(1)(ii)(D) - A description of the operation exempted and how the data supports the exemption; and

§1910.1045(q)(1)(ii)(E) - Other data relevant to the operations, materials, and processing covered by the exemption.

*§1910.1045(q)(1)(iii)* - The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

**Purpose:** The purpose of this information collection requirement is to discourage abuse of the exemption. Under the recordkeeping provisions of the Standard, notably paragraph (q)(4)(ii), workers and their representatives have access to the information and data used by an employer to determine whether or not the exemption applies to their workplace. Such access enables workers to assure that the determinations are reasonable and the exemption warranted. Maintaining a record of the information and objective data used in making the determinations permits OSHA to ascertain whether or not the employer complied with the requirements of this provision.

*Exposure monitoring §1910.1045(q)(2)* – The employer shall establish and maintain an accurate record of all monitoring required by paragraph (e) of this section.

*§1910.1045(q)(2)(ii)* - This record shall include:

§1910.1045(q)(2)(ii)(A) - The dates, number, duration, and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure;

§1910.1045(q)(2)(ii)(B) - A description of the sampling and analytical methods used and the data relied upon to establish that the methods used meet the accuracy and precision requirements of paragraph (e)(6) of this section;

§1910.1045(q)(2)(ii)(C) - Type of respiratory protective devices worn, if any; and

§1910.1045(q)(2)(ii)(D) - Name and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent.

*§1910.1045(q)(2)(iii)* - The employer shall maintain this record for at least forty (40) years, or for the duration of employment plus twenty (20) years, whichever is longer.

**Purpose:** Maintaining these records for extended periods is necessary because of the long latency associated with the development of AN-related cancers.

*Medical surveillance §1910.1045(q)(3)(i)* - The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by paragraph (n) of this section.

*§1910.1045(q)(3)(ii)* - This record shall include:

§1910.1045(q)(3)(ii)(A) - A copy of the physician's written opinions;

§1910.1045(q)(3)(ii)(B) - Any employee medical complaints related to exposure to AN;

§1910.1045(q)(3)(ii)(C) - A copy of the information provided to the physician as required by paragraph (n)(5) of this section; and

§1910.1045(q)(3)(ii)(D) - A copy of the employee's medical and work history.

**Purpose:** Exposure monitoring and medical surveillance provide both employers and workers with access to useful information. The exposure-monitoring and medical-surveillance records required by the Standard assist workers and their physicians in determining the need for treatment or other interventions as a result of the workers' exposure to AN. The information also alerts employers if worker overexposure to AN occurs; thereby, enabling employers to implement controls to reduce AN exposures.

*§1910.1045(q)(3)(iii)* - The employer shall assure that this record be maintained for at least forty (40) years, or for the duration of employment plus twenty (20) years, whichever is longer.

**Purpose:** Maintaining these records for extended periods is necessary because of the long latency associated with the development of AN-related cancers.

*Availability §1910.1045(q)(4)(i)* - The employer shall make all records required to be maintained by this section available, upon request, to the Assistant Secretary and the Director for examination and copying.

Note: OSHA has determined that the requirement for employers to make records available upon request to the Assistant Secretary is not a collection of information; OSHA typically requests access to records during an inspection, and information collected by the agency during the investigation is not subject to the PRA under 5 CFR 1320.4(a)(2). While NIOSH may use records collected from employers for research purposes, the agency does not anticipate that NIOSH will request employers to make available records during the approval period. Therefore, the burden for the employer to make this information available to NIOSH is zero.

*§1910.1045(q)(4)(ii)* - Records required by paragraphs (q)(1) through (q)(3) of this section shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with 29 CFR 1910.1020 (a) through (e) and (q) through (i). Records required by paragraph (q)(1) shall be provided in the same manner as exposure monitoring records.

**Purpose:** OSHA compliance officer's uses these records to assess employer compliance with the major requirements of the Standard, while NIOSH may compile these records for research purposes. Workers and worker representatives use exposure-monitoring and medical-surveillance records to assess worker medical status over the course of employment, to evaluate the effectiveness of the employer's exposure-reduction program, and for other reasons.

*Transfer of Records §1910.1045(q)(5)(i) and (ii)*

*§ 1910.1045(q)(5)(i)* - Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by this section for the prescribed period.

*§1910.1045(q)(5)(i) (ii)* - The employer shall comply with the requirements involving transfer of records set forth in 29 CFR 1910.1020(h).

**Purpose:** Paragraph (h) of §1910.1020 requires employers who cease to do business to transfer medical and exposure-monitoring records to the successor employer, who then must receive and maintain the records. If no successor employer is available, the employer must, at least three months before ceasing business, notify current workers who have records of their right to access these records.

OSHA considers the employer's transfer of records to a successor employer to be usual and customary communications during the transition from one employer to a successor employer. In

this regard, the employer would communicate the location of all records, including employee exposure-monitoring and medical records, at the facility to the successor employer during the transfer of business operations, as a matter of usual and customary business practice. In addition, OSHA accounts for the burden hours and costs resulting from the employee notification requirements under the Information Collection Request (ICR) for its Access to Employee Exposure and Medical Records Standard (§1910.1020), OMB Control No. 1218-0065.

- 3. Describe whether, and to what extent, the collection of information involves the use of automated, electronic, mechanical, or other technological collection techniques or other forms of information technology, e.g., permitting electronic submission of responses, and the basis for the decision for adopting this means of collection. Also describe any consideration of using information technology to reduce burden.**

Employers may use improved information technology, including electronic recording, when establishing or maintaining records. OSHA wrote the paperwork requirements of the Standard in performance-oriented language, i.e., in terms of what data to collect, not how to collect the data.

- 4. Describe efforts to identify duplication. Show specifically why any similar information already available cannot be used or modified for use for the purposes described in Item A.2 above.**

The requirements to collect and maintain information are specific to each employer and worker involved, and no other source or agency duplicates these requirements or can make the required information available to OSHA (i.e., the required information is available only from employers).

- 5. If the collection of information impacts small businesses or other small entities, describe any methods used to minimize burden.**

The information collection requirements of the Standard do not have a significant impact on a substantial number of small entities.

- 6. Describe the consequence to Federal program or policy activities if the collection is not conducted or is conducted less frequently, as well as any technical or legal obstacles to reducing burden.**

The agency believes that the information collection frequencies required by the Standard are the minimum frequencies necessary to effectively monitor the exposure and health status of workers exposed to AN, and; thereby, fulfill its mandate "to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources" as specified by the OSH Act at 29 U.S.C. 651. Accordingly, if employers do not perform the required information collections, or delay in providing this information, workers will have an increased probability of developing cancer, dermatitis, and skin irritation because of their AN exposures.

- 7. Explain any special circumstances that would cause an information collection to be conducted in a manner:**

- **Requiring respondents to report information to the agency more often than quarterly.**
- **Requiring respondents to prepare a written response to a collection of information in fewer than 30 days after receipt of it.**
- **Requiring respondents to submit more than an original and two copies of any document.**
- **Requiring respondents to retain records, other than health, medical, government contract, grant-in-aid, or tax records for more than three years.**
- **In connection with a statistical survey, that is not designed to produce valid and reliable results that can be generalized to the universe of study.**
- **Requiring the use of a statistical data classification that has not been reviewed and approved by OMB.**
- **That includes a pledge of confidentiality that is not supported by authority established in statute or regulation, that is not supported by disclosure and data security policies that are consistent with the pledge, or which unnecessarily impedes sharing of data with other agencies for compatible confidential use.**
- **Requiring respondents to submit proprietary trade secret, or other confidential information unless the agency can demonstrate that it has instituted procedures to protect the information's confidentiality to the extent permitted by law.**

As specified in paragraph (e)(5) of the Standard, employers must notify each worker either individually in writing, or by posting the monitoring results within 15 working days after receiving the results. If the results show that a worker's exposure to AN exceeds the PEL, the employer must notify them of this finding, and inform them of the corrective actions they are taking to prevent overexposure.

- 8. If applicable, provide a copy and identify the date and page number of publication in the Federal Register of the agency's notice, required by 5 CFR 1320.8(d), soliciting comments on the information collection prior to submission to OMB. Summarize public comments received in response to that notice and describe actions taken by the agency in response to these comments. Specifically address comments received on cost and hour burden.**

**Describe efforts to consult with persons outside the agency to obtain their views on the availability of data, frequency of collection, the clarity of instructions and recordkeeping, disclosure, or reporting format (if any), and on the data elements to be recorded, disclosed, or reported.**

**Consultation with representatives of those from whom information is to be obtained or those who must compile records should occur at least once every 3 years -- even if the collection of information activity is the same as in prior periods. There may be circumstances that may preclude consultation in a specific situation. These circumstances should be explained.**

As required by the Paperwork Reduction Act of 1995 (PRA) (44 U.S.C. 3506(c)(2)(A)), OSHA published a notice in the *Federal Register* on October 8, 2024 (89 FR 81577) soliciting comments on its proposal to extend the Office of Management and Budget's approval of the information collection requirements specified by the Acrylonitrile Standard (29 CFR 1910.1045) under the Docket Number OSHA-2011-0195. This notice is part of a preclearance consultation program that provides the general public and government agencies with an opportunity to comment. The agency will respond to any public comments in response to this notice.

**9. Explain any decision to provide any payment or gift to respondents, other than remuneration of contractors or grantees.**

The agency will not provide payments or gifts to the respondents.

**10. Describe any assurance of confidentiality provided to respondents and the basis for the assurance in statute, regulation, or agency policy.**

To ensure that the personal information contained in medical records remains confidential, OSHA developed 29 CFR 1913.10 to regulate access to these records.

**11. Provide additional justification for any questions of a sensitive nature, such as sexual behavior and attitudes, religious beliefs, and other matters that are commonly considered private. This justification should include the reasons why the agency considers the questions necessary, the specific uses to be made of the information, the explanation to be given to persons from whom the information is requested, and any steps to be taken to obtain their consent.**

None of the provisions in the regulations require sensitive information.

**12. Provide estimates of the hour burden of the collection of information. The statement should:**

- **Indicate the number of respondents, frequency of response, annual hour burden, and an explanation of how the burden was estimated. Unless directed to do so, agencies should not conduct special surveys to obtain information on which to base hour burden estimates. Consultation with a sample (fewer than 10) of potential respondents is desirable. If the hour burden on respondents is expected to vary widely because of differences in activity, size, or complexity, show the range of estimated hour burden, and explain the reasons for the variance. Generally,**

**estimates should not include burden hours for customary and usual business practices.**

- **If this request for approval covers more than one form, provide separate hour burden estimates for each form and aggregate the hour burdens.**
- **Provide estimates of annualized cost to respondents for the hour burdens for collections of information, identifying and using appropriate wage-rate categories.**

### **Respondent Burden Hour and Cost Determinations**

The data used in this supporting statement is determined by multiplying the updated total number of plants in each sector by the number of workers per plant in each sector as presented in the previous ICR update. Table 2 below provides summary data for plants and workers associated with different sectors that produce AN and AN-based materials.

The agency determined the wage rate from the mean hourly wage earnings to represent the cost of employee time. For the relevant Standard Occupational Classification (SOC) category, OSHA used the wage rates reported in the Bureau of Labor Statistics (BLS), U.S. Department of Labor, *Occupational Employment and Wage Statistics (OEWS)*, May 2023 [date accessed: August 26, 2024]. (OEWS data is available at <https://www.bls.gov/oes/tables.htm>. To access a wage rate, select the year, “Occupation profiles,” and the SOC code.)

To account for fringe benefits markup, the agency used the BLS 10:00 AM (ET), June 18, 2024 news release: *Employer Costs for Employee Compensation – March 2024* news release text; ([https://www.bls.gov/news.release/archives/ecec\\_06182024.htm](https://www.bls.gov/news.release/archives/ecec_06182024.htm)). BLS reported that for private industry workers, fringe benefits accounted for 29.7 percent of total compensation and wages accounted for the remaining 70.3 percent. To calculate the loaded hourly wage for each occupation, the agency multiplied the mean hourly wage by one over one minus the fringe benefits.

In Table 1 is a summary of the how the wage rate estimates were derived for the information collection requirements specified by the Standard.

<b>Table 1 – WAGE HOUR ESTIMATES</b>				
<b>Occupational Title</b>	<b>SOC Code</b>	<b>Mean Hourly Wage Rate (A)</b>	<b>Fringe Benefits (B)</b>	<b>Loaded Hourly Wage Rate (C) = (A)/((1-(B)))</b>
First-Line Supervisors of Production and Operating Workers	51-1011	\$34.48	0.297	\$49.05
Secretaries and Administrative Assistants	43-6014	\$21.87	0.297	\$31.11
Production Occupations	51-000	\$22.90	0.297	\$32.57
Industrial Hygienist Technician	29-9012 (29-9000)	\$33.78	0.297	\$48.05



**Table 2 - Summary Data for Plants and Employees Associated with Sectors that Produce AN and AN-Based Materials<sup>4</sup>**

<b>Plants/Employees</b>	<b>AN-Production Sector</b>	<b>Acrylic-Fibers Sector<sup>5</sup></b>	<b>ABS/SAN Resins Sector</b>	<b>Nitrile-Rubber Sector</b>	<b>Totals</b>
Total no. of plants in each sector	5 <sup>6</sup>	0 <sup>7</sup>	42 <sup>8</sup>	57 <sup>9</sup>	104
Total no. of employees in each sector <sup>10</sup>	875	0	5,796	6,042	12,713
No. of employees per plant in each sector <sup>11</sup>	175	0	138	106	419
Estimated no. of employees exposed to AN at or above the AL, but at or below the PEL, in each sector <sup>12</sup>	146	0	966	1,007	2,119
Estimated no. of employees exposed to AN above the PEL <sup>13</sup>	82	0	541	564	1,187

<sup>4</sup> The following designations identify the four production sectors that produce AN or AN-based materials; AN production, Acrylic Fibers, ABS/SAN Resins, and Nitrile Rubber.

<sup>5</sup> Data limitations at the time of the previous ICR prevented OSHA from identifying the number of affected employees in this sector. Despite evidence of current U.S. production activity in this sector (as shown on ThomasNet), the agency remains unable to profile the number of affected employees, and therefore this ICR repeats the profile shown in the previous ICR.

<sup>6</sup> ThomasNet (search for Acrylonitrile, click on manufacturer). Accessed August 6, 2024. \*\*Assumes 1 manufacturer = 1 plant.\*\*

<sup>7</sup> ThomasNet (search for Acrylic Fiber (no results for modacrylic), then search within results for manufacturer or custom manufacturer) yields 95 acrylic fibers manufacturers plus 2 manufacturers of fire & flame resistant & retardant fabrics that include modacrylic fibers are listed here: [https://www.thomasnet.com/suppliers/search?cov=NA&format=json&heading=27261403&limit=15&searchsource=suppliers&searchterm=Fire+%26+Flame+Resistant+%26+Retardant+Fabrics&what=Fire+%26+Flame+Resistant+%26+Retardant+Fabrics&which=prod&coverage\\_area=NA&searchwithin=modacrylic](https://www.thomasnet.com/suppliers/search?cov=NA&format=json&heading=27261403&limit=15&searchsource=suppliers&searchterm=Fire+%26+Flame+Resistant+%26+Retardant+Fabrics&what=Fire+%26+Flame+Resistant+%26+Retardant+Fabrics&which=prod&coverage_area=NA&searchwithin=modacrylic). \*\*Assumes 1 manufacturer = 1 plant.\*\* Accessed August 6, 2024.

<sup>8</sup> ThomasNet (search for Acrylonitrile-Butadiene-Styrene Resins, then search within results for manufacturer or custom manufacturer). \*\*Assumes 1 manufacturer = 1 plant.\*\* Accessed August 6, 2024.

<sup>9</sup> ThomasNet (search for Nitrile Rubber, click on manufacturer, sum of manufacturer and custom manufacturer not also listed as manufacturer). \*\*Assumes 1 manufacturer = 1 plant.\*\* Accessed August 6, 2024.

<sup>10</sup> Because updated information was unavailable, the agency estimated the total number of workers in each

Regarding the time estimates for performing the wide variety of information collections required by the Standard, OSHA is using the time estimates from the previous ICR. These estimates appear to be reasonable because the agency based them on data from the Regulatory Impact Analysis, which was available for public review and comment when it published the final AN Standard. In addition, most of the firms engaged in performing the information have many years of experience in doing so; therefore, these times are probably upper-bound estimates.

The following sections summarize the methodology used for estimating the number of burden hours and costs resulting from the information collection requirements of the AN Standard.

### **A. Exposure monitoring (§1910.1045(e))**

The agency used the data from Table 2 to determine the number of workers exposed at or above the AL and above the PEL. In addition, OSHA estimates that an industrial hygiene technician requires 1 hour to collect and analyze each sample and that an employer uses each exposure monitoring sample to represent the exposures of two workers (i.e., the worker from whom the industrial hygiene technician took the sample and another, similarly-situated, workers).

#### Initial monitoring (§1910.1045(e)(2))

Only new plants incur burden for initial monitoring. The agency believes that no new plants will begin operations during the period covered by this ICR. Therefore, this paperwork requirement results in no employer burden or cost.

#### Periodic monitoring (§1910.1045(e)(3))

The Standard requires that employers provide semi-annual exposure monitoring to workers exposed to AN at or above the AL, but below the PEL, while workers exposed above the PEL must receive monitoring at least quarterly.

$$\begin{aligned} \text{Burden hours: } & [(2,119 \text{ workers} \div 2 \text{ workers per sample}) \times 1 \text{ hour} \times 2 \text{ (semi-annually)}] \\ & + [(1,187 \text{ workers} \div 2 \text{ workers per sample}) \times 1 \text{ hour} \times 4 \text{ (quarterly)}] = \\ & 4,493 \text{ hours} \end{aligned}$$

$$\text{Cost: } 4,493 \text{ hours} \times \$48.05 = \$215,889$$

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sector by multiplying the updated total number of plants in each sector by the number of workers per plant in each sector as presented in the previous ICR update.

<sup>11</sup> These estimates have been retained from the previous ICR update.

<sup>12</sup> Based on available sampling data, OSHA estimates that, on average, 16.7% of the total number of employees in each production sector have AN exposures at or above the AL, but at or below the PEL, retained from previous ICR update.

<sup>13</sup> OSHA estimates a rate of 9.3% of the total number of employees in each production section exposed to AN above the PEL, retained from previous ICR update.

Additional monitoring (§1910.1045(e)(4))

The agency assumes that each plant takes one additional exposure-monitoring sample (representing two workers) each year to determine if a change in production, process, control, or personnel increases the distribution or concentration of airborne AN. OSHA estimates that the total annual burden hours and cost of this paperwork requirement are:

**Burden hours:**  $104 \text{ plants} \times 1 \text{ hour} = 104 \text{ hours}$   
**Cost:**  $104 \text{ hours} \times \$48.05 = \$4,997$

Employee notification (§1910.1045(e)(5))

Employers may post monitoring results in a readily accessible location. OSHA assumes that each of the facilities have workers exposed above the AL but below the PEL; and, workers exposed above the PEL. Employers will satisfy the semi-annual posting requirements when they quarterly post their workers monitoring results. OSHA also assumes that each of the 104 employers will conduct additional monitoring.

**Burden hours:**  $[(104 \text{ plants} \times 4 \text{ quarterly}) + (104 \text{ plants} \times 1 \text{ annually})] \times 5/60 \text{ hour to post} = 43 \text{ hours}$   
**Cost:**  $43 \text{ hours} \times \$31.11 = \$1,338$

**B. Compliance program (§1910.1045(g)(2))**

Employers must establish and implement a written program to reduce employee exposures to or below the permissible exposure limits solely by means of engineering and work practice controls. Table 2 indicates that 1,187 workers have AN exposures above the PEL. However, OSHA cannot determine at which plants these workers work. Therefore, for the purpose of this determination, the agency assumes that each of the 104 plants have some workers exposed to AN above the PEL, and that each of these plants must update their compliance plans annually. OSHA estimates that a supervisor requires 30 minutes (30/60 hour) to update each plan, resulting in the following total annual burden hour and cost estimates:

**Burden hours:**  $104 \text{ plants} \times 30/60 \text{ hour} \times 1 \text{ annually} = 52 \text{ hours}$   
**Cost:**  $52 \text{ hours} \times \$49.05 = \$2,551$

**C. Respirator program (§1910.1045(h)(2))**

The agency accounts for the burden hours and cost resulting from the respiratory protection requirements under the ICR for the Respiratory Protection Standard, Office of Management and Budget (OMB) Control Number 1218-0099.

**D. Emergency situations (§1910.1045(i))**

Written plans (§1910.1045(i)(1))

The agency assumes that the existing plants producing AN or AN-based materials developed their emergency plans during previous clearance periods. Therefore, OSHA is not attributing any burden hours or cost to this provision.

#### **E. Cleaning and replacement (§1910.1045(j)(2)(v))**

OSHA believes that employers who produce AN or AN-based materials contract with commercial laundries to clean protective clothing, and that a secretary takes five minutes (5/60 hour) to notify a contract laundry once a year of the potentially harmful effects of AN exposure. Accordingly, this provision results in the following total burden hours and cost each year:

**Burden hours:** 104 plants × 5/60 hour = 9 hours

**Cost:** 9 hours × \$31.11 = \$280

#### **F. Medical surveillance (§1910.1045(n))**

OSHA estimates that a worker spends 30 minutes (30/60 hour) traveling to and from an offsite medical facility for each medical examination, and that the examination requires one (1) hour to administer (for a total of 1.50 hours).

##### Initial, periodic, employment-termination, and additional examinations (§1910.1045(n)(2), (n)(3), and (n)(4))

Based on the information in Table 2, the agency estimates that 3,306 workers<sup>14</sup> must receive an initial or periodic examination each year. Assuming<sup>15</sup> an annual separation rate of 27.10%, OSHA estimates a total of 896 workers would receive an initial examination. Again, accounting for the annual separation rate, 2,410 workers (3,306 minus 896) would receive a periodic examination.

The agency assumes that 18.6% (615) of the workers will require additional medical examination.

##### Initial and Additional Medical Examinations:

There are 896 new employees that will still receive a chest x-ray, as well as those 615 employees who receive additional medical examinations. Medical examinations having chest x-rays are estimated to take 1 hour and 30 minutes (1.50 hours) for a worker making \$32.57 an hour.

**Burden hours:** 1,511 workers x 90/60 hour = 2,267 hours

**Cost:** 2,267 hours x \$32.57 = \$73,836

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<sup>14</sup>Consisting of 2,119 employees exposed to AN at or above the AL, but below the PEL, and 1,187 employees exposed to AN at or above the PEL. (2,119 employees + 1,187 employees = 3,306 employees)

<sup>15</sup> Assuming the same separation rate has not changed from the previous ICR.

### Periodic Medical Examinations

There are 2,410 workers receiving examinations annually. The time for each periodic medical examination will be reduced by 15 minutes because the standard no longer requires x-rays for workers getting periodic exams. This means a worker will only spend 1 hour and 15 minutes (1.25 hours) away from the job instead of 1 hour and 30 minutes (1.50 hours).

**Burden hours:** 2,410 workers x 75/60 hour = 3,013 hours

**Cost:** 3,013 hours x \$32.57 = \$98,133

### Information provided to the physician (§1910.1045(n)(5))

The agency assumes that for each medical examination, a secretary requires five minutes (5/60 hour) to compile the required information and deliver it to the physician. With 3,921 initial, periodic, employment-termination, and additional examinations administered each year, the total annual burden hours and cost of this provision are:

**Burden hours:** 3,921 examinations x 5/60 hour = 327 hours

**Cost:** 327 hours × \$31.11 = \$10,173

### Physician's written opinion (§1910.1045(n)(6))

OSHA assumes that a secretary takes five minutes (5/60 hour) to file each of the 3,921 opinions in a worker's medical record, as well as deliver a copy of it to the worker, resulting in an annual total burden hour and cost estimate of:

**Burden hours:** 3,921 opinions × 5/60 hour = 327 hours

**Cost:** 327 hours × \$31.11 = \$10,173

### **G. Employee information and training (§1910.1045(o))**

The agency assumes that employers covered by the Standard developed and updated their training programs during previous clearance periods. Therefore, OSHA is not attributing any burden hours or cost to this activity.

### **H. Signs and labels (§1910.1045(p))**

The provisions containing the paperwork requirements associated with signs and labels specify the design, format, and specific language for these materials. Therefore, OSHA is taking no burden for these provisions because it is providing the information needed by employers to meet these requirements. (See Controlling Paperwork Burden on the Public (5 CFR 1320.3(c)(2)).

### **I. Recordkeeping (§1910.1045(q))**

#### Objective data for exempted operations (§1910.1045(q)(1))

The agency believes that no employer currently implements this provision. Therefore, OSHA is not attributing any burden hours or cost to it.

Exposure monitoring (§1910.1045(q)(2))

OSHA estimates that a secretary takes five minutes (5/60 hour) annually to collect, file, and maintain each of the 4,597 exposure-monitoring records.<sup>16</sup> Thus, the total burden hours and cost of this requirement each year are:

**Burden hours:** 4,597 records × 5/60 hour = 383 hours

**Cost:** 383 hours × \$31.11 = \$11,915

Medical surveillance (§1910.1045(q)(3))

The agency determines that a secretary requires five minutes (5/60 hour) annually to collect, file, and maintain each of the 3,921 medical-surveillance records,<sup>17</sup> resulting in a total yearly estimated hour burden and cost of:

**Burden hours:** 3,921 records × 5/60 hour = 327 hours

**Cost:** 327 hours × \$31.11 = \$10,173

Availability (§ 1910.1045(q)(4))

The agency assumes that 10% of the workers exposed to AN at or above the AL (i.e., 3,306 workers × 10% = 331 workers),<sup>18</sup> request access to medical records, exposure-monitoring records, training materials, or written compliance plans each year. OSHA estimates that a secretary takes five minutes (5/60 hour) to make the requested record available to each worker. Therefore, the total yearly burden hours and cost associated with making the required records available to workers is:

**Burden hours:** 331 worker-related requests × 5/60 hour = 28 hours

**Cost:** 28 hours × \$31.11 (secretarial) = \$871

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<sup>16</sup>See “Employee monitoring (§1910.1045(e)(2)(3) and (4))” above for an explanation of the procedure used to determine the total number of exposure monitoring records (i.e., 4,597).

<sup>17</sup> See “Information Provided to the Physician (§1910.1045 (n)(5))” above for an explanation of the procedure used to determine the total number of medical-surveillance records (i.e., 3,921).

<sup>18</sup>See Table 2 above for details; this total includes the employees' designated representatives.

**Table 3 - Summary of Estimated Annualized Respondent Burden Hour and Cost**

<b>Information Collection Requirement</b>	<b>Number of Respondents</b>	<b>Responses per Respondent</b>	<b>Total Responses</b>	<b>Time per Response (in Hours)</b>	<b>Burden Hours</b>	<b>Loaded Hourly Wage</b>	<b>Burden Costs</b>
<b>A. Exposure Monitoring</b>							
Initial monitoring	104	0	0	0	0	0	\$0
Periodic monitoring	104	43.2019231	4,493	1	4,493	\$48.05	\$215,889
Additional Monitoring	104	1	104	1	104	\$48.05	\$4,997
Employee notification	104	5	520	5/60	43	\$31.11	\$1,338
<b>B. Compliance program</b>							
	104	1	104	30/60	52	\$49.05	\$2,551
<b>C. Respiratory protection</b>							
	104	0	0	0	0	\$0	\$0
<b>D. Emergency situations</b>							
Written plans	104	0	0	0	0	\$0	\$0
<b>E. Cleaning and replacement</b>							
	104	1	104	5/60	9	\$31.11	\$280
<b>F. Medical surveillance</b>							
Initial and additional exams	104	14.5288462	1,511	90/60	2,267	\$32.57	\$73,836

Information Collection Requirement	Number of Respondents	Responses per Respondent	Total Responses	Time per Response (in Hours)	Burden Hours	Loaded Hourly Wage	Burden Costs
Periodic exams	104	23.1730769	2,410	75/60	3,013	\$32.57	\$98,133
Information provided to the physician	104	37.7019231	3,921	5/60	327	\$31.11	\$10,173
Physician's written opinion	104	37.7019231	3,921	5/60	327	\$31.11	\$10,173
<b>G. Employee information and training</b>							
	104	0	0	0	0	\$0	\$0
<b>H. Signs and labels</b>							
	104	0	0	0	0	\$0	\$0
<b>I. Recordkeeping</b>							
Objective data for exempted operations	104	0	0	0	0	\$0	\$0
Exposure monitoring	104	44.2019231	4,597	5/60	383	\$31.11	\$11,915
Medical surveillance	104	37.7019231	3,921	5/60	327	\$31.11	\$10,173
Availability	104	3.18269231	331	5/60	28	\$31.11	\$871
<b>Totals</b>			<b>25,937</b>		<b>11,373</b>		<b>\$440,329</b>

\*The number of respondents is 104.



**13. Provide an estimate of the total annual cost burden to respondents or recordkeepers resulting from the collection of information. (Do not include the cost of any hour burden shown in Items 12 and 14).**

- **The cost estimate should be split into two components: (a) a total capital and start-up cost component (annualized over its expected useful life); and (b) a total operation and maintenance and purchase of service component. The estimates should take into account costs associated with generating, maintaining, and disclosing or providing the information. Include descriptions of methods used to estimate major cost factors including system and technology acquisition, expected useful life of capital equipment, the discount rate(s), and the time period over which costs will be incurred. Capital and start-up costs include, among other items, preparations for collecting information such as purchasing computers and software; monitoring, sampling, drilling and testing equipment; and record storage facilities.**
- **If cost estimates are expected to vary widely, agencies should present ranges of cost burdens and explain the reasons for the variance. The cost of purchasing or contracting out information collection services should be a part of this cost burden estimate. In developing cost burden estimates, agencies may consult with a sample of respondent (fewer than 10), utilize the 60-day pre-OMB submission public comment process and use existing economic or regulatory impact analysis associated with the rulemaking containing the information collection, as appropriate.**
- **Generally, estimates should not include purchases of equipment or services, or portions thereof, made: (1) prior to October 1, 1995, (2) to achieve regulatory compliance with requirements not associated with the information collection, (3) for reasons other than to provide information or keep records for the government, or (4) as part of customary and usual business or private practices.**

### **Operation and Maintenance Cost Determinations**

#### **Exposure monitoring:**

Based on the determination that employers will take 4,597 monitoring samples<sup>19</sup>, the annual capital cost for analyzing these exposure monitoring samples is:

$$\text{Cost: } 4,597 \text{ samples} \times \$32.00 = \$147,104$$

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<sup>19</sup> According to “Exposure monitoring (§ 1910.1045(q)(2)),” employers will take a total of 2,119 semi-annual exposure monitoring samples, another total 2,374 quarterly monitoring samples and 104 additional monitoring samples for a total of 4,597 samples.

### **Medical Exams:**

The agency estimates the cost of the basic medical examination at \$171.53, and the cost for one chest x-ray at \$73.11.<sup>20</sup> Only 1 chest x-ray is required annually for each of these employees, regardless of the frequency specified for the medical examinations. And therefore, the total cost for a medical exam is \$244.64.

OSHA estimates that of 3,921 annual medical examinations, 896 examinations are for employees receiving initial medical examination, 2,410 employees are periodic medical examinations and another 615 examinations are for employees who are taking additional examinations.

#### Initial and Additional Medical Examinations:

OSHA estimated that there are 1,511 exams where chest x-rays are part of the initial, additional, and employment termination medical examinations:

$$\text{Cost: } 1,511 \text{ workers} \times \$244.64 = \$369,651$$

#### Periodic Medical Examinations:

OSHA estimates that there are 2,410 employees will be receiving periodic medical examinations and chest x-rays are not a part of the examinations:

$$\text{Cost: } 2,410 \text{ workers} \times \$171.53 = \$413,387$$

$$\text{Total Medical Exam Cost: } \$369,651 + \$413,387 = \$783,038$$

#### **Total cost for exposure monitoring and medical exams is:**

$$\$147,104 + \$783,038 = \$930,142$$

- 14. Provide estimates of annualized cost to the Federal government. Also, provide a description of the method used to estimate cost, which should include quantification of hours, operational expenses (such as equipment, overhead, printing, and support staff), and any other expense that would not have been incurred without this collection of information. Agencies also may aggregate cost estimates from Items 12, 13, and 14 in a single table.**

There is no cost to the Federal Government associated with this information collection request.

- 15. Explain the reasons for any program changes or adjustments.**

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<sup>20</sup> The Consumer Price Index indicated a 5.83% increase in the price of professional medical services June 2017; the cost of a chest x-ray was assumed to have increased by 5.83% as well, to \$73.11. The cost for a medical examination, excluding the chest x-ray, remains \$171.53.

The agency is requesting an adjustment decrease of 3,333 burden hours (from 14,706 hours to 11,373 hours). The decrease in burden is due to a decrease in the number of employees and the number of establishments. Table 4, *Estimated Change in Burden Hours*, shows the changes in detail by provision.

In addition, the estimated capital cost to employers decreased from \$1,164,653 to \$930,142, a total decrease of \$234,511. This decrease is due to a decrease in the number of workers being sampled and receiving medical exams.

**Table 4 - Estimated Change in Burden Hours**

<b>Information collection Requirement</b>	<b>Current Burden Hours</b>	<b>Requested Burden Hours</b>	<b>Adjustment</b>
<b>A. Exposure Monitoring</b>			
Initial monitoring	0	0	0
Frequency	5,620	4,493	-1,127
Additional Monitoring	139	104	-35
Employee notification	58	43	-15
<b>B. Compliance program</b>	70	52	-18
<b>C. Respiratory protection</b>	0	0	0
<b>D. Emergency situations</b>			
Written plans	0	0	0
<b>E. Cleaning and replacement</b>	11	9	-2
<b>F. Medical surveillance</b>			
Initial, periodic, employment-termination, and additional exams	6,609	5,280	-1,329
Information provided to the physician	409	327	-82
Physician's written opinion	409	327	-82
<b>G. Employee information and training</b>	0	0	0

<b>Information collection Requirement</b>	<b>Current Burden Hours</b>	<b>Requested Burden Hours</b>	<b>Adjustment</b>
<b>H. Signs and labels</b>	0	0	0
<b>I. Recordkeeping</b>			
Objective data for exempted operations	0	0	0
Exposure monitoring	937	383	-554
Medical surveillance	409	327	-82
Availability	35	28	-7
<b>Totals</b>	<b>14,706</b>	<b>11,373</b>	<b>-3,333</b>

- 16. For collections of information whose results will be published, outline plans for tabulation, and publication. Address any complex analytical techniques that will be used. Provide the time schedule for the entire project, including beginning and ending dates of the collection information, completion of report, publication dates, and other actions.**

OSHA will not publish the information collected under the standard.

- 17. If seeking approval to not display the expiration date for OMB approval of the information collection, explain the reasons that display would be appropriate.**

OSHA lists current valid control numbers in §§ 1910.8, 1915.8, 1917.4, 1918.4, and 1926.5 and publishes the expiration date in the Federal Register notice announcing OMB approval of the information collection requirement. (See 5 CFR 1320.3(f)(3)). OSHA believes that this is the most appropriate and accurate mechanism to inform interested parties of these expiration dates.

- 18. Explain each exception to the certification statement.**

OSHA is not requesting an exception to the certification statement.

**B. COLLECTIONS OF INFORMATION EMPLOYING STATISTICAL MEHTODS**

There are no collections of information employing statistical methods.

## **SEC. 2. Congressional Findings and Purpose**

(a) The Congress finds that personal injuries and illnesses arising out of work situations impose a substantial burden upon, and are a hindrance to, interstate commerce in terms of lost production, wage loss, medical expenses, and disability compensation payments.

(b) The Congress declares it to be its purpose and policy, through the exercise of its powers to regulate commerce among the several States and with foreign nations and to provide for the general welfare, to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources --

29 USC 651

(1) by encouraging employers and employees in their efforts to reduce the number of occupational safety and health hazards at their places of employment, and to stimulate employers and employees to institute new and to perfect existing programs for providing safe and healthful working conditions; (2) by providing that employers and employees have separate but dependent responsibilities and rights with respect to achieving safe and healthful working conditions;

(3) by authorizing the Secretary of Labor to set mandatory occupational safety and health standards applicable to businesses affecting interstate commerce, and by creating an Occupational Safety and Health Review Commission for carrying out adjudicatory functions under the Act;

(4) by building upon advances already made through employer and employee initiative for providing safe and healthful working conditions;

(5) by providing for research in the field of occupational safety and health, including the psychological factors involved, and by developing innovative methods, techniques, and approaches for dealing with occupational safety and health problems;

(6) by exploring ways to discover latent diseases, establishing causal connections between diseases and work in environmental conditions, and conducting other research relating to health problems, in recognition of the fact that occupational health standards present problems often different from those involved in occupational safety;

(7) by providing medical criteria which will assure insofar as practicable that no employee will suffer diminished health, functional capacity, or life expectancy as a result of his work experience;

(8) by providing for training programs to increase the number and competence of personnel engaged in the field of occupational safety and health; affecting the OSH Act since its passage in 1970 through January 1, 2004.

(9) by providing for the development and promulgation of occupational safety and health standards;

(10) by providing an effective enforcement program which shall include a prohibition against giving advance notice of any inspection and sanctions for any individual violating this prohibition;

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(11) by encouraging the States to assume the fullest responsibility for the

administration and enforcement of their occupational safety and health laws by providing grants to the States to assist in identifying their needs and responsibilities in the area of occupational safety and health, to develop plans in accordance with the provisions of this Act, to improve the administration and enforcement of State occupational safety and health laws, and to conduct experimental and demonstration projects in connection therewith;

(12) by providing for appropriate reporting procedures with respect to occupational safety and health which procedures will help achieve the objectives of this Act and accurately describe the nature of the occupational safety and health problem;

(13) by encouraging joint labor-management efforts to reduce injuries and disease arising out of employment.

## **6. Occupational Safety and Health Standards**

29 USC 655:

(a) Without regard to chapter 5 of title 5, United States Code, or to the other subsections of this section, the Secretary shall, as soon as practicable during the period beginning with the effective date of this Act and ending two years after such date, by rule promulgate as an occupational safety or health standard any national consensus standard, and any established Federal standard, unless he determines that the promulgation of such a standard would not result in improved safety or health for specifically designated employees. In the event of conflict among any such standards, the Secretary shall promulgate the standard which assures the greatest protection of the safety or health of the affected employees. (b) The Secretary may by rule promulgate, modify, or revoke any occupational safety or health standard in the following manner:

(1) Whenever the Secretary, upon the basis of information submitted to him in writing by an interested person, a representative of any organization of employers or employees, a nationally recognized standards-producing organization, the Secretary of Health and Human Services, the National Institute for Occupational Safety and Health, or a State or political subdivision, or on the basis of information developed by the Secretary or otherwise available to him, determines that a rule should be promulgated in order to serve the objectives of this Act, the Secretary may request the recommendations of an advisory committee appointed under section 7 of this Act. The Secretary shall provide such an advisory committee with any proposals of his own or of the Secretary of Health and Human Services, together with all pertinent factual information developed by the Secretary or the Secretary of Health and Human Services, or otherwise available, including the results of research, demonstrations, and experiments. An advisory committee shall submit to the Secretary its recommendations regarding the rule to be promulgated within ninety days from the date of its appointment or within such longer or shorter period as may be prescribed by the Secretary, but in no event for a period which is longer than two hundred and seventy days. (2) The Secretary shall publish a proposed rule promulgating, modifying, or revoking an occupational safety or health standard in the Federal Register and shall afford interested persons a period of thirty days after publication to submit written data or comments. Where an advisory committee is appointed and the Secretary determines that a rule should be issued, he shall publish the

proposed rule within sixty days after the submission of the advisory committee's recommendations or the expiration of the period prescribed by the Secretary for such submission. (3) On or before the last day of the period provided for the submission of written data or comments under paragraph (2), any interested person may file with the Secretary written objections to the proposed rule, stating the grounds therefore and requesting a public hearing on such objections. Within thirty days after the last day for filing such objections, the Secretary shall publish in the Federal Register a notice specifying the occupational safety or health standard to which objections have been filed and a hearing requested, and specifying a time and place for such hearing.

### **SEC. 8. Inspections, Investigations, and Recordkeeping**

(a) In order to carry out the purposes of this Act, the Secretary, upon presenting appropriate credentials to the owner, operator, or agent in charge, is authorized --  
29 USC 657

(1) to enter without delay and at reasonable times any factory, plant, establishment, construction site, or other area, workplace or environment where work is performed by an employee of an employer; and (2) to inspect and investigate during regular working hours and at other reasonable times, and within reasonable limits and in a reasonable manner, any such place of employment and all pertinent conditions, structures, machines, apparatus, devices, equipment, and materials therein, and to question privately any such employer, owner, operator, agent or employee.

(b) In making his inspections and investigations under this Act the Secretary may require the attendance and testimony of witnesses and the production of evidence under oath. Witnesses shall be paid the same fees and mileage that are paid witnesses in the courts of the United States. In case of a contumacy, failure, or refusal of any person to obey such an order, any district court of the United States or the United States courts of any territory or possession, within the jurisdiction of which such person is found, or resides or transacts business, upon the application by the Secretary, shall have jurisdiction to issue to such person an order requiring such person to appear to produce evidence if, as, and when so ordered, and to give testimony relating to the matter under investigation or in question, and any failure to obey such order of the court may be punished by said court as a contempt thereof. (c) (1) Each employer shall make, keep and preserve, and make available to the Secretary or the Secretary of Health and Human Services, such records regarding his activities relating to this Act as the Secretary, in cooperation with the Secretary of Health and Human Services, may prescribe by regulation as necessary or appropriate for the enforcement of this Act or for developing information regarding the causes and prevention of occupational accidents and illnesses. In order to carry out the provisions of this paragraph such regulations may include provisions requiring employers to conduct periodic inspections. The Secretary shall also issue regulations requiring that employers, through posting of notices or other appropriate means,

keep their employees informed of their protections and obligations under this Act, including the provisions of applicable standards.

(2) The Secretary, in cooperation with the Secretary of Health and Human Services, shall prescribe regulations requiring employers to maintain accurate records of, and to make periodic reports on, work-related deaths, injuries and illnesses other than minor injuries requiring only first aid treatment and which do not involve medical treatment, loss of consciousness, restriction of work or motion, or transfer to another job.



# The Electronic Code of Federal Regulations

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**Editorial Note:** Nomenclature changes to part 1910 appear at [84 FR 21597](#), May 14, 2019.

## § 1910.1045 Acrylonitrile.

(a) *Scope and application.*

- (1) This section applies to all occupational exposures to acrylonitrile (AN), Chemical Abstracts Service Registry No. 000107131, except as provided in [paragraphs \(a\)\(2\)](#) and [\(a\)\(3\)](#) of this section.
- (2) This section does not apply to exposures which result solely from the processing, use, and handling of the following materials:
  - (i) ABS resins, SAN resins, nitrile barrier resins, solid nitrile elastomers, and acrylic and modacrylic fibers, when these listed materials are in the form of finished polymers, and products fabricated from such finished polymers;
  - (ii) Materials made from and/or containing AN for which objective data is reasonably relied upon to demonstrate that the material is not capable of releasing AN in airborne concentrations in excess of 1 ppm as an eight (8)-hour time-weighted average, under the expected conditions of processing, use, and handling which will cause the greatest possible release; and
  - (iii) Solid materials made from and/or containing AN which will not be heated above 170 °F during handling, use, or processing.
- (3) An employer relying upon exemption under paragraph (a)(2)(ii) shall maintain records of the objective data supporting that exemption, and of the basis of the employer's reliance on the data, as provided in [paragraph \(q\)](#) of this section.

(b) *Definitions.* *Acrylonitrile* or *AN* means acrylonitrile monomer, chemical formula  $\text{CH}_2 = \text{CHCN}$ .

**Action level** means a concentration of AN of 1 ppm as an eight (8)-hour time-weighted average.

**Assistant Secretary** means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

**Authorized person** means any person specifically authorized by the employer whose duties require the person to enter a regulated area, or any person entering such an area as a designated representative of employees for the purpose of exercising the opportunity to observe monitoring procedures under [paragraph \(r\)](#) of this section.

**Decontamination** means treatment of materials and surfaces by water washdown, ventilation, or other means, to assure that the materials will not expose employees to airborne concentrations of AN above 1 means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

**Emergency** means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment, which results in an unexpected massive release of AN.

**Liquid AN** means AN monomer in liquid form, and liquid or semiliquid polymer intermediates, including slurries, suspensions, emulsions, and solutions, produced during the polymerization of AN.

**OSHA Area Office** means the Area Office of the Occupational Safety and Health Administration having jurisdiction over the geographic area where the affected workplace is located.

(c) *Permissible exposure limits* –

(1) *Inhalation.*

(i) *Time weighted average limit (TWA).* The employer shall assure that no employee is exposed to an airborne concentration of acrylonitrile in excess of two (2) parts acrylonitrile per million parts of air (2 ppm) as an eight (8)-hour time-weighted average.

(ii) *Ceiling limit.* The employer shall assure that no employee is exposed to an airborne concentration of acrylonitrile in excess of ten (10) ppm as averaged over any fifteen (15)-minute period during the work day.

(2) *Dermal and eye exposure.* The employer shall assure that no employee is exposed to skin contact or eye contact with liquid AN.

(d) [Reserved]

(e) *Exposure monitoring* –

(1) *General.*

(i) Determinations of airborne exposure levels shall be made from air samples that are representative of each employee's exposure to AN over an eight (8)-hour period.

(ii) For the purposes of this section, employee exposure is that exposure which would occur if the employee were not using a respirator.

(2) *Initial monitoring.* Each employer who has a place of employment in which AN is present shall monitor each such workplace and work operation to accurately determine the airborne concentrations of AN to which employees may be exposed.

(3) *Frequency.*

- (i) If the monitoring required by this section reveals employee exposure to be below the action level, the employer may discontinue monitoring for that employee.
  - (ii) If the monitoring required by this section reveals employee exposure to be at or above the action level but at or below the permissible exposure limits, the employer must repeat such monitoring for each such employee at least every 6 months. The employer must continue these measurements every 6 months until at least two consecutive measurements taken at least seven (7) days apart, are below the action level, and thereafter the employer may discontinue monitoring for that employee.
  - (iii) If the monitoring required by this section reveals employee exposure to be in excess of the permissible exposure limits, the employer must repeat these determinations for each such employee at least quarterly. The employer must continue these quarterly measurements until at least two consecutive measurements, taken at least seven (7) days apart, are at or below the permissible exposure limits, and thereafter the employer must monitor at least every 6 months.
- (4) *Additional monitoring.* Whenever there has been a production, process, control, or personnel change which may result in new or additional exposures to AN, or whenever the employer has any other reason to suspect a change which may result in new or additional exposures to AN, additional monitoring which complies with this paragraph shall be conducted.
- (5) *Employee notification.*
- (i) The employer must, within 15 working days after the receipt of the results of any monitoring performed under this section, notify each affected employee of these results either individually in writing or by posting the results in an appropriate location that is accessible to employees.
  - (ii) Whenever the results indicate that the representative employee exposure exceeds the permissible exposure limits, the employer shall include in the written notice a statement that the permissible exposure limits were exceeded and a description of the corrective action being taken to reduce exposure to or below the permissible exposure limits.
- (6) *Accuracy of measurement.* The method of measurement of employee exposures shall be accurate to a confidence level of 95 percent, to within plus or minus 35 percent for concentrations of AN at or above the permissible exposure limits, and plus or minus 50 percent for concentrations of AN below the permissible exposure limits.
- (f) *Regulated areas.*
- (1) The employer shall establish regulated areas where AN concentrations are in excess of the permissible exposure limits.
  - (2) Regulated areas shall be demarcated and segregated from the rest of the workplace, in any manner that minimizes the number of persons who will be exposed to AN.

(3) Access to regulated areas shall be limited to authorized persons or to persons otherwise authorized by the act or regulations issued pursuant thereto.

(4) The employer shall assure that food or beverages are not present or consumed, tobacco products are not present or used, and cosmetics are not applied in the regulated area.

(g) *Methods of compliance* –

(1) *Engineering and work practice controls.*

(i) By November 2, 1980, the employer shall institute engineering and work practice controls to reduce and maintain employee exposures to AN, to or below the permissible exposure limits, except to the extent that the employer establishes that such controls are not feasible.

(ii) Wherever the engineering and work practice controls which can be instituted are not sufficient to reduce employee exposures to or below the permissible exposure limits, the employer shall nonetheless use them to reduce exposures to the lowest levels achievable by these controls, and shall supplement them by the use of respiratory protection which complies with the requirements of [paragraph \(h\)](#) of this section.

(2) *Compliance program.*

(i) The employer shall establish and implement a written program to reduce employee exposures to or below the permissible exposure limits solely by means of engineering and work practice controls, as required by [paragraph \(g\)\(1\)](#) of this section.

(ii) Written plans for these compliance programs shall include at least the following:

(A) A description of each operation or process resulting in employee exposure to AN above the permissible exposure limits;

(B) An outline of the nature of the engineering controls and work practices to be applied to the operation or process in question;

(C) A report of the technology considered in meeting the permissible exposure limits;

(D) A schedule for implementation of engineering and work practice controls for the operation or process, which shall project completion no later than November 2, 1980; and

(E) Other relevant information.

(iii) The employer shall complete the steps set forth in the compliance program by the dates in the schedule.

(iv) Written plans shall be submitted upon request to the Assistant Secretary and the Director, and shall be available at the worksite for examination and copying by the Assistant Secretary, the Director, or any affected employee or representative.

- (v) The plans required by this paragraph must be revised and updated at least annually to reflect the current status of the program.
- (h) *Respiratory protection* —(1) *General*. For employees who use respirators required by this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this paragraph. Respirators must be used during:
  - (i) Periods necessary to install or implement feasible engineering and work-practice controls.
    - (ii) Work operations, such as maintenance and repair activities or reactor cleaning, for which the employer establishes that engineering and work-practice controls are not feasible.
    - (iii) Work operations for which feasible engineering and work-practice controls are not yet sufficient to reduce employee exposure to or below the permissible exposure limits.
    - (iv) Emergencies.
- (2) *Respirator program*.
  - (i) The employer must implement a respiratory protection program in accordance with [§ 1910.134\(b\)](#) through [\(d\)](#) (except [\(d\)\(1\)\(iii\)](#), [\(d\)\(3\)\(iii\)\(b\)\(1\)](#), and [\(2\)](#)), and [\(f\)](#) through [\(m\)](#), which covers each employee required by this section to use a respirator.
  - (ii) If air-purifying respirators (chemical-cartridge or chemical-canister types) are used:
    - (A) The air-purifying canister or cartridge must be replaced prior to the expiration of its service life or at the completion of each shift, whichever occurs first.
    - (B) A label must be attached to the cartridge or canister to indicate the date and time at which it is first installed on the respirator.
- (3) *Respirator selection*. Employers must:
  - (i) Select, and provide to employees, the appropriate respirators specified in [paragraph \(d\)\(3\)\(i\)\(A\) of 29 CFR 1910.134](#).
  - (ii) For escape, provide employees with any organic vapor respirator or any self-contained breathing apparatus permitted for use under [paragraph \(h\)\(3\)\(i\)](#) of this standard.
- (i) *Emergency situations* —(1) *Written plans*. (i) A written plan for emergency situations shall be developed for each workplace where liquid AN is present. Appropriate portions of the plan shall be implemented in the event of an emergency.
  - (ii) The plan shall specifically provide that employees engaged in correcting emergency conditions shall be equipped as required in [paragraph \(h\)](#) of this section until the emergency is abated.
  - (iii) Employees not engaged in correcting the emergency shall be evacuated from the area and shall not be permitted to return until the emergency is abated.

(2) *Alerting employees.* Where there is the possibility of employee exposure to AN in excess of the ceiling limit, a general alarm shall be installed and used to promptly alert employees of such occurrences.

(j) *Protective clothing and equipment –*

(1) *Provision and use.* Where eye or skin contact with liquid AN may occur, the employer shall provide at no cost to the employee, and assure that employees wear, impermeable protective clothing or other equipment to protect any area of the body which may come in contact with liquid AN. The provision of §§ 1910.132 and 1910.133 shall be complied with.

(2) *Cleaning and replacement.*

(i) The employer shall clean, launder, maintain, or replace protective clothing and equipment required by this section as needed to maintain their effectiveness.

(ii) The employer shall assure that impermeable protective clothing which contacts or is likely to have contacted liquid AN shall be decontaminated before being removed by the employee.

(iii) The employer shall assure that an employee whose nonimpermeable clothing becomes wetted with liquid AN shall immediately remove that clothing and proceed to shower. The clothing shall be decontaminated before it is removed from the regulated area.

(iv) The employer shall assure that no employee removes protective clothing or equipment from the change room, except for those employees authorized to do so for the purpose of laundering, maintenance, or disposal.

(v) The employer shall inform any person who launders or cleans protective clothing or equipment of the potentially harmful effects of exposure to AN.

(k) *Housekeeping.*

(1) All surfaces shall be maintained free of visible accumulations of liquid AN.

(2) For operations involving liquid AN, the employer shall institute a program for detecting leaks and spills of liquid AN, including regular visual inspections.

(3) Where spills of liquid AN are detected, the employer shall assure that surfaces contacted by the liquid AN are decontaminated. Employees not engaged in decontamination activities shall leave the area of the spill, and shall not be permitted in the area until decontamination is completed.

(l) *Waste disposal.* AN waste, scrap, debris, bags, containers, or equipment shall be decontaminated before being incorporated in the general waste disposal system.

(m) *Hygiene facilities and practices.*

- (1) Where employees are exposed to airborne concentrations of AN above the permissible exposure limits, or where employees are required to wear protective clothing or equipment pursuant to [paragraph \(j\)](#) of this section, the facilities required by [29 CFR 1910.141](#), including clean change rooms and shower facilities, shall be provided by the employer for the use of those employees, and the employer shall assure that the employees use the facilities provided.
  - (2) The employer shall assure that employees wearing protective clothing or equipment for protection from skin contact with liquid AN shall shower at the end of the work shift.
  - (3) The employer shall assure that, in the event of skin or eye exposure to liquid AN, the affected employee shall shower immediately to minimize the danger of skin absorption.
  - (4) The employer shall assure that employees working in the regulated area wash their hands and faces prior to eating.
- (n) *Medical surveillance* –
- (1) *General.*
    - (i) The employer shall institute a program of medical surveillance for each employee who is or will be exposed to AN at or above the action level, without regard to the use of respirators. The employer shall provide each such employee with an opportunity for medical examinations and tests in accordance with this paragraph.
    - (ii) The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and that they shall be provided without cost to the employee.
  - (2) *Initial examinations.* At the time of initial assignment, or upon institution of the medical surveillance program, the employer shall provide each affected employee an opportunity for a medical examination, including at least the following elements:
    - (i) A work history and medical history with special attention to skin, respiratory, and gastrointestinal systems, and those nonspecific symptoms, such as headache, nausea, vomiting, dizziness, weakness, or other central nervous system dysfunctions that may be associated with acute or with chronic exposure to AN;
    - (ii) A complete physical examination giving particular attention to the peripheral and central nervous system, gastrointestinal system, respiratory system, skin, and thyroid;
    - (iii) A 14- by 17-inch or other reasonably-sized standard film or digital posterior-anterior chest X-ray; and
    - (iv) Further tests of the intestinal tract, including fecal occult blood screening, for all workers 40 years of age or older, and for any other affected employees for whom, in the opinion of the physician, such testing is appropriate.

(3) *Periodic examinations.*

- (i) The employer shall provide the examinations specified in [paragraphs \(n\)\(2\)\(i\), \(ii\), and \(iv\)](#) of this section at least annually for all employees specified in [paragraph \(n\)\(1\)](#) of this section.
- (ii) If an employee has not had the examination specified in [paragraphs \(n\)\(2\)\(i\), \(ii\), and \(iv\)](#) of this section within 6 months preceding termination of employment, the employer shall make such examination available to the employee prior to such termination.

(4) *Additional examinations.* If the employee for any reason develops signs or symptoms which may be associated with exposure to AN, the employer shall provide an appropriate examination and emergency medical treatment.

(5) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

- (i) A copy of this standard and its appendixes;
- (ii) A description of the affected employee's duties as they relate to the employee's exposure;
- (iii) The employee's representative exposure level;
- (iv) The employee's anticipated or estimated exposure level (for preplacement examinations or in cases of exposure due to an emergency);
- (v) A description of any personal protective equipment used or to be used; and
- (vi) Information from previous medical examinations of the affected employee, which is not otherwise available to the examining physician.

(6) *Physician's written opinion.*

- (i) The employer shall obtain a written opinion from the examining physician which shall include:
  - (A) The results of the medical examination and test performed;
  - (B) The physician's opinion as to whether the employee has any detected medical condition(s) which would place the employee at an increased risk of material impairment of the employee's health from exposure to AN;
  - (C) Any recommended limitations upon the employee's exposure to AN or upon the use of protective clothing and equipment such as respirators; and
  - (D) A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.



- (ii) The employer shall instruct the physician not to reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure to AN.
- (iii) The employer shall provide a copy of the written opinion to the affected employee.
- (o) *Employee information and training –*
  - (1) *Training program.*
    - (i) The employer shall train each employee exposed to AN above the action level, each employee whose exposures are maintained below the action level by engineering and work practice controls, and each employee subject to potential skin or eye contact with liquid AN in accordance with the requirements of this section. The employer shall institute a training program and ensure employee participation in the program.
    - (ii) Training shall be provided at the time of initial assignment, or upon institution of the training program, and at least annually thereafter, and the employer shall assure that each employee is informed of the following:
      - (A) The information contained in appendixes A and B;
      - (B) The quantity, location, manner of use, release, or storage of AN, and the specific nature of operations which could result in exposure to AN, as well as any necessary protective steps;
      - (C) The purpose, proper use, and limitations of respirators and protective clothing;
      - (D) The purpose and a description of the medical surveillance program required by [paragraph \(n\)](#) of this section;
      - (E) The emergency procedures developed, as required by [paragraph \(i\)](#) of this section;
      - (F) Engineering and work practice controls, their function, and the employee's relationship to these controls; and
      - (G) A review of this standard.
  - (2) *Access to training materials.*
    - (i) The employer shall make a copy of this standard and its appendixes readily available to all affected employees.
    - (ii) The employer shall provide, upon request, all materials relating to the employee information and training program to the Assistant Secretary and the Director.
- (p) *Communication of hazards –*
  - (1) *Hazard communication—general.*

- (i) Chemical manufacturers, importers, distributors and employers shall comply with all requirements of the Hazard Communication Standard (HCS) ([§ 1910.1200](#)) for AN and AN-based materials not exempted under [paragraph \(a\)\(2\)](#) of this section.
- (ii) In classifying the hazards of AN and AN-based materials at least the following hazards are to be addressed: Cancer; central nervous system effects; liver effects; skin sensitization; skin, respiratory, and eye irritation; acute toxicity effects; and flammability.
- (iii) Employers shall include AN and AN-based materials in the hazard communication program established to comply with the HCS ([§ 1910.1200](#)). Employers shall ensure that each employee has access to labels on containers of AN and AN-based materials and to safety data sheets, and is trained in accordance with the requirements of HCS and [paragraph \(o\)](#) of this section.
- (iv) The employer shall ensure that no statement appears on or near any sign or label required by this [paragraph \(p\)](#) that contradicts or detracts from the required sign or label.

(2) *Signs.*

- (i) The employer shall post signs to clearly indicate all workplaces where AN concentrations exceed the permissible exposure limits. The signs shall bear the following legend:

DANGER  
ACRYLONITRILE (AN)  
MAY CAUSE CANCER  
RESPIRATORY PROTECTION MAY BE REQUIRED IN THIS AREA  
AUTHORIZED PERSONNEL ONLY

- (ii) The employer shall ensure that signs required by this [paragraph \(p\)\(2\)](#) are illuminated and cleaned as necessary so that the legend is readily visible.
- (iii) Prior to June 1, 2016, employers may use the following legend in lieu of that specified in [paragraph \(p\)\(2\)\(i\)](#) of this section:

DANGER  
ACRYLONITRILE (AN)  
CANCER HAZARD  
AUTHORIZED PERSONNEL ONLY  
RESPIRATORS MAY BE REQUIRED

(3) *Labels.*

- (i) The employer shall ensure that precautionary labels are in compliance with [paragraph \(p\)\(1\)\(i\)](#) of this section and are affixed to all containers of liquid AN and AN-based materials not exempted under [paragraph \(a\)\(2\)](#) of this section. The employer shall ensure that the labels remain affixed when the materials are sold, distributed, or otherwise leave the employer's workplace.
- (ii) Prior to June 1, 2015, employers may include the following information on precautionary labels required by this [paragraph \(p\)\(3\)](#) in lieu of the labeling requirements in [paragraph \(p\)\(1\)](#) of this section:

DANGER

CONTAINS ACRYLONITRILE (AN)

CANCER HAZARD

- (iii) The employer shall ensure that the precautionary labels required by this [paragraph \(p\)\(3\)](#) are readily visible and legible.

(q) *Recordkeeping –*

(1) *Objective data for exempted operations.*

- (i) Where the processing, use, and handling of materials made from or containing AN are exempted pursuant to [paragraph \(a\)\(2\)\(ii\)](#) of this section, the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.
- (ii) This record shall include at least the following information:
  - (A) The material qualifying for exemption;
  - (B) The source of the objective data;
  - (C) The testing protocol, results of testing, and/or analysis of the material for the release of AN;
  - (D) A description of the operation exempted and how the data supports the exemption; and
  - (E) Other data relevant to the operations, materials, and processing covered by the exemption.
- (iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(2) *Exposure monitoring.*

- (i) The employer shall establish and maintain an accurate record of all monitoring required by [paragraph \(e\)](#) of this section.
  - (ii) This record shall include:
    - (A) The dates, number, duration, and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure;
    - (B) A description of the sampling and analytical methods used and the data relied upon to establish that the methods used meet the accuracy and precision requirements of [paragraph \(e\)\(6\)](#) of this section;
    - (C) Type of respiratory protective devices worn, if any; and
    - (D) Name and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent.
  - (iii) The employer shall maintain this record for at least forty (40) years, or for the duration of employment plus twenty (20) years, whichever is longer.
- (3) *Medical surveillance.*
- (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by [paragraph \(n\)](#) of this section.
  - (ii) This record shall include:
    - (A) A copy of the physician's written opinions;
    - (B) Any employee medical complaints related to exposure to AN;
    - (C) A copy of the information provided to the physician as required by [paragraph \(n\)\(5\)](#) of this section; and
    - (D) A copy of the employee's medical and work history.
  - (iii) The employer shall assure that this record be maintained for at least forty (40) years, or for the duration of employment plus twenty (20) years, whichever is longer.
- (4) *Availability.*
- (i) The employer shall make all records required to be maintained by this section available, upon request, to the Assistant Secretary and the Director for examination and copying.
  - (ii) Records required by [paragraphs \(q\)\(1\)](#) through [\(q\)\(3\)](#) of this section shall be provided upon request to employees, designated representatives, and the Assistant Secretary in accordance with [29 CFR 1910.1020 \(a\)](#) through [\(e\)](#) and [\(q\)](#) through [\(i\)](#). Records required by paragraph (q)(1) shall be provided in the same manner as exposure monitoring records.

(5) *Transfer of records.*

- (i) Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by this section for the prescribed period.
- (ii) The employer shall also comply with any additional requirements involving transfer of records set forth in [29 CFR 1910.1020\(h\)](#).

(r) *Observation of monitoring –*

- (1) *Employee observation.* The employer shall provide affected employees, or their designated representatives, an opportunity to observe any monitoring of employee exposure to AN conducted pursuant to [paragraph \(e\)](#) of this section.

(2) *Observation procedures.*

- (i) Whenever observation of the monitoring of employee exposure to AN requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the observer with personal protective clothing and equipment required to be worn by employees working in the area, assure the use of such clothing and equipment, and require the observer to comply with all other applicable safety and health procedures.

- (ii) Without interfering with the monitoring, observers shall be entitled:

- (A) To receive an explanation of the measurement procedures;
- (B) To observe all steps related to the measurement of airborne concentrations of AN performed at the place of exposure; and
- (C) To record the results obtained.

- (s) [Reserved]

- (t) *Appendixes.* The information contained in the appendixes is not intended, by itself, to create any additional obligation not otherwise imposed, or to detract from any obligation.

## Appendix A to § 1910.1045—Substance Safety Data Sheet for Acrylonitrile

### i. Substance Identification

- A. Substance: Acrylonitrile (CH<sub>2</sub> CHCN).
- B. Synonyms: Propenenitrile; vinyl cyanide; cyanoethylene; AN; VCN; acylon; carbacryl; fumigrian; ventox.
- C. Acrylonitrile can be found as a liquid or vapor, and can also be found in polymer resins, rubbers, plastics, polyols, and other polymers having acrylonitrile as a raw or intermediate material.
- D. AN is used in the manufacture of acrylic and modiacrylic fibers, acrylic plastics and resins, speciality polymers, nitrile rubbers, and other organic chemicals. It has also been used as a fumigant.

E. Appearance and odor: Colorless to pale yellow liquid with a pungent odor which can only be detected at concentrations above the permissible exposure level, in a range of 13-19 parts AN per million parts of air (13-19 ppm).

F. Permissible exposure: Exposure may not exceed either:

1. Two parts AN per million parts of air (2 ppm) averaged over the 8-hour workday; or
2. Ten parts AN per million parts of air (10 ppm) averaged over any 15-minute period in the workday.
3. In addition, skin and eye contact with liquid AN is prohibited.

## ii. Health Hazard Data

A. Acrylonitrile can affect your body if you inhale the vapor (breathing), if it comes in contact with your eyes or skin, or if you swallow it. It may enter your body through your skin.

B. Effects of overexposure: 1. Short-term exposure: Acrylonitrile can cause eye irritation, nausea, vomiting, headache, sneezing, weakness, and light-headedness. At high concentrations, the effects of exposure may go on to loss of consciousness and death. When acrylonitrile is held in contact with the skin after being absorbed into shoe leather or clothing, it may produce blisters following several hours of no apparent effect. Unless the shoes or clothing are removed immediately and the area washed, blistering will occur. Usually there is no pain or inflammation associated with blister formation.

2. Long-term exposure: Acrylonitrile has been shown to cause cancer in laboratory animals and has been associated with higher incidences of cancer in humans. Repeated or prolonged exposure of the skin to acrylonitrile may produce irritation and dermatitis.

3. Reporting signs and symptoms: You should inform your employer if you develop any signs or symptoms and suspect they are caused by exposure to acrylonitrile.

## iii. Emergency First Aid Procedures

A. Eye exposure: If acrylonitrile gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

B. Skin exposure: If acrylonitrile gets on your skin, immediately wash the contaminated skin with water. If acrylonitrile soaks through your clothing, especially your shoes, remove the clothing immediately and wash the skin with water. If symptoms occur after washing, get medical attention immediately.

Thoroughly wash the clothing before reusing. Contaminated leather shoes or other leather articles should be discarded.

C. Inhalation: If you or any other person breathes in large amounts of acrylonitrile, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

D. Swallowing: When acrylonitrile has been swallowed, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

E. Rescue: Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the location of the emergency equipment before the need arises.

F. Special first aid procedures: First aid kits containing an adequate supply (at least two dozen) of amyl nitrite pearls, each containing 0.3 ml, should be maintained at each site where acrylonitrile is used. When a person is suspected of receiving an overexposure to acrylonitrile, immediately remove that person from the contaminated area using established rescue procedures. Contaminated clothing must be removed and the acrylonitrile washed from the skin immediately. Artificial respiration should be started at once if breathing has stopped. If the person is unconscious, amyl nitrite may be used as an antidote by a properly

trained individual in accordance with established emergency procedures. Medical aid should be obtained immediately.

#### iv. Respirators and Protective Clothing

A. Respirators. You may be required to wear a respirator for nonroutine activities, in emergencies, while your employer is in the process of reducing acrylonitrile exposures through engineering controls, and in areas where engineering controls are not feasible. If respirators are worn, they must have a label issued by the National Institute for Occupational Safety and Health under the provisions of [42 CFR part 84](#) stating that the respirators have been approved for use with organic vapors. For effective protection, respirators must fit your face and head snugly. Respirators must not be loosened or removed in work situations where their use is required.

Acrylonitrile does not have a detectable odor except at levels above the permissible exposure limits. Do not depend on odor to warn you when a respirator cartridge or canister is exhausted. Cartridges or canisters must be changed daily or before the end-of-service-life, whichever comes first. Reuse of these may allow acrylonitrile to gradually filter through the cartridge and cause exposures which you cannot detect by odor. If you can smell acrylonitrile while wearing a respirator, proceed immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

B. Supplied-air suits: In some work situations, the wearing of supplied-air suits may be necessary. Your employer must instruct you in their proper use and operation.

C. Protective clothing: You must wear impervious clothing, gloves, face shield, or other appropriate protective clothing to prevent skin contact with liquid acrylonitrile. Where protective clothing is required, your employer is required to provide clean garments to you as necessary to assume that the clothing protects you adequately.

Replace or repair impervious clothing that has developed leaks.

Acrylonitrile should never be allowed to remain on the skin. Clothing and shoes which are not impervious to acrylonitrile should not be allowed to become contaminated with acrylonitrile, and if they do the clothing and shoes should be promptly removed and decontaminated. The clothing should be laundered or discarded after the AN is removed. Once acrylonitrile penetrates shoes or other leather articles, they should not be worn again.

D. Eye protection: You must wear splashproof safety goggles in areas where liquid acrylonitrile may contact your eyes. In addition, contact lenses should not be worn in areas where eye contact with acrylonitrile can occur.

#### v. Precautions for Safe Use, Handling, and Storage

A. Acrylonitrile is a flammable liquid, and its vapors can easily form explosive mixtures in air.

B. Acrylonitrile must be stored in tightly closed containers in a cool, well-ventilated area, away from heat, sparks, flames, strong oxidizers (especially bromine), strong bases, copper, copper alloys, ammonia, and amines.

C. Sources of ignition such as smoking and open flames are prohibited wherever acrylonitrile is handled, used, or stored in a manner that could create a potential fire or explosion hazard.

D. You should use non-sparking tools when opening or closing metal containers of acrylonitrile, and containers must be bonded and grounded when pouring or transferring liquid acrylonitrile.

E. You must immediately remove any non-impervious clothing that becomes wetted with acrylonitrile, and this clothing must not be reworn until the acrylonitrile is removed from the clothing.

F. Impervious clothing wet with liquid acrylonitrile can be easily ignited. This clothing must be washed down with water before you remove it.

G. If your skin becomes wet with liquid acrylonitrile, you must promptly and thoroughly wash or shower with soap or mild detergent to remove any acrylonitrile from your skin.

H. You must not keep food, beverages, or smoking materials, nor are you permitted to eat or smoke in regulated areas where acrylonitrile concentrations are above the permissible exposure limits.

- I. If you contact liquid acrylonitrile, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.
- J. Fire extinguishers and quick drenching facilities must be readily available, and you should know where they are and how to operate them.
- K. Ask your supervisor where acrylonitrile is used in your work area and for any additional plant safety and health rules.

## vi. Access to Information

- A. Each year, your employer is required to inform you of the information contained in this Substance Safety Data Sheet for acrylonitrile. In addition, your employer must instruct you in the proper work practices for using acrylonitrile, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to acrylonitrile. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure. If your employer determines that you are being overexposed, he or she is required to inform you of the actions which are being taken to reduce your exposure to within permissible exposure limits.
- C. Your employer is required to keep records of your exposures and medical examinations. These records must be kept by the employer for at least forty (40) years or for the period of your employment plus twenty (20) years, whichever is longer.
- D. Your employer is required to release your exposure and medical records to you or your representative upon your request.

## Appendix B to § 1910.1045—Substance Technical Guidelines for Acrylonitrile

### i. Physical and Chemical Data

- A. Substance identification: 1. Synonyms: AN; VCN; vinyl cyanide; propenenitrile; cyanoethylene; Acrylon; Carbacryl; Fumigrain; Ventox.
- 2. Formula:  $\text{CH}_2 = \text{CHCN}$ .
- 3. Molecular weight: 53.1.
- B. Physical data: 1. Boiling point (760 mm Hg): 77.3 °C (171 °F);
- 2. Specific gravity (water = 1): 0.81 (at 20 °C or 68 °F);
- 3. Vapor density (air = 1 at boiling point of acrylonitrile): 1.83;
- 4. Melting point: -83 °C (-117 °F);
- 5. Vapor pressure (@20 °F): 83 mm Hg;
- 6. Solubility in water, percent by weight @20 °C (68 °F): 7.35;
- 7. Evaporation rate (Butyl Acetate = 1): 4.54; and
- 8. Appearance and odor: Colorless to pale yellow liquid with a pungent odor at concentrations above the permissible exposure level. Any detectable odor of acrylonitrile may indicate overexposure.

### ii. Fire, Explosion, and Reactivity Hazard Data

- A. Fire: 1. Flash point: -1 °C (30 °F) (closed cup).
- 2. Autoignition temperature: 481 °C (898 °F).
- 3. Flammable limits air, percent by volume: Lower: 3, Upper: 17.
- 4. Extinguishing media: Alcohol foam, carbon dioxide, and dry chemical.
- 5. Special fire-fighting procedures: Do not use a solid stream of water, since the stream will scatter and spread the fire. Use water to cool containers exposed to a fire.



6. Unusual fire and explosion hazards: Acrylonitrile is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where acrylonitrile is handled, used, or stored in a manner that could create a potential fire or explosion hazard. Acrylonitrile vapors are heavier than air and may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which acrylonitrile is being handled.

7. For purposes of compliance with the requirements of [29 CFR 1910.106](#), acrylonitrile is classified as a class IB flammable liquid. For example, 7,500 ppm, approximately one-fourth of the lower flammable limit, would be considered to pose a potential fire and explosion hazard.

8. For purposes of compliance with [29 CFR 1910.157](#), acrylonitrile is classified as a Class B fire hazard.

9. For purpose of compliance with [29 CFR 1919.309](#), locations classified as hazardous due to the presence of acrylonitrile shall be Class I, Group D.

**B. Reactivity:**

1. Conditions contributing to instability: Acrylonitrile will polymerize when hot, and the additional heat liberated by the polymerization may cause containers to explode. Pure AN may self-polymerize, with a rapid build-up of pressure, resulting in an explosion hazard. Inhibitors are added to the commercial product to prevent self-polymerization.

2. Incompatibilities: Contact with strong oxidizers (especially bromine) and strong bases may cause fires and explosions. Contact with copper, copper alloys, ammonia, and amines may start serious decomposition.

3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen cyanide, oxides of nitrogen, and carbon monoxide) may be released in a fire involving acrylonitrile and certain polymers made from acrylonitrile.

4. Special precautions: Liquid acrylonitrile will attack some forms of plastics, rubbers, and coatings.

### iii. Spill, Leak, and Disposal Procedures

A. If acrylonitrile is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.

2. The area should be evacuated at once and re-entered only after the area has been thoroughly ventilated and washed down with water.

3. If liquid acrylonitrile or polymer intermediate, collect for reclamation or absorb in paper, vermiculite, dry sand, earth, or similar material, or wash down with water into process sewer system.

B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until clean-up has been completed.

C. Waste disposal methods: Waste material shall be disposed of in a manner that is not hazardous to employees or to the general population. Spills of acrylonitrile and flushing of such spills shall be channeled for appropriate treatment or collection for disposal. They shall not be channeled directly into the sanitary sewer system. In selecting the method of waste disposal, applicable local, State, and Federal regulations should be consulted.

### iv. Monitoring and Measurement Procedures

A. Exposure above the Permissible Exposure Limit:

1. Eight-hour exposure evaluation: Measurements taken for the purpose of determining employee exposure under this section are best taken so that the average 8-hour exposure may be determined from a single 8-hour sample or two (2) 4-hour samples. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee.)

2. Ceiling evaluation: Measurements taken for the purpose of determining employee exposure under this section must be taken during periods of maximum expected airborne concentrations of acrylonitrile in the employee's breathing zone. A minimum of three (3) measurements should be taken on one work shift. The average of all measurements taken is an estimate of the employee's ceiling exposure.

3. Monitoring techniques: The sampling and analysis under this section may be performed by collecting the acrylonitrile vapor on charcoal adsorption tubes or other composition adsorption tubes, with subsequent chemical analysis. Sampling and analysis may also be performed by instruments such as real-time continuous monitoring systems, portable direct-reading instruments, or passive dosimeters. Analysis of resultant samples should be by gas chromatograph.

Appendix D lists methods of sampling and analysis which have been tested by NIOSH and OSHA for use with acrylonitrile. NIOSH and OSHA have validated modifications of NIOSH Method S-156 (See appendix D) under laboratory conditions for concentrations below 1 ppm. The employer has the obligation of selecting a monitoring method which meets the accuracy and precision requirements of the standard under his unique field conditions. The standard requires that methods of monitoring must be accurate, to a 95-percent confidence level, to  $\pm 35$ -percent for concentrations of AN at or above 2 ppm, and to  $\pm 50$ -percent for concentrations below 2 ppm. In addition to the methods described in appendix D, there are numerous other methods available for monitoring for AN in the workplace. Details on these other methods have been submitted by various companies to the rulemaking record, and are available at the OSHA Docket Office.

B. Since many of the duties relating to employee exposure are dependent on the results of monitoring and measuring procedures, employers shall assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

## v. Protective Clothing

Employees shall be provided with and required to wear appropriate protective clothing to prevent any possibility of skin contact with liquid AN. Because acrylonitrile is absorbed through the skin, it is important to prevent skin contact with liquid AN. Protective clothing shall include impermeable coveralls or similar full-body work clothing, gloves, head-coverings, as appropriate to protect areas of the body which may come in contact with liquid AN.

Employers should ascertain that the protective garments are impermeable to acrylonitrile. Non-impermeable clothing and shoes should not be allowed to become contaminated with liquid AN. If permeable clothing does become contaminated, it should be promptly removed, placed in a regulated area for removal of the AN, and not worn again until the AN is removed. If leather footwear or other leather garments become wet from acrylonitrile, they should be replaced and not worn again, due to the ability of leather to absorb acrylonitrile and hold it against the skin. Since there is no pain associated with the blistering which may result from skin contact with liquid AN, it is essential that the employee be informed of this hazard so that he or she can be protected.

Any protective clothing which has developed leaks or is otherwise found to be defective shall be repaired or replaced. Clean protective clothing shall be provided to the employee as necessary to assure its protectiveness. Whenever impervious clothing becomes wet with liquid AN, it shall be washed down with water before being removed by the employee. Employees are also required to wear splash-proof safety goggles where there is any possibility of acrylonitrile contacting the eyes.

## vi. Housekeeping and Hygiene Facilities

For purposes of complying with [29 CFR 1910.141](#), the following items should be emphasized:

A. The workplace should be kept clean, orderly, and in a sanitary condition. The employer is required to institute a leak and spill detection program for operations involving liquid AN in order to detect sources of fugitive AN emissions.

B. Dry sweeping and the use of compressed air is unsafe for the cleaning of floors and other surfaces where liquid AN may be found.

C. Adequate washing facilities with hot and cold water are to be provided, and maintained in a sanitary condition. Suitable cleansing agents are also to be provided to assure the effective removal of acrylonitrile from the skin.

D. Change or dressing rooms with individual clothes storage facilities must be provided to prevent the contamination of street clothes with acrylonitrile. Because of the hazardous nature of acrylonitrile, contaminated protective clothing should be placed in a regulated area designated by the employer for removal of the AN before the clothing is laundered or disposed of.

## vii. Miscellaneous Precautions

- A. Store acrylonitrile in tightly-closed containers in a cool, well-ventilated area and take necessary precautions to avoid any explosion hazard.
- B. High exposures to acrylonitrile can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal acrylonitrile containers. These containers must be effectively grounded and bonded prior to pouring.
- D. Never store uninhibited acrylonitrile.
- E. Acrylonitrile vapors are not inhibited. They may form polymers and clog vents of storage tanks.
- F. Use of supplied-air suits or other impervious coverings may be necessary to prevent skin contact with and provide respiratory protection from acrylonitrile where the concentration of acrylonitrile is unknown or is above the ceiling limit. Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life-endangering characteristics of supplied-air suits.
- G. Employers shall advise employees of all areas and operations where exposure to acrylonitrile could occur.

## viii. Common Operations

Common operations in which exposure to acrylonitrile is likely to occur include the following: Manufacture of the acrylonitrile monomer; synthesis of acrylic fibers, ABS, SAN, and nitrile barrier plastics and resins, nitrile rubber, surface coatings, specialty chemicals, use as a chemical intermediate, use as a fumigant and in the cyanoethylation of cotton.

## Appendix C to § 1910.1045—Medical Surveillance Guidelines for Acrylonitrile

### i. route of entry

Inhalation; skin absorption; ingestion.

### ii. toxicology

Acrylonitrile vapor is an asphyxiant due to inhibitory action on metabolic enzyme systems. Animals exposed to 75 or 100 ppm for 7 hours have shown signs of anoxia; in some animals which died at the higher level, cyanomethemoglobin was found in the blood. Two human fatalities from accidental poisoning have been reported; one was caused by inhalation of an unknown concentration of the vapor, and the other was thought to be caused by skin absorption or inhalation. Most cases of intoxication from industrial exposure have been mild, with rapid onset of eye irritation, headache, sneezing, and nausea. Weakness, lightheadedness, and vomiting may also occur. Exposure to high concentrations may produce profound weakness, asphyxia, and death. The vapor is a severe eye irritant. Prolonged skin contact with the liquid may result in absorption with systemic effects, and in the formation of large blisters after a latent period of several hours. Although there is usually little or no pain or inflammation, the affected skin resembles a second-degree thermal burn. Solutions spilled on exposed skin, or on areas covered only by

a light layer of clothing, evaporate rapidly, leaving no irritation, or, at the most, mild transient redness. Repeated spills on exposed skin may result in dermatitis due to solvent effects. Results after 1 year of a planned 2-year animal study on the effects of exposure to acrylonitrile have indicated that rats ingesting as little as 35 ppm in their drinking water develop tumors of the central nervous system. The interim results of this study have been supported by a similar study being conducted by the same laboratory, involving exposure of rats by inhalation of acrylonitrile vapor, which has shown similar types of tumors in animals exposed to 80 ppm. In addition, the preliminary results of an epidemiological study being performed by duPont on a cohort of workers in their Camden, S.C. acrylic fiber plant indicate a statistically significant increase in the incidence of colon and lung cancers among employees exposed to acrylonitrile.

### iii. signs and symptoms of acute overexposure

Asphyxia and death can occur from exposure to high concentrations of acrylonitrile. Symptoms of overexposure include eye irritation, headache, sneezing, nausea and vomiting, weakness, and light-headedness. Prolonged skin contact can cause blisters on the skin with appearance of a second-degree burn, but with little or no pain. Repeated skin contact may produce scaling dermatitis.

### iv. treatment of acute overexposure

Remove employee from exposure. Immediately flush eyes with water and wash skin with soap or mild detergent and water. If AN has been swallowed, and person is conscious, induce vomiting. Give artificial resuscitation if indicated. More severe cases, such as those associated with loss of consciousness, may be treated by the intravenous administration of sodium nitrite, followed by sodium thiosulfate, although this is not as effective for acrylonitrile poisoning as for inorganic cyanide poisoning.

### v. surveillance and preventive considerations

A. As noted above, exposure to acrylonitrile has been linked to increased incidence of cancers of the colon and lung in employees of the duPont acrylic fiber plant in Camden, S.C. In addition, the animal testing of acrylonitrile has resulted in the development of cancers of the central nervous system in rats exposed by either inhalation or ingestion. The physician should be aware of the findings of these studies in evaluating the health of employees exposed to acrylonitrile.

Most reported acute effects of occupational exposure to acrylonitrile are due to its ability to cause tissue anoxia and asphyxia. The effects are similar to those caused by hydrogen cyanide. Liquid acrylonitrile can be absorbed through the skin upon prolonged contact. The liquid readily penetrates leather, and will produce burns of the feet if footwear contaminated with acrylonitrile is not removed.

It is important for the physician to become familiar with the operating conditions in which exposure to acrylonitrile may occur. Those employees with skin diseases may not tolerate the wearing of whatever protective clothing may be necessary to protect them from exposure. In addition, those with chronic respiratory disease may not tolerate the wearing of negative-pressure respirators.

B. Surveillance and screening. Medical histories and laboratory examinations are required for each employee subject to exposure to acrylonitrile above the action level. The employer must screen employees for history of certain medical conditions which might place the employee at increased risk from exposure.

1. *Central nervous system dysfunction.* Acute effects of exposure to acrylonitrile generally involve the central nervous system. Symptoms of acrylonitrile exposure include headache, nausea, dizziness, and general weakness. The animal studies cited above suggest possible carcinogenic effects of acrylonitrile on the central nervous system, since rats exposed by either inhalation or ingestion have developed similar CNS tumors.

2. *Respiratory disease.* The du Pont data indicate an increased risk of lung cancer among employees exposed to acrylonitrile.
3. *Gastrointestinal disease.* The du Pont data indicate an increased risk of cancer of the colon among employees exposed to acrylonitrile. In addition, the animal studies show possible tumor production in the stomachs of the rats in the ingestion study.
4. *Skin disease.* Acrylonitrile can cause skin burns when prolonged skin contact with the liquid occurs. In addition, repeated skin contact with the liquid can cause dermatitis.
5. *General.* The purpose of the medical procedures outlined in the standard is to establish a baseline for future health monitoring. Persons unusually susceptible to the effects of anoxia or those with anemia would be expected to be at increased risk. In addition to emphasis on the CNS, respiratory and gastrointestinal systems, the cardiovascular system, liver, and kidney function should also be stressed.

## Appendix D to § 1910.1045—Sampling and Analytical Methods for Acrylonitrile

There are many methods available for monitoring employee exposures to acrylonitrile. Most of these involve the use of charcoal tubes and sampling pumps, with analysis by gas chromatograph. The essential differences between the charcoal tube methods include, among others, the use of different desorbing solvents, the use of different lots of charcoal, and the use of different equipment for analysis of the samples.

Besides charcoal, considerable work has been performed on methods using porous polymer sampling tubes and passive dosimeters. In addition, there are several portable gas analyzers and monitoring units available on the open market.

This appendix contains details for the methods which have been tested at OSHA Analytical Laboratory in Salt Lake City, and NIOSH in Cincinnati. Each is a variation on NIOSH Method S-156, which is also included for reference. This does not indicate that these methods are the only ones which will be satisfactory. There also may be workplace situations in which these methods are not adequate, due to such factors as high humidity. Copies of the other methods available to OSHA are available in the rulemaking record, and may be obtained from the OSHA Docket Office. These include, the Union Carbide, Monsanto, Dow Chemical and Dow Badische methods, as well as NIOSH Method P & CAM 127.

Employers who note problems with sample breakthrough should try larger charcoal tubes. Tubes of larger capacity are available, and are often used for sampling vinyl chloride. In addition, lower flow rates and shorter sampling times should be beneficial in minimizing breakthrough problems.

Whatever method the employer chooses, he must assure himself of the method's accuracy and precision under the unique conditions present in his workplace.

### NIOSH Method S-156 (Unmodified)

Analyte: Acrylonitrile.

Matrix: Air.

Procedure: Absorption on charcoal, desorption with methanol, GC.

#### 1. *Principle of the method* (Reference 11.1).

1.1 A known volume of air is drawn through a charcoal tube to trap the organic vapors present.

1.2 The charcoal in the tube is transferred to a small, stoppered sample container, and the analyte is desorbed with methanol.

1.3 An aliquot of the desorbed sample is injected into a gas chromatograph.

1.4 The area of the resulting peak is determined and compared with areas obtained for standards.

## 2. Range and sensitivity.

2.1 This method was validated over the range of 17.5-70.0 mg/cu m at an atmospheric temperature and pressure of 22 °C and 760 MM Hg, using a 20-liter sample. Under the conditions of sample size (20-liters) the probable useful range of this method is 4.5-135 mg-cu m. The method is capable of measuring much smaller amounts if the desorption efficiency is adequate. Desorption efficiency must be determined over the range used.

2.2 The upper limit of the range of the method is dependent on the adsorptive capacity of the charcoal tube. This capacity varies with the concentrations of acrylonitrile and other substances in the air. The first section of the charcoal tube was found to hold at least 3.97 mg of acrylonitrile when a test atmosphere containing 92.0 mg/cu m of acrylonitrile in air was sampled 0.18 liter per minute for 240 minutes; at that time the concentration of acrylonitrile in the effluent was less than 5 percent of that in the influent. (The charcoal tube consists of two sections of activated charcoal separated by a section of urethane foam. See [section 6.2.](#)) If a particular atmosphere is suspected of containing a large amount of contaminant, a smaller sampling volume should be taken.

## 3. Interference.

3.1 When the amount of water in the air is so great that condensation actually occurs in the tube, organic vapors will not be trapped efficiently. Preliminary experiments using toluene indicate that high humidity severely decreases the breakthrough volume.

3.2 When interfering compounds are known or suspected to be present in the air, such information, including their suspected identities, should be transmitted with the sample.

3.3 It must be emphasized that any compound which has the same retention time as the analyte at the operating conditions described in this method is an interference. Retention time data on a single column cannot be considered proof of chemical identity.

3.4 If the possibility of interference exists, separation conditions (column packing, temperature, etc.) must be changed to circumvent the problem.

## 4. Precision and accuracy.

4.1 The Coefficient of Variation ( $CV_T$ ) for the total analytical and sampling method in the range of 17.5-70.0 mg/cu m was 0.073. This value corresponds to a 3.3 mg/cu m standard deviation at the (previous) OSHA standard level (20 ppm). Statistical information and details of the validation and experimental test procedures can be found in Reference 11.2.

4.2 On the average the concentrations obtained at the 20 ppm level using the overall sampling and analytical method were 6.0 percent lower than the "true" concentrations for a limited number of laboratory experiments. Any difference between the "found" and "true" concentrations may not represent a bias in the sampling and analytical method, but rather a random variation from the experimentally determined "true" concentration. Therefore, no recovery correction should be applied to the final result in [section 10.5.](#)

## 5. Advantages and disadvantages of the method.

5.1 The sampling device is small, portable, and involves no liquids. Interferences are minimal, and most of those which do occur can be eliminated by altering chromatographic conditions. The tubes are analyzed by means of a quick, instrumental method.

The method can also be used for the simultaneous analysis of two or more substances suspected to be present in the same sample by simply changing gas chromatographic conditions.

5.2 One disadvantage of the method is that the amount of sample which can be taken is limited by the number of milligrams that the tube will hold before overloading. When the sample value obtained for the backup section of the charcoal tube exceeds 25 percent of that found on the front section, the possibility of sample loss exists.

5.3 Furthermore, the precision of the method is limited by the reproducibility of the pressure drop across the tubes. This drop will affect the flow rate and cause the volume to be imprecise, because the pump is usually calibrated for one tube only.

## 6. Apparatus.

6.1 A calibrated personal sampling pump whose flow can be determined within  $\pm 5$  percent at the recommended flow rate. (Reference 11.3).

6.2 Charcoal tubes: Glass tubes with both ends flame sealed, 7 cm long with a 6-mm O.D. and a 4-mm I.D., containing 2 sections of 20/40 mesh activated charcoal separated by a 2-mm portion of urethane foam. The activated charcoals prepared from coconut shells and is fired at 600 °C prior to packing. The adsorbing section contains 100 mg of charcoal, the backup section 50 mg. A 3-mm portion of urethane foam is placed between the outlet end of the tube and the backup section. A plug of silicated glass wool is placed in front of the adsorbing section. The pressure drop across the tube must be less than 1 inch of mercury at a flow rate of 1 liter per minute.

6.3 Gas chromatograph equipped with a flame ionization detector.

6.4 Column (4-ft × 1/4-in stainless steel) packed with 50/80 mesh Poropak, type Q.

6.5 An electronic integrator or some other suitable method for measuring peak areas.

6.6 Two-milliliter sample containers with glass stoppers or Teflon-lined caps. If an automatic sample injector is used, the associated vials may be used.

6.7 Microliter syringes: 10-microliter and other convenient sizes for making standards.

6.8 Pipets: 1.0-ml delivery pipets.

6.9 Volumetric flask: 10-ml or convenient sizes for making standard solutions.

#### 7. Reagents.

7.1 Chromatographic quality methanol.

7.2 Acrylonitrile, reagent grade.

7.3 Hexane, reagent grade.

7.4 Purified nitrogen.

7.5 Prepurified hydrogen.

7.6 Filtered compressed air.

#### 8. Procedure.

8.1 Cleaning of equipment. All glassware used for the laboratory analysis should be detergent washed and thoroughly rinsed with tap water and distilled water.

8.2 Calibration of personal pumps. Each personal pump must be calibrated with a representative charcoal tube in the line. This will minimize errors associated with uncertainties in the sample volume collected.

8.3 Collection and shipping of samples.

8.3.1 Immediately before sampling, break the ends of the tube to provide an opening at least one-half the internal diameter of the tube (2 mm).

8.3.2 The smaller section of charcoal is used as a backup and should be positioned nearest the sampling pump.

8.3.3 The charcoal tube should be placed in a vertical direction during sampling to minimize channeling through the charcoal.

8.3.4 Air being sampled should not be passed through any hose or tubing before entering the charcoal tube.

8.3.5 A maximum sample size of 20 liters is recommended. Sample at a flow of 0.20 liter per minute or less. The flow rate should be known with an accuracy of at least ±5 percent.

8.3.6 The temperature and pressure of the atmosphere being sampled should be recorded. If pressure reading is not available, record the elevation.

8.3.7 The charcoal tubes should be capped with the supplied plastic caps immediately after sampling. Under no circumstances should rubber caps be used.

8.3.8 With each batch of 10 samples submit one tube from the same lot of tubes which was used for sample collection and which is subjected to exactly the same handling as the samples except that no air is drawn through it. Label this as a blank.

8.3.9 Capped tubes should be packed tightly and padded before they are shipped to minimize tube breakage during shipping.

8.3.10 A sample of the bulk material should be submitted to the laboratory in a glass container with a Teflon-lined cap. This sample should not be transported in the same container as the charcoal tubes.

#### 8.4 Analysis of samples.

8.4.1 Preparation of samples. In preparation for analysis, each charcoal tube is scored with a file in front of the first section of charcoal and broken open. The glass wool is removed and discarded. The charcoal

in the first (larger) section is transferred to a 2-ml stoppered sample container. The separating section of foam is removed and discarded; the second section is transferred to another stoppered container. These two sections are analyzed separately.

8.4.2 Desorption of samples. Prior to analysis, 1.0 ml of methanol is pipetted into each sample container. Desorption should be done for 30 minutes. Tests indicate that this is adequate if the sample is agitated occasionally during this period. If an automatic sample injector is used, the sample vials should be capped as soon as the solvent is added to minimize volatilization.

8.4.3 GC conditions. The typical operating conditions for the gas chromatograph are:

1. 50 ml/min (60 psig) nitrogen carrier gas flow.
2. 65 ml/min (24 psig) hydrogen gas flow to detector.
3. 500 ml/min (50 psig) air flow to detector.
4. 235 °C injector temperature.
5. 255 °C manifold temperature (detector).
6. 155 °C column temperature.

8.4.4 Injection. The first step in the analysis is the injection of the sample into the gas chromatograph. To eliminate difficulties arising from blowback or distillation within the syringe needle, one should employ the solvent flush injection technique. The 10-microliter syringe is first flushed with solvent several times to wet the barrel and plunger. Three microliters of solvent are drawn into the syringe to increase the accuracy and reproducibility of the injected sample volume. The needle is removed from the solvent, and the plunger is pulled back about 0.2 microliter to separate the solvent flush from the sample with a pocket of air to be used as a marker. The needle is then immersed in the sample, and a 5-microliter aliquot is withdrawn, taking into consideration the volume of the needle, since the sample in the needle will be completely injected. After the needle is removed from the sample and prior to injection, the plunger is pulled back 1.2 microliters to minimize evaporation of the sample from the tip of the needle. Observe that the sample occupies 4.9-5.0 microliters in the barrel of the syringe. Duplicate injections of each sample and standard should be made. No more than a 3 percent difference in area is to be expected. An automatic sample injector can be used if it is shown to give reproducibility at least as good as the solvent flush method.

8.4.5 Measurement of area. The area of the sample peak is measured by an electronic integrator or some other suitable form of area measurement, and preliminary results are read from a standard curve prepared as discussed below.

#### 8.5 *Determination of desorption efficiency.*

8.5.1 Importance of determination. The desorption efficiency of a particular compound can vary from one laboratory to another and also from one batch of charcoal to another. Thus, it is necessary to determine at least once the percentage of the specific compound that is removed in the desorption process, provided the same batch of charcoal is used.

8.5.2 Procedure for determining desorption efficiency. Activated charcoal equivalent to the amount in the first section of the sampling tube (100 mg) is measured into a 2.5 in, 4-mm I.D. glass tube, flame sealed at one end. This charcoal must be from the same batch as that used in obtaining the samples and can be obtained from unused charcoal tubes. The open end is capped with Parafilm. A known amount of hexane solution of acrylonitrile containing 0.239 g/ml is injected directly into the activated charcoal with a microliter syringe, and tube is capped with more Parafilm. When using an automatic sample injector, the sample injector vials, capped with Teflon-faced septa, may be used in place of the glass tube.

The amount injected is equivalent to that present in a 20-liter air sample at the selected level.

Six tubes at each of three levels (0.5X, 1X, and 2X of the standard) are prepared in this manner and allowed to stand for at least overnight to assure complete adsorption of the analyte onto the charcoal. These tubes are referred to as the sample. A parallel blank tube should be treated in the same manner except that no sample is added to it. The sample and blank tubes are desorbed and analyzed in exactly the same manner as the sampling tube described in [section 8.4](#).

Two or three standards are prepared by injecting the same volume of compound into 1.0 ml of methanol with the same syringe used in the preparation of the samples. These are analyzed with the samples.



The desorption efficiency (D.E.) equals the average weight in mg recovered from the tube divided by the weight in mg added to the tube, or

$$\text{D.E.} = \frac{\text{Average weight recovered (mg)}}{\text{weight added (mg)}}$$

The desorption efficiency is dependent on the amount of analyte collected on the charcoal. Plot the desorption efficiency versus weight of analyte found. This curve is used in [section 10.4](#) to correct for adsorption losses.

#### 9. Calibration and standards.

It is convenient to express concentration of standards in terms of mg/1.0 ml methanol, because samples are desorbed in this amount of methanol. The density of the analyte is used to convert mg into microliters for easy measurement with a microliter syringe. A series of standards, varying in concentration over the range of interest, is prepared and analyzed under the same GC conditions and during the same time period as the unknown samples. Curves are established by plotting concentration in mg/1.0 ml versus peak area.

Note:

Since no internal standard is used in the method, standard solutions must be analyzed at the same time that the sample analysis is done. This will minimize the effect of known day-to-day variations and variations during the same day of the FID response.

#### 10. Calculations.

10.1 Read the weight, in mg, corresponding to each peak area from the standard curve. No volume corrections are needed, because the standard curve is based on mg/1.0 ml methanol and the volume of sample injected is identical to the volume of the standards injected.

10.2 Corrections for the blank must be made for each sample.

mg = mg sample - mg blank

Where:

mg sample = mg found in front section of sample tube.

mg sample = mg found in front section of blank tube.

A similar procedure is followed for the backup sections.

10.3 Add the weights found in the front and backup sections to get the total weight in the sample.

10.4 Read the desorption efficiency from the curve (see sec. 8.5.2) for the amount found in the front section. Divide the total weight by this desorption efficiency to obtain the corrected mg/sample.

$$\text{Corrected mg/sample} = \frac{\text{Total weight}}{\text{D.E.}}$$

10.5 The concentration of the analyte in the air sampled can be expressed in mg/cu m.

$$\text{mg/cu m} = \text{Corrected mg (section 10.4)} \times \frac{1,000 \text{ (liter/cu m)}}{\text{air volume sampled (liter)}}$$

10.6 Another method of expressing concentration is ppm.

ppm = m mg/cu × 24.45/M.W. × 760/P × T. + 273/298

Where:

$P$  = Pressure (mm Hg) of air sampled.

$T$  = Temperature ( $^{\circ}\text{C}$ ) of air sampled.

24.45 = Molar volume (liter/mole) at  $25^{\circ}\text{C}$  and 760 mm Hg.

$M.W.$  = Molecular weight (g/mole) of analyte.

760 = Standard pressure (mm Hg).

298 = Standard temperature ( $^{\circ}\text{K}$ ).

#### 11. References.

11.1 White, L. D. et al., "A Convenient Optimized Method for the Analysis of Selected Solvent Vapors in the Industrial Atmosphere," *Amer. Ind. Hyg. Assoc. J.*, 31:225 (1970).

11.2 Documentation of NIOSH Validation Tests, NIOSH Contract No. CDC-99-74-45.

11.3 Final Report, NIOSH Contract HSM-99-71-31, "Personal Sampler Pump for Charcoal Tubes," September 15, 1972.

### NIOSH MODIFICATION OF NIOSH METHOD S-156

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The NIOSH recommended method for low levels for acrylonitrile is a modification of method S-156. It differs in the following respects:

(1) Samples are desorbed using 1 ml of 1 percent acetone in  $\text{CS}_2$  rather than methanol.

(2) The analytical column and conditions are:

Column: 20 percent SP-1000 on 80/100 Supelcoport 10 feet  $\times$   $\frac{1}{8}$  inch S.S.

Conditions:

Injector temperature:  $200^{\circ}\text{C}$ .

Detector temperature:  $100^{\circ}\text{C}$ .

Column temperature:  $85^{\circ}\text{C}$ .

Helium flow: 25 ml/min.

Air flow: 450 ml/min.

Hydrogen flow: 55 ml/min.

(3) A  $2\ \mu\text{l}$  injection of the desorbed analyte is used.

(4) A sampling rate of 100 ml/min is recommended.

### OSHA LABORATORY MODIFICATION OF NIOSH METHOD S-156

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Analyte: Acrylonitrile.

Matrix: Air.

Procedure: Adsorption on charcoal, desorption with methanol, GC.

1. *Principle of the Method* (Reference 1).

- 1.1 A known volume of air is drawn through a charcoal tube to trap the organic vapors present.
- 1.2 The charcoal in the tube is transferred to a small, stoppered sample vial, and the analyte is desorbed with methanol.
- 1.3 An aliquot of the desorbed sample is injected into a gas chromatograph.
- 1.4 The area of the resulting peak is determined and compared with areas obtained for standards.

2. *Advantages and disadvantages of the method.*

- 2.1 The sampling device is small, portable, and involves no liquids. Interferences are minimal, and most of those which do occur can be eliminated by altering chromatographic conditions. The tubes are analyzed by means of a quick, instrumental method.
- 2.2 This method may not be adequate for the simultaneous analysis of two or more substances.
- 2.3 The amount of sample which can be taken is limited by the number of milligrams that the tube will hold before overloading. When the sample value obtained for the backup section of the charcoal tube exceeds 25 percent of that found on the front section, the possibility of sample loss exists.
- 2.4 The precision of the method is limited by the reproducibility of the pressure drop across the tubes. This drop will affect the flow rate and cause the volume to be imprecise, because the pump is usually calibrated for one tube only.

3. *Apparatus.*

- 3.1 A calibrated personal sampling pump whose flow can be determined within  $\pm 5$  percent at the recommended flow rate.
- 3.2 Charcoal tubes: Glass tube with both ends flame sealed, 7 cm long with a 6-mm O.D. and a 4-mm I.D., containing 2 sections of 20/40 mesh activated charcoal separated by a 2-mm portion of urethane foam. The activated charcoal is prepared from coconut shells and is fired at 600 °C prior to packing. The adsorbing section contains 100 mg of charcoal, the back-up section 50 mg. A 3-mm portion of urethane foam is placed between the outlet end of the tube and the back-up section. A plug of sililated glass wool is placed in front of the adsorbing section. The pressure drop across the tube must be less than one inch of mercury at a flow rate of 1 liter per minute.
- 3.3 Gas chromatograph equipped with a nitrogen phosphorus detector.
- 3.4 Column (10-ft  $\times$  1/8"-in stainless steel) packed with 100/120 Supelcoport coated with 10 percent SP 1000.
- 3.5 An electronic integrator or some other suitable method for measuring peak area.
- 3.6 Two-milliliter sample vials with Teflon-lined caps
- 3.7 Microliter syringes: 10-microliter, and other convenient sizes for making standards.
- 3.8 Pipets: 1.0-ml delivery pipets.
- 3.9 Volumetric flasks: convenient sizes for making standard solutions.

4. *Reagents.*

- 4.1 Chromatographic quality methanol.
- 4.2 Acrylonitrile, reagent grade.
- 4.3 Filtered compressed air.
- 4.4 Purified hydrogen.
- 4.5 Purified helium.

5. *Procedure.*

- 5.1 Cleaning of equipment. All glassware used for the laboratory analysis should be properly cleaned and free of organics which could interfere in the analysis.
- 5.2 Calibration of personal pumps. Each pump must be calibrated with a representative charcoal tube in the line.
- 5.3 Collection and shipping of samples.

5.3.1 Immediately before sampling, break the ends of the tube to provide an opening at least one-half the internal diameter of the tube (2 mm).

5.3.2 The smaller section of the charcoal is used as the backup and should be placed nearest the sampling pump.

5.3.3 The charcoal should be placed in a vertical position during sampling to minimize channeling through the charcoal.

5.3.4 Air being sampled should not be passed through any hose or tubing before entering the charcoal tube.

5.3.5 A sample size of 20 liters is recommended. Sample at a flow rate of approximately 0.2 liters per minute. The flow rate should be known with an accuracy of at least  $\pm 5$  percent.

5.3.6 The temperature and pressure of the atmosphere being sampled should be recorded.

5.3.7 The charcoal tubes should be capped with the supplied plastic caps immediately after sampling. Rubber caps should not be used.

5.3.8 Submit at least one blank tube (a charcoal tube subjected to the same handling procedures, without having any air drawn through it) with each set of samples.

5.3.9. Take necessary shipping and packing precautions to minimize breakage of samples.

5.4 Analysis of samples.

5.4.1 Preparation of samples. In preparation for analysis, each charcoal tube is scored with a file in front of the first section of charcoal and broken open. The glass wool is removed and discarded. The charcoal in the first (larger) section is transferred to a 2-ml vial. The separating section of foam is removed and discarded; the section is transferred to another capped vial. These two sections are analyzed separately.

5.4.2 Desorption of samples. Prior to analysis, 1.0 ml of methanol is pipetted into each sample container. Desorption should be done for 30 minutes in an ultrasonic bath. The sample vials are recapped as soon as the solvent is added.

5.4.3 GC conditions. The typical operating conditions for the gas chromatograph are:

1. 30 ml/min (60 psig) helium carrier gas flow.
2. 3.0 ml/min (30 psig) hydrogen gas flow to detector.
3. 50 ml/min (60 psig) air flow to detector.
4. 200 °C injector temperature.
5. 200 °C detector temperature.
6. 100 °C column temperature.

5.4.4 Injection. Solvent flush technique or equivalent.

5.4.5 Measurement of area. The area of the sample peak is measured by an electronic integrator or some other suitable form of area measurement, and preliminary results are read from a standard curve prepared as discussed below.

5.5 Determination of desorption efficiency.

5.5.1 Importance of determination. The desorption efficiency of a particular compound can vary from one laboratory to another and also from one batch of charcoal to another. Thus, it is necessary to determine, at least once, the percentage of the specific compound that is removed in the desorption process, provided the same batch of charcoal is used.

5.5.2 Procedure for determining desorption efficiency. The reference portion of the charcoal tube is removed. To the remaining portion, amounts representing 0.5X, 1X, and 2X (X represents TLV) based on a 20 l air sample are injected onto several tubes at each level. Dilutions of acrylonitrile with methanol are made to allow injection of measurable quantities. These tubes are then allowed to equilibrate at least overnight. Following equilibration they are analyzed following the same procedure as the samples. A curve of the desorption efficiency amt recovered/amt added is plotted versus amount of analyte found. This curve is used to correct for adsorption losses.

6. *Calibration and standards.*

A series of standards, varying in concentration over the range of interest, is prepared and analyzed under the same GC conditions and during the same time period as the unknown samples. Curves are prepared by plotting concentration versus peak area.

Note:

Since no internal standard is used in the method, standard solutions must be analyzed at the same time that the sample analysis is done. This will minimize the effect of known day-to-day variations and variations during the same day of the NPD response. Multiple injections are necessary.

*7. Calculations.*

Read the weight, corresponding to each peak area from the standard curve, correct for the blank, correct for the desorption efficiency, and make necessary air volume corrections.

*8. Reference.* NIOSH Method S-156.

[[43 FR 45809](#), Oct. 3, 1978, as amended at [45 FR 35283](#), May 23, 1980; [54 FR 24334](#), June 7, 1989; [58 FR 35310](#), June 30, 1993; [61 FR 5508](#), Feb. 13, 1996; [63 FR 1291](#), Jan. 8, 1998; [63 FR 20099](#), Apr. 23, 1998; [70 FR 1142](#), Jan. 5, 2005; [71 FR 16672](#), [16673](#), Apr. 3, 2006; [71 FR 50190](#), Aug. 24, 2006; [73 FR 75586](#), Dec. 12, 2008; [76 FR 33609](#), June 8, 2011; [77 FR 17783](#), Mar. 26, 2012; [84 FR 21518](#), May 14, 2019]