DOLI Virginia Occupational Safety and Health VOSH

VOSH PROGRAM DIRECTIVE: **02-439** **ISSUED**: **September 15, 2006**

SUBJECT: **Section 1910.1018, Inspection and Compliance Procedures for the Permanent Occupational Exposure Standard for Inorganic Arsenic Compounds**

A. **Purpose**.

This directive transmits existing 1978 guidelines and uniform inspection and compliance procedures for the occupational exposure standard for arsenic and arsenic-containing, inorganic compounds which were previously not forwarded to field personnel.

This Program Directive is an internal guideline, not a statutory or regulatory rule, and is intended to provide instructions to VOSH personnel regarding internal operation of the Virginia Occupational Safety and Health Program and is solely for the benefit of the program. This document is not subject to the Virginia Register Act or the Administrative Process Act; it does not have general application and is not being enforced as having the force of law.

NOTE: ***Throughout the attachments, updated references have been included usually in brackets or parentheses. Language appearing in Attachment 1 that has been struck-through means the referenced section, paragraph or sub-paragraph no longer exists.***

B. **Scope**.

This directive applies to all VOSH personnel, and specifically to Occupational Health Compliance and Consultation Services personnel.

C. **Reference**.

OSHA Instruction CPL 2-2.22 (October 10, 1978).

D. **Cancellation**.

Not applicable.

E. **Action**.

Directors and Managers shall ensure that the guidelines in this Directive are followed.

F. **Effective Date**.

September 15, 2006.

C. Ray Davenport
Commissioner

Attachment: OSHA Instruction 02-02-022 (CPL 2-2.22) (October 10, 1978)

Distribution: Commissioner of Labor and Industry
Assistant Commissioner - Programs
VOSH Directors and Managers
VOSH Compliance Staff
Cooperative Programs Director and Manager
Legal Support Staff
IMIS Support Staff
OSHA Area Office, Norfolk
OSHA Regional Administrator, Region III

When the guidelines, as set forth in this Program Directive, are applied to the Commissioner of the Department of Labor and Industry and/or to Virginia employers, the following federal terms if, and where they are used, shall be considered to read as below:

Federal Terms	VOSH Equivalent
29 CFR	VOSH Standard
Regional Administrator	Commissioner of Labor and Industry
Area Director	Region Director
Regional Solicitor	Attorney General or VOSH Office of Legal Support (OLS)
Agency	Department
Office of Statistics	VOSH Research and Analysis
Compliance Safety and Health Officer (CSHO) and/or Industrial Hygienist	CSHO
Field Inspection Reference Manual (FIRM)	VOSH Field Operations Manual (FOM)

CPL 02-02-022 - CPL 2-2.22 - 29 CFR 1910.1018 Inspection and Compliance Procedures for the Permanent Occupation Exposure Standard for Inorganic Arsenic Compounds.

• Record Type:	Instruction
• Directive Number:	CPL 02-02-022
• Old Directive Number:	CPL 2-2.22
• Title:	29 CFR 1910.1018 Inspection and Compliance Procedures for the Permanent Occupation Exposure Standard for Inorganic Arsenic Compounds.
• Information Date:	10/10/1978
• Standard Number:	1910.1018

OSHA Instruction CPL 2-2.22 October 10, 1978 OSHA PROGRAM DIRECTIVE

TO: REGIONAL ADMINISTRATORS/OSHA

THRU: DONALD E. MACKENZIE Field Coordinator

SUBJECT: 29 CFR 1910.1018, Inspection and Compliance Procedures For the Permanent Occupational Exposure Standard For Inorganic Arsenic Compounds

1. **Purpose.**

The purpose of this directive is to provide guidelines and establish uniform inspection and compliance procedures for the occupational exposure standard for arsenic and arsenic-containing, inorganic compounds published in the Federal Register May 5, 1978, and effective August 1, 1978.

2. **Documentation Affected**.

This directive supplements and references the OSHA Industrial Hygiene Field Operations Manual (IHFOM)[now OSHA Technical Manual] and the OSHA Field Operations Manual (FOM)[now Field Inspection Reference Manual (FIRM)].

3. **Background**.

The advent of the new standard for occupational exposure to inorganic arsenic has created the need for additional guidance beyond that contained in the IHFOM [OSHA Technical Manual] and FOM [FIRM]. This directive focuses on providing such supplemental guidance.

4. **Clarification**

a. Based on available scientific evidence, the occupational Safety and Health Administration (OSHA) concludes that employees exposed to elemental arsenic and to inorganic compounds containing trivalent and pentavalent arsenic have an increased risk of developing cancer. Therefore, in accordance with OSHA policy of limiting employee exposures to carcinogens to the lowest level generally feasible, a new, more protective standard for occupational exposure to the aforementioned chemicals has been promulgated.

b. The standard limits occupational exposure to air contaminated with the chemicals under its scope on the basis of the mass concentration of arsenic that is airborne. The limit is 10 micrograms of arsenic per cubic meter of air, averaged over any 8-hour period.

c. Other provisions of the standard concern the following:

(1) Notification of the OSHA Area Office of operations dictating establishment of regulated areas.

(2) Exposure monitoring.

(3) Regulated areas.

(4) Methods of compliance.

(5) Respiratory protection.

(6) Protective work clothing and equipment.

(7) Housekeeping.

(8) Hygiene facilities and practices.

(9) Medical surveillance.

(10) Employee information and training.

(11) Signs and labels.

(12) Recordkeeping.

(13) Observation of monitoring.

d. Table Z-1 of 29 CFR 1910.1000 was amended May 5, 1978, as follows:

(1) Previous entry, "Arsenic and its compounds (as AS) -- 0.5 mg^3," is changed to indicate that only organic arsenic compounds are included under the 0.5 mg^3 limit.

(2) Calcium arsenate and lead arsenate are deleted from the Table because they are now covered under 29 CFR 1910.1018.

e. Arsine is not included in the standard and remains as an entry in Table Z-1 of 29 CFR 1910.1000.

5. **Action**

a. Resource allocations.

Include arsenic, all arsenic-containing, inorganic compounds and arsine among the substances in the "High Hazard Health" category. Use the guidelines in OSHA Program Directive #400-3, Annual Field Compliance Program Plan, to plan compliance inspections. Arsine is included in the "High Health Hazard" category because it is a highly toxic substance which when encountered will often be associated with chemicals regulated under 29 CFR 1910.1018. Refer to Attachment 6 with this directive for a listing of some types of establishments where there is a potential for

exposures regulated under 29 CFR 1910.1018.

b. Scope and applicability.

(1) Coverage by industry segments.

29 CFR 1910.1018 applies to "General Industry", "Construction" and "Maritime Employment", but does not apply to "agricultural operations."

(2) Occupational exposures within the scope of the standard.

29 CFR 1910.1018 applies to most occupational exposures to elemental arsenic and arsenic-containing, inorganic compounds. Many of the occupational exposures covered occur at establishments listed in the industry profile, Attachment 6 with this directive.

(3) Occupational exposures outside the scope of the standard.

(a) 29 CFR 1910.1018 does not apply to occupational exposure resulting from cotton ginning, agricultural uses of arsenic or any of its compounds, treatment of wood with any type of arsenic-containing preservatives and application of any type of arsenic-containing pesticides.

(b) 29 CFR 1910.1018 does not apply to arsenic exposures of farm employees and applicators which occur during mixing of pesticides and cleaning of pesticide containers. These operations are considered to be a part of pesticide application.

(c) 29 CFR 1910.1018 does not apply to exposures resulting from utilization of arsenically preserved wood.

(4) Portions of the standard which are inapplicable when airborne concentrations are below set limits.

(a) Portions of the standard which are inapplicable when initial monitoring reveals that all employee exposures are at or less than the permissible exposure limit are as follows:

- Paragraph (d)--Notification of use.
- Subparagraph (e)(3)(ii)--Exposure monitoring--Frequency.
- Subparagraph (e)(5)(ii)--Exposure monitoring--Employee notification.
- Subparagraph (e)(6)(i)--Exposure monitoring--Accuracy of

measurement.

- o Paragraph (f)--Regulated area.
- o Paragraph (g)--Methods of compliance.
- o Paragraph (h)--Respiratory protection.
- o Subparagraph (m)(3)(i)--Hygiene facilities and practices--Lunchrooms.
- o Subparagraph (m)(5)--Hygiene facilities and practices--Vacuuming clothes. (In fact, this subparagraph is inapplicable if 8-hour TWA airborne exposures are at or less than 100 micrograms (as arsenic) per cubic meter.)
- o Subparagraph (p)(2)--Signs and labels--Signs.

NOTE: Additional portions of the standard, designed to control eye and skin contact and ingestion hazards, may also be inapplicable, but this cannot be established merely on the basis of intensity of exposure to contaminated air.

(b) Portions of the standard, in addition to those listed in 5.b.(4)(a) of this directive, which are inapplicable when initial monitoring reveals that all employee exposures are at or less than the action level are as follows:

- o Subparagraph (e)(3)(iii)--Exposure monitoring--Frequency.
- o Subparagraph (e)(3)(iv)--Exposure monitoring--Frequency.
- o Subparagraph (e)(6)(ii)--Exposure monitoring--Accuracy of measurement.
- o Paragraph (n)--Medical surveillance.
- o Subparagraph (q)(2)--Recordkeeping--Medical surveillance.

NOTE: 1. Paragraph (n) and subparagraph (q)(2) are applicable if the employer has employees whose past exposures meet the criteria presented in 29 CFR 1910.1018 (n)(1)(i)(B).

2. Additional portions of the standard, designed to control eye and skin contact and ingestion hazards, may also be inapplicable, but this cannot

be established merely on the basis of intensity of exposure to contaminated air.

(5) Independent contractors and their employees.

(a) In accordance with established policy contained in the FOM, Chapter X, under F.(VOSH FOM Chapter III, B.7), independent contractors such as construction contractors are responsible for protecting their employees from health and safety hazards even if they are not the creators of the hazards. However, independent contractors would not normally be required to achieve this protection for their employees by instituting permanent engineering controls at their client's establishment. For example, independent contractors would obviously not be required to protect their employee's from arsenic trioxide fume from a reverbatory furnace in a copper smelter through installing engineering controls for the furnace. Although, as in the furnace example, it might not be feasible for independent contractors to protect their employees by controlling at the source an emission they are not creating, it might be feasible for them to achieve some protection of their employees with other forms of engineering controls and with work practices. Where this is fact, independent contractors must institute such controls; e.g., provide portable local exhaust hoods and require their employees to vacate specified areas during cycles or periods of peak air contamination.

(b) The foregoing discussion relates to the methods of compliance provisions under 29 CFR 1910.1018(g). All other provisions under 29 CFR 1910.1018 are accorded the same applicability to independent contractors as to general industry employers.

c. Interpretations and discussions.

The reader is encouraged to first read the pertinent portion of 29 CFR 1910.1018 and then read the following interpretation and/or discussion:

(1) 29 CFR 1910.1018(c), Permissible exposure limit.

(a) The permissible exposure limit is expressed in terms of the mass of arsenic in a cubic meter of air. The volume unit in the expression is a cubic meter of air at 25 degrees C and 760 mm Hg. This is generally accepted to be the “standard cubic meter” of the industrial hygiene profession.

(b) Compliance officers and employers must convert the volumes of air they sampled to “standard volumes”. The conversion is performed by a simple calculation presented in each sampling data sheet attached to this directive.

(2) 29 CFR 1910.1018(e)(1)(i), Exposure monitoring--General.

(a) A given employee's exposure will not have to be directly measured by placing a personal sampling system on him or her if another employee's exposure that is known to be virtually identical will be measured and represented as the given employee's exposure.

(b) A measurement is not representative of an employee's exposure if it is not at least as accurate as 29 CFR 1910.1018(e)(6) requires it to be.

(3) 29 CFR 1910.1018(e)(1)(iii), Exposure monitoring--General.

At least 7 continuous hours of sampling is required if the employee's exposure occurs continuously or intermittently over a 7- to 8-hour period. If all the exposure occurs in less than a 7-hour span, it is necessary to sample only during this lesser period.

(4) 29 CFR 1910.1018(e)(3), Exposure monitoring--Frequency.

(a) Table I of this directive depicts the minimum frequency with which employers must measure each employee's exposure while working at a routine job.

(b) Employees such as maintenance employees who are continuously performing different jobs must have their exposures measured each time they perform a job resulting in a potentially different exposure. Table II of this directive depicts the minimum frequency of measurement of exposure required if the employee occasionally repeats the same job.

Table I.--Minimum Required Frequency for Measuring Each Employee's Exposure While Working at a Routine Job

Present exposure result	Last exposure exposure result	Longest time that may elapse between next measurement provided an (e)(4) event does not occur first
At or below AL.	None. Present Measurement is an	No further measurement required until an (e)(4) event occurs.
At or below AL.	Above AL but at or below PEL	6 months.
At or below AL.	Above PEL.	6 months.
At or below AL.	At or below AL.	No further measurement required until (e)(4) event occurs provided 7 days or more elapsed between last two measurements.
Above AL but at or below PEL	Not relevant for determining the next time exposure must be measured.	6 months.
Above PEL.	Not relevant for determining the next time exposure must be measured.	3 months

Abbreviations:	AL	=	action level
	PEL	=	permissible exposure limit
	(e)(4)	=	29 CFR 1910.1018(e)(4)

Table II.--Minimum Required Frequency for Measuring
Sporadically Occurring Employee Exposure

Present exposure result	Last exposure result for the same job	Longest time that may elapse before exposure from the job must be remeasured
At or below AL.	None. Present Measurement is An initial measurement.	No further measurement required until an (e)(4) event occurs.
At or below AL.	Above AL but at or below PEL	6 months plus time that elapses before the job is performed again.
At or below AL.	Above PEL.	6 months plus time that elapses before the job is performed again
At or below AL.	At or Below PEL.	No further measurement Required until an (e)(4) event occurs Provided 7 days or more elapsed between last two measurements.
Above PEL. but at or below PEL.	Not relevant for determining the next time exposure must be measured.	6 months plus time that elapses before the job is performed again.
Above PEL.	Not relevant for determining the Next time exposure Must be measured.	3 months plus time that elapses before the job is performed again.

Abbreviations:

AL	=	action level
PEL	=	permissible exposure limit
(e)(4)	=	29 CFR 1910.1018(e)(4)

(5) 29 CFR 1910.1018(e)(6), Exposure monitoring--Accuracy of measurement.

(a) Analytical accuracy.

Sufficient analytical accuracy is achievable with arsine generation, atomic absorption spectrophotometric; flameless atomic absorption spectrophotometric; d.c. discharge emission spectrophotometric and X-ray fluorescence methods.

(b) Sampling accuracy.

(i) Any of the air contaminants listed or specified in Attachment 2 with this directive can be sampled with sufficient accuracy at 30C and below by collection on an 0.8-micron pore size, 37-millimeter diameter, cellulose acetate-cellulose nitrate filter inserted in a 3-piece, closed-face cassette.

(ii) If workplace air contamination originates from a solid, arsenic-containing, inorganic compound that has an equilibrium vapor concentration (as arsenic) in excess of 1 microgram per cubic meter at the existing air temperature, then, in order to sample the air contaminant(s) with sufficient accuracy, a sampling approach that collects both aerosol and vapor must be used. A prominent way of collecting a combination of solid aerosol and vapor is by trapping the aerosol on the filter (described in 5.c.(5)(b)(i) of this directive) and by absorbing the vapor with a solution contained in a midget bubbler. The collecting devices are hooked in series with the cassette and filter preceding the midget bubbler.

(iii) Examples of solid, arsenic-containing, inorganic compounds with equilibrium vapor concentrations (as arsenic) in excess of 1 microgram per cubic meter at 25 degrees C are as follows:

- Arsenic tribromide.
- Arsenic triiodide.
- Arsenic monophosphide.

(iv) The vapor of an arsenic-containing, inorganic liquid or an arsenic-containing, inorganic gas can be sampled with sufficient accuracy with an air pump, absorbing solution and a midget bubbler.

(v) Examples of an arsenic-containing, inorganic gas and of arsenic-containing, inorganic liquids are as follows:

- o Arsenic pentafluoride (gas).
- o Arsenic trichloride (liquid).
- o Arsenic trifluoride (liquid).

(c) Investigating accuracy. An employer may use any sampling and analytical system that will measure employee 8-hour time-weighted average exposures with the accuracy required by 29 CFR 1910.1018(e)(6). However, if an analytical method or collecting device other than the aforementioned ones is found in use by an employer, its accuracy should be investigated. Assistance from the National Office can be initiated by contacting the Division of Occupational Health Programming.

(6) 29 CFR 1910.1018(g)(1)(ii), Methods of compliance--Controls.

Work practice controls are on equal par with engineering controls. Employee rotation, which is "... not a control strategy included under work practices ...", cannot be used in lieu of feasible engineering and work practice controls. Respirators may be used in lieu of employee rotation. However, this is not mandatory.

(7) 29 CFR 1910.1018(h)~~(2)~~(3)(i), Respiratory protection-- Respirator selection.

(a) Respirators may be selected from Table I of 29 CFR 1910.1018, where respiratory protection is required against any of the substances listed or specified in Attachment 2 with this directive.

(b) Respirators must be selected from Table II of 29 CFR 1910.1018, where respiratory protection is required against any of the substances included or specified in the list that follows:

(i) Arsenic trichloride.

(ii) Arsenic trifluoride.

(iii) Arsenic pentafluoride.

(iv) Arsenic tribromide.

(v) Arsenic triiodide.

(vi) Arsenic monophosphide.

(vii) Any other arsenic-containing, inorganic compound that has an equilibrium vapor concentration (as arsenic) in excess of 1 microgram per cubic meter at 30C.

(8) 29 CFR 1910.1018(h)(3)(ii) and (h)(3)(iii), Respiratory protection--Respirator usage.

(a) Any one of the three methods of fit testing (described in the IHFOM, Chapter XII, E.2.b. (i), (ii) and (iv) [now OSHA Technical Manual, Section VIII, Chapter 2)] will satisfy the qualitative fit test requirement for nonpowered, air-purifying respirators. In order for the fit tests (described in E.2.b.(i) and (ii)) [now OSHA Technical Manual, Section VIII, Chapter 2)] to satisfy the requirement, the employer must observe the est and evaluate the fit.

(b) The level of leakage and degree of protection is specifically measured in a quantitative fit test. One type of quantitative fit test involves using a simple hood, sodium chloride vapor and automated instrumentation.

(c) The standard does not require the employer to keep records of fit testing. The OSHA inspector will document adherence to the schedules for fit testing through employee interviews.

(9) 29 CFR 1910.1018(m)(1), Hygiene facilities and practices--Change rooms.

29 CFR 1910.1018(m)(1) is interpreted to require change rooms for employees working in regulated areas; working with arsenic trichloride; working in contact with nonairborne granules of arsenic and arsenic-containing, inorganic compounds; or working in contact with a liquid solution containing an arsenic-containing, inorganic solute.

d. Inspection procedures.

(1) Qualification of inspecting compliance officer. Inspections to assess compliance with 29 CFR 1910.1018 must be conducted by or be under the guidance of an industrial hygienist. The compliance officers must have been instructed and trained in the proper use of powered, air-purifying respirators and must be aware of their limitations.

(2) Personal protective equipment and associated items that should be taken on inspection trips.

(a) Respirators.

(i) General. Once the inside of a respirator gets contaminated with arsenic it should not be put back on until it has been decontaminated. Compliance officers should use this principle

as the basis for determining the appropriate number of respirators to take on the inspection.

(ii) Inspections in copper, zinc or lead smelters.

- Protection against arsenic trioxide and other solid aerosols only.

  Take powered, air-purifying respirators with high-efficiency filters. The respirator and filter combination must be approved by the National Institute for Occupational Safety and Health (NIOSH) for protection against dusts, fumes and mists having permissible exposure limits of less than 50 micrograms per cubic meter.

- Protection against a combination of arsenic trioxide aerosol and sulfur dioxide gas.

  Take gas masks with Type "N" front- or back-mounted canisters containing high-efficiency filters and sorbent for acid gases. The mask, sorbent and filter combination must be approved by the U.S. Bureau of Mines or NIOSH for respiratory protection in atmospheres containing as much as 2-percent acid gases and also for protection against dusts, fumes and mists having permissible exposure limits of less than 100 micrograms per cubic meter.

(iii) Inspections involving any of the substances listed or specified in Attachment 2 with this directive. Take the powered, air-purifying respirators specified under 5.d.(2)(a)(ii) of this directive.

(iv) Inspections involving any of the substances listed or specified under 5.c.(7)(b) of this directive. Take the gas masks specified under 5.d.(2)(a)(ii) of this directive.

(b) Personal protective clothing.

(i) General.

Protective clothing that is contaminated with arsenic should not be put back on. Compliance officers should use this principle as the basis for determining the appropriate number of sets of protective clothing to take on the inspection.

(ii) Inspections involving solid, arsenic-containing, inorganic chemicals.

Take full-body protective clothing that is impervious to dust and fume. Impervious gloves, coveralls, caps or hoods and shoe coverlets constitute one example of a set of full-body protective clothing.

(iii) Inspections involving arsenic trichloride liquid, arsenic trifluoride liquid, or liquid solutions of arsenic-containing, inorganic compounds.

- o Take full-body protective clothing that is impermeable to the liquid or solution of concern. Impermeable gloves, boots, coveralls and caps or hoods constitute one example of a set of full-body protective clothing.

- o Representations of the permeabilities of materials that have tested best against arsenic trichloride and arsenic trifluoride liquids are planned for inclusion as later attachments to this directive.

- o The types of material required for protection against liquid solutions of arsenic-containing, inorganic compounds depends upon the type of solution involved. Salt solutions require material impervious to the solvent; acid solutions require material impervious to acid; and basic solutions require material impervious to base.

(c) Eye and face protective devices.

Refer to the IHFOM, Chapter XI, Part H [now OSHA Technical Manual, Section VIII, Chapter 2, B.] and to 29 CFR 1910.1018(j)(1)(iii).

(d) Containers.

Take containers for depositing, storing and transporting the compliance officer's arsenic contaminated protective clothing and equipment. The containers must be impermeable to the contaminant of concern. If the contaminant is among those listed or specified under 5.c.(7)(b) of this directive, the containers must close vapor tight.

(e) Procurement.

All the aforementioned items should be purchased with Area Office funds.

(3) Opening Conference.

(a) Compliance officers will not interrupt opening conferences to make quick surveys of workplaces. This deviation from normal is for the protection of the compliance officers. Instead of immediately surveying the workplaces, compliance officers will attempt to acquire information during opening conferences that will help them predetermine the adequacy of their respirators and locations where they will be needed. The guidance provided in 5.d.(3)(b), (c), (d) and (e) of this directive is meant to assist the compliance officers in this respect. This guidance supplements the guidance presented in the FOM [FIRM] and IHFOM [now OSHA Technical Manual].

(b) Conduct the opening conference in an office in the plant reception area or at some other location away from potential exposure to arsenic or arsenic-containing, inorganic compounds. Bring to the conference a copy of the employer's notification of use report required under 29 CFR 1910.1018(d). Request the attendance of personnel who can respond to questions concerning the following:

(i) Notification of use report.

(ii) Monitoring of employee exposures and establishing regulated areas.

(iii) Maintenance of the exposure monitoring records.

(iv) Institution of work practices.

(v) Institution and maintenance of engineering controls.

(vi) Development of the compliance program required under 29 CFR 1910.1018(g)(2).

(c) Obtain from the employer a diagram of the plant layout. If one is not available, develop one with the aid of the conference attendants. Review the notification of use report with them and determine if it is accurate, complete and up to date. Ask them to discuss and explain operations that involve elemental arsenic or arsenic-containing, inorganic compounds and with their help represent the operations on the diagram. Discuss the engineering controls and the work practices that have been instituted and establish their effectiveness. Find out if there are any operations where the employer has difficulty in exposures. Examine and discuss the controlling compliance program required under 29 CFR 1910.1018(g)(2) with an aim toward gaining an insite into the employer's proficiency in and utilization of air contamination control technology.

(d) With the assistance of the conference attendants, use the employer s exposure monitoring records to represent air concentration patterns on the diagram of the plant layout. Draw in the regulated areas that have been established.

(e) Review the sampling and analytical method to gain an impression of its accuracy. Look for clues that might indicate whether the employer is underestimating air concentrations. If any doubts arise about the analytical method used by the employer, the Salt Lake City Analytical Laboratory (SLCAL) [now Salt Lake Technical Center (SLTC)] may be contacted for an opinion.

(4) Use of protective equipment, precautions and personal hygiene.

(a) General.

(i) Compliance officers should adhere to the respirator, protective clothing and equipment, and hygiene practice provisions of the standard.

(ii) Compliance officers that enter regulated areas or in some way get their protective clothing and equipment contaminated must remove this clothing and equipment in the employee's change room. If employees are not provided change rooms or the compliance officers judge that the permissible exposure limit is exceeded in the change rooms because they are not properly maintained, the compliance officers should remove their contaminated protective clothing and equipment in the outside air. If the latter situation exists, compliance officers should wear lightweight street clothes under their protective clothing.

(iii) Compliance officers should never put contaminated protective clothing and equipment back on. Once it is removed, it should be immediately placed in a container brought along on the inspection for this purpose.

(b) Respirators.

(i) Compliance officers must use respiratory protection in areas the employer has designated as "regulated areas." They may limit their use of respiratory protection to these areas if they are confident, as a result of information acquired during the opening conference, that the employer has included and correctly demarcated all areas that should be "regulated areas."

(ii) If compliance officers are not confident that the employer has demarcated all areas that must be regulated, then they should

also use respiratory protection in undemarcated areas whenever they are unsure of maintaining their 8-hour TWA exposure at or below the permissible limit.

(iii) Compliance officers must not remain in a contaminated atmosphere longer than their respiratory protective device safely permits. For example, in accordance with Table II under 29 CFR 1910.1018(h), a compliance officer using a gas mask with a back-mounted canister containing a high-efficiency filter and sorbent for acid gases must not remain in an atmosphere containing an average concentration of arsenic trichloride of 1 milligram per cubic meter (as arsenic) for more than 4 hours. Of course, 4 hours would be an acceptable duration to remain in the atmosphere only if there were no other exposure to airborne elemental arsenic or an arsenic-containing, inorganic compound during the day.

(iv) Since compliance officers have no instrumental method for screening airborne concentrations of arsenic, they should be conservative about the time they spend in areas where high concentrations exist. Still, when compliance officers are sampling employee exposures in these areas, they should frequent the areas often enough to keep the sampling under surveillance.

(v) When inspections are being performed in copper, lead or zinc smelters, compliance officers should perform a sufficient amount of sampling with gas detector tubes to assess the need for respiratory protection against sulfur dioxide gas in addition to arsenic trioxide aerosol.

(c) Showering.

Compliance officers who enter regulated areas should shower in the employees shower prior to leaving the workplace for the day unless they find violations of sanitation regulations. If the compliance officers do not shower in the employees shower, they should go immediately to the place they are staying and shower.

(5) Special air sampling consideration. The level of potential airborne exposure of employees must be known in order to establish which type of respiratory protective device listed in the tables under 29 CFR 1910.1018(h) is required. When the compliance officer is concerned that the exposure may be too great for the respiratory protective devices in use, he or she should collect samples in accordance with the sampling guidelines presented in the appropriate sampling data sheet attached to this directive in order to establish whether his or her concern is warranted. The sampling guidelines presented cover evaluations at

all 8-hour TWA concentrations of concern; i.e., 100 micrograms per cubic meter to 100 milligrams per cubic meter.

(6) Wipe testing and bulk sample collection.

(a) Bulk samples and wipe tests are used for gathering evidence.

(b) Do not submit bulk samples for analysis or perform wipe tests unless you have considered what they are intended to prove.

(c) Bulk samples of a liquid or solid can be used to prove that elemental arsenic or an inorganic compound containing arsenic is present in it as an ingredient or as a contaminant. Unless the arsenic were bound in such a manner as to make the possibility of airborne exposure above the action level unlikely, the proof of its presence would establish the requirement to comply with the labeling provisions under 29 CFR 1910.1018(p)(1) and (3).

(d) Bulk solid samples should be approximately 20 grams in weight. Bulk liquid samples should be approximately 20 ml in volume.

(e) SLCAL [now SLTC] does not require bulk samples in order to analyze samples of airborne elemental arsenic and arsenic-containing, inorganic compounds.

(f) Wipe tests can provide evidence that surfaces are contaminated with elemental arsenic or arsenic-containing, inorganic compounds. This evidence in conjunction with evidence that the surfaces are not maintained as free as practicable of this contamination establishes a violation of 29 CFR 1910.1018(k)(1).

(g) Wipe sampling shall be conducted on workplace surfaces which have had frequent contact, and on lunch containers, lunch tables, chairs, drinking fountains, etc. Attachment 5 with this directive presents guidelines for performing wipe sampling.

(h) Package the vials containing wipe test filters and all bulk samples for shipping in accordance with the instructions given in the IHFOM, Chapter VII, Part IV., D.1.[now OSHA Technical Manual, Section II: Chapter 4, II. E. and F.]

(i) Send wipe test samples and bulk samples to SLCAL [now SLTC] for analysis.

(7) Evaluation of compliance with provisions that must be instituted “as soon as possible” or at the “earliest possible time.” The standard stipulates that certain of its provisions must be instituted “as soon as possible” or, equivalently, at the

"earliest possible time" and, in either case, no later than specific dates. When an inspection is conducted before all of the "no later than" dates have expired and institution of one or more of the provisions has not yet been achieved, the compliance officer should investigate the employer's effort to institute the provision(s) "as soon as possible" or at the "earliest possible time." Any finding of a lack of concentrated and sustained effort by the employer to institute a provision is a violation. The correction date for the violation should be represented as the date by when the employer must institute the provision. The correction date should precede the "no later than" date for the provision if earlier correction is possible.

(8) Evaluation of compliance with 29 CFR 1910.1018(k)(1), Housekeeping--Surfaces.

(a) Compliance with the requirement to maintain surfaces "...as free as practicable of accumulations of inorganic (compounds containing) arsenic (and of elemental arsenic)" should be evaluated by looking for anything the employer can do to cut down on contamination of the surfaces--such as, improved work practices, improved engineering controls, more frequent cleaning, etc. The housekeeping plan required under 29 CFR 1910.1018(k)(4) should also be inspected.

(b) When the compliance officer has determined that the employer can reduce contamination of the surfaces, he or she will have to provide evidence that the substance on the surfaces is in fact elemental arsenic or an inorganic compound containing arsenic. Wipe samples would be one way of providing this evidence. Refer to Attachment 5 with this directive for directions on taking wipe samples and submitting them for analysis.

(9) Evaluation of availability of Medical Surveillance For Employees

(a) Although, in accordance with 29 CFR 1910.1018(n), employers are required, to provide employees an opportunity for medical examinations, employees are not required to take them. Employers must continue to offer a medical examination to each authorized employee every time it comes due again, even if the employee has previously refused such an examination.

(b) Where authorized employees are not receiving medical examinations, investigate compliance with the requirement to provide employees an opportunity for medical examination by interviewing interested parties--for example, employees, employee representatives and employers. If any employees are apparently refusing medical examinations, investigate, with particular care, compliance with the requirement to inform employees of the purpose and elements of the medical examination. This last requirement is found under 29 CFR

1910.1018(o)(1)(ii)(D). Where violations are found follow the grouping and classification guidance presented in 5.e. and 5.f. of this directive and in Attachment 1 with this directive.

e. Classification of violations.

(1) The recommended classification of violations is listed in Attachment 1 with this directive. "Serious" classifications are designated by the letter "S"; "other" classifications are designated by the letter "O". The recommendations are subject to the discretion of the Area Director. When a classification differs from the recommendation in Attachment 1, the case file should indicate the reasons. The majority of the recommended classifications are "serious" because of the severe impairment of health that may result as a consequence of the violations. Information on the health hazards associated with exposure to arsenic and arsenic-containing, inorganic compounds is presented in the preamble to the standard. See the Federal Register, May 5, 1978, Divisions III and IV under SUPPLEMENTAL INFORMATION.

(2) The recommended classifications assigned to specific entries under the "29 CFR 1910.1018" heading in Attachment 1 with this directive are what is deemed appropriate when that entry alone is violated. One condition for exception is denoted for entry (e)(5).

(3) The 29 CFR 1910.1018 entries, (d); (e)(2) and (u)(2); (e)(3)(ii) through (e)(3)(iv); (e)(5); (e)(6); (f)(1) and (u)(3); (g)(1)(i) and (g)(1)(ii) (engineering and work practice controls requirements); (g)(2)(i), (g)(2)(iii) and (u)(4); (g)(2)(ii); (h)(2); (h)(3)(i) and (h)(3)(ii); (h)(4); (j)(1)(i) through (j)(1)(iii); (j)(2)(i) through (j)(2)(iii); (m)(2)(ii); (m)(4); (n)(2); (n)(3); (n)(5); (n)(6); (o)(1); (q)(1)(i) through (q)(1)(ii)(E); (q)(2)(i) through (q)(2)(iii)(H); and (r)(2)(ii), are each comprised of sets of closely related requirements with one basic purpose. The classification of violation recommended for each of these entries is applicable when there is noncompliance with the basic purpose of the sets of requirements. For example, the classification of violation recommended for (n)(2) is appropriate if variations from the requirements in (n)(2) result in ineffective medical surveillance of employees. When there is compliance with only part of the requirements of these entries, professional judgment must be exercised to determine if there is sufficient compliance with the basic purpose to warrant a more lenient classification of violation than recommended.

(4) The definitions and guidance given in the FOM, Chapter VIII [now FIRM, Chapter III; VOSH FOM, Chapter III.B.] will determine if a violation is "repeated," "willful" or a "failure to correct."

f. Guidelines for determining items of the citation and when to establish correction dates.

(1) General.

(a) Some of the violations of individual requirements of 29 CFR 1910.1018 are grouped, as indicated in Attachment 1 with this directive, to form one item of the citation. If an individual requirement has been violated in more than one instance, then each instance of violation is specifically listed and incorporated into the same item of the citation.

(b) No more than one penalty may be proposed per item of the citation. Every individual instance of violation of every individual requirement of the standard must be specifically assigned a correction date. This applies regardless of whether or not grouping of violations is involved.

(c) Each employee exposure in excess of the permissible limit under 29 CFR 1910.1018(c) constitutes one instance of violation of 29 CFR 1910.1018(c) unless there is no related violation of 29 CFR 1910.1018 (g)(1) and (h). Refer to 5.g.(2) of this directive for more detail.

(d) Each time an employee has eye or skin contact with a liquid, arsenic-containing, inorganic compound; a liquid solution containing an arsenic-containing, inorganic solute; granules of arsenic; or granules of an arsenic-containing, inorganic compound constitutes one instance of violation of 29 CFR 1910.1018(m)(6).

(e) The exposing of the eyes or skin of employees to an 8-hour TWA concentration of arsenic trichloride vapor in excess of 10 micrograms arsenic per cubic meter of air is also a violation of 29 CFR 1910.1018 (m)(6). Each such exposure constitutes one instance of violation of 29 CFR 1910.1018(m)(6).

(f) The exposing of the eyes or skin of employees to irritating amounts of an airborne, arsenic-containing, inorganic compound other than arsenic trichloride is another violation of 29 CFR 1910.1018(m)(6). Each such exposure constitutes instance of violation of 29 CFR 1910.1018(m)(6).

(g) Each work practice contributing to exposure in excess of the permissible limit under 29 CFR 1910.1018(c) constitutes one instance of violation of 29 CFR 1910.1018(g)(1)(i) or (ii) provided it is technically feasible to modify the work practice in a manner that will reduce the exposure.

(h) Each source of emission contributing to exposure in excess of the permissible limit under 29 CFR 1910.1018(c) constitutes one instance of violation of 29 CFR 1910.1018 (g)(1)(i) or (ii) provided it is technically feasible to reduce the emission by instituting one or more

engineering controls.

(1) Each instance of violation of the engineering and work practice controls requirements of 29 CFR 1910.1018(g)(1) is to be listed on the citation. Specific dates are to be established for correcting each instance of violation.

(2) Example of combining and grouping violations and establishing correction dates. All instances of violation of 29 CFR 1910.1018(h)(1)(i) and all associated instances of violation of 29 CFR 1910.1043(f)(4), (h)(2)(i), (h)(2)(ii) and (h)(2)(iii) are respectively combined. Each of these sets of combined instances of violation are then grouped to form one item of the citation and one penalty is proposed. All instances of violation of 29 CFR 1910.1018(c) are combined to form another item of the citation and another penalty is proposed. Each instance of violation of 29 CFR 1910.1018(h)(1)(i), each instance of violation of 29 CFR 1910.1018(f)(4), (h)(2)(i), (h)(2)(ii) and (h)(2)(iii) that is associated with the 29 CFR 1910.1018(h)(1)(i) violations, and each instance of violation of 29 CFR 1910.1018(c) is listed on the citation and assigned an individual correction date. Of course, those violations of 29 CFR 1910.1018(h)(1)(i), (f)(4), (h)(2)(i), (h)(2)(ii) and (h)(2)(iii) that belong to the same instance will necessarily have the same correction date.

g. Association between 29 CFR 1910.1018(c) violations, 29 CFR 1910.1018(g)(1) violations and 29 CFR 1910.1018(h) violations.

(1) Where employee exposures to airborne compounds regulated under 29 CFR 1910.1018 are in excess of the permissible exposure limit and all technically feasible engineering and work practice controls as required under 29 CFR 1910.1018(g)(1) have not been instituted as early as possible and before January 1, 1980, then 29 CFR 1910.1018(c) and 29 CFR 1910.1018(g)(1) are all violated regardless of whether or not there is compliance with all the respiratory protection requirements under 29 CFR 1910.1018(h).

(2) If all technically feasible engineering and work practice controls have been or are being instituted as early as possible and before January 1, 1980, but employee exposures remain in excess of the permissible exposure limit, and if the employer is not in compliance with all of the respiratory protection requirements under 29 CFR 1910.1018(h), then 29 CFR 1910.1018(c) is violated. If, in the foregoing circumstance, the employer is in compliance with all the respiratory protection requirements under 29 CFR 1910.1018(h), then 29 CFR 1910.1018(c) is not violated.

h. Correction dates and penalties.

(1) Refer to the IHFOM, Chapter I, Section I; the FOM, Chapter X, Section G [FIRM, Chapter IV., VOSH FOM, Chapter IV]; and 5.d. (7) of this directive for guidance in establishing correction dates.

(2) Refer to the FOM, Chapter XI [FIRM, Chapter IV, VOSH FOM, Chapter IV, C], for guidance in determining penalties.

i. Followup inspection policy. After a determination has been made to cite, the Industrial Hygienist shall prepare a schedule for followup inspection of the cited facility based on the employer's plan of abatement. Where a notice of contest has been filed, refer to the FOM, Chapter V, F.1.b.2 [now FIRM, Chapter IV; VOSH FOM, IIA, E.2.i.] for guidance. When possible, reinspection visits to the facility should occur shortly after the scheduled implementation of each important step in the abatement plan. The goal of such followup inspections is to assess the extent of an employer's compliance with the interim steps set forth in his own abatement plan as well as compliance with correction dates in the citation. This schedule shall become part of the file which shall carefully record all the details of an employer's compliance under the standard as noted in each reinspection or other contact with the employer.

j. Federal enforcement in State plan States.

OSHA will enforce 29 CFR 1910.1018 in each State plan State until the State has promulgated a new permanent standard for elemental arsenic and arsenic-containing, inorganic compounds. Accordingly, until a State plan State has promulgated such a standard, it will refer all complaints involving arsenic and arsenic-containing, inorganic compounds to the OSHA Regional Office for investigation. k. Questions concerning this directive may be addressed to the OSHA National Office Division of Occupational Health Programming, Washington, D.C., Telephone number: FTS 523-8034.

6. **Effective Date**

This directive is effective immediately and will remain in effect until further notice.

Bruce Hillenbrand Acting Director,
Federal Compliance and State Programs

ATTACHMENTS

CITATION POLICY FOR INORGANIC ARSENIC

29 CFR 1910.1018	INSTRUCTIONS FOR GROUPING	RECOMMENDED CLASSIFICATION
(c) Permissible exposure limit.	Violations of (c) are not grouped with other violations.	S
~~(d) Notification of use.~~	~~Violations of (d)(1)(i) through (d)(2) are grouped due to the close relationship. There is no additional grouping of (d) violations.~~	~~O~~
(e)(1)(i) Exposure monitoring--General.	Violations of the general requirement under (e)(1)(i) are not cited alone but instead are cited in conjunction with the joint violations of interrelated specific requirements under (e)(1)(iii), (e)(2), (e)(3), (e)(4), (e)(6) and (u)(2).	
(e)(1)(ii) Exposure monitoring–General.	Provision (e)(1)(ii) is not citable.	
(e)(1)(iii) Exposure monitoring--General.	Violations of (e)(1)(iii) infer (e)(2), (e)(3) and/or (e)(4) violations. Violations of (e)(1)(iii) are grouped only with joint (e)(1)(i) violations if any of the employee exposures associated with paragraph (e) violations exceed the permissible exposure limit. Violations of (e)(1)(iii) are grouped with (e)(1)(i), (e)(2), (e)(3), (e)(4), (e)(5), (e)(6) and (u)(2) violations if no employee exposures associated with paragraph (e) violations exceed the permissible exposure limit.	S
(e)(2) Exposure monitoring--Initial monitoring; (u)(2) Startup dates–Monitoring	Violations of (e)(2) and (u)(2) are grouped due to the close relationship. The only additional grouping of these violations is with joint (e)(1)(i) violations if any employee exposures associated with paragraph (e) violations exceed the permissible exposure limit. Violations of (e)(2) and (u)(2) are grouped with (e)(1)(i), (e)(1)(iii), (e)(3), (e)(4), (e)(5) and (e)(6) violations if no employee exposures associated with paragraph (e) violations exceed the permissible exposure limit.	S

29 CFR 1910.1018	INSTRUCTIONS FOR GROUPING	RECOMMENDED CLASSIFICATION
(e)(3)(i) Exposure monitoring--Frequency.	(e)(3)(i) is citable only as an adjunct to (e)(4).	
(e)(3)(ii) through (e)(3)(iv) Exposure monitoring–Frequency.	Violations of (e)(3)(ii) through (e)(3)(iv) are grouped due to the close relationship. The only additional grouping of these violations is with joint (e)(1)(i) violations if any employee exposures associated with paragraph (e) violations exceed the permissible exposure limit. Violations of (e)(3)(ii) through (e)(3)(iv) are grouped with (e)(1)(i), (e)(1)(iii), (e)(2), (e)(3)(i), (e)(4), (e)(5), (e)(6) and (u)(2) violations if no employee exposures associated with paragraph (e) violations exceed the permissible limit.	S
(e)(4) Exposure monitoring--Additional monitoring.	Violations of (e)(4) are grouped only with joint (e)(1)(i) violations and joint (e)(3)(i) violations if employee exposures associated with paragraph (e) violations exceed the permissible exposure limit. Violations of (e)(4) are grouped with (e)(1)(i), (e)(1)(iii), (e)(2), (e)(3), (e)(5), (e)(6) and (u)(2) violations if no employee exposures associated with paragraph (e) violations exceed the permissible exposure limit.	S
(e)(5) Exposure monitoring--Employee notification.	Violations of (e)(5)(i) and (e)(5)(ii) are grouped due to the close relationship. Failure to perform any of the monitoring required under (e)(2), (e)(3) and (e)(4) is tantamount to violation of (e)(5). Violations of (e)(5) are not grouped with other violations if any employee exposures exposures associated with paragraph (e) violations exceed the permissible exposure limit. Violations of (e)(5) are grouped with (e)(1)(i), (e)(1)(iii), (e)(2), (e)(3), (e)(4), (e)(6) and (u)(2) violations if no employee exposures associated with paragraph (e) violations exceed the permissible exposure limit.	S
(e)(5) Exposure monitoring--Employee notification. -- Continued	The (e)(5) violations should be classified as “other” when no employee exposures associated with the violations exceed the action level if one of the following conditions exists: Only (e)(5) of paragraph (e) is violated; or it is inappropriate, as established in the third sentence, to group (e)(5) violations with other paragraph (e) violations.	

29 CFR 1910.1018 (cont'd)	INSTRUCTIONS FOR GROUPING	RECOMMENDED CLASSIFICATION
(e)(6) Exposure monitoring--Accuracy of measurement.	Violations of (e)(6) infer (e)(2), (e)(3) and/or (e)(4) violations. Violations of (e)(6)(i) and (e)(6)(ii) are grouped due to the close relationship. The only additional grouping of (e)(6) violations is with joint (e)(1)(i) violations if any of the employee exposures associated with paragraph (e) violations exceed the permissible exposure limit. There is additional grouping of (e)(6) violations with (e)(1)(i), (e)(1)(iii), (e)(2), (e)(3), (e)(4), (e)(5) and (u)(2) violations if no employee exposures associated with paragraph (e) violations exceed the permissible exposure limit.	S
(f)(1) Regulated area--Establishment; (u)(3) Startup dates – Regulated areas.	Violations of (f)(1) and (u)(3) are grouped due to the close relationship. There is no additional grouping of these violations.	S
(f)(2) Regulated area--Demarcation.	Violations of (f)(2) are not grouped with other violations.	S
(f)(3) Regulated area--Access.	Violations of (f)(3) are not grouped with other violations.	S
(f)(4) Regulated area--Provision of respirators.	Violations of (f)(4) that are joint violations of (h)(1)(i) are grouped with (h)(1)(i) violations and associated (h)(2) violations. Violations of (f)(4) that are joint violations of (h)(1)(ii) are grouped with (h)(1)(ii) violations and associated (h)(2) violations. Violations of (f)(4) that are joint violations of (h)(1)(iii) and (g)(1)(ii) are grouped with (h)(1)(iii) and (g)(1)(ii) violations and associated (h)(2) violations. Violation of (f)(4) that are joint violations of (h)(1)(iv) are grouped with (h)(1)(iv) violations and associated (h)(2) violations.	S
(f)(4) Regulated area--Provision of respirators.	Violations of (f)(4) that are not construed to be joint violations of (h)(1) provisions provisions are grouped with associated (h)(2) violations.	

29 CFR 1910.1018	INSTRUCTIONS FOR GROUPING	RECOMMENDED CLASSIFICATION
(f)(5) Regulated area--Prohibited activities.	Violations of (f)(5) are not grouped with other violations.	S
(g)(1)(i) and (g)(1)(ii) Methods of compliance--Controls (engineering and work practice controls requirements).	Violations of the engineering and work practice controls requirements under (g)(1)(i) and (g)(1)(ii) are grouped due to the close relationship. There is no additional grouping of these violations.	S
(g)(1)(ii) Methods of compliance--Controls (respiratory protection requirement).	Violations of the respiratory protection requirement under (g)(1)(ii) are grouped with (h)(1)(iii) violations, joint (f)(4) violations and associated (h)(2) violations.	S
(g)(1)(ii) Methods of compliance--Controls (other personal protective equipment requirement).	The general requirement under (g)(1)(ii) to use other necessary personal protective equipment is interrelated with specific requirements under (j)(1). When the aforementioned (g)(1)(ii) requirement is violated, either all or part of (j)(1)(i) through (j)(1)(iii) or (j)(1)(iv) are jointly violated Therefore, individual violations of this (g)(1)(ii) requirement are not cited alone but instead are cited either in conjunction with joint violations of all or part of (j)(1)(i) through (j)(1)(iii) of in conjunction with joint violations of (j)(1)(iv). These joint violations are grouped with associated (m)(6) violations.	
(g)(2)(i) and (g)(2)(iii) Methods of compliance--Compliance program; (u)(4) Startup dates–Compliance program.	Violations of (g)(2)(i), (g)(2)(iii) and (u)(4) are grouped due to the close relationship. There is no additional grouping of these violations.	S
(g)(2)(ii) Methods of of compliance-- Compliance program.	Violations of (g)(2)(ii)(A) through (g)(2)(ii)(G) are grouped due to the relationship. The (g)(2)(ii) violations are grouped in turn with (g)(2)(iv) violations.	S
(g)(2)(iv) Methods of compliance–Compliance	Violations of (g)(2)(iv) are grouped with (g)(2)(ii) violations.	S

29 CFR 1910.1018	INSTRUCTIONS FOR GROUPING	RECOMMENDED CLASSIFICATION
(h)(1)(i) Respiratory protection–General.	Violations of (h)(1)(i) are grouped with joint (f)(4) violations and with associated (h)(2) violations.	S
(h)(1)(ii) Respiratory protection–General.	Violations of (h)(1)(ii) are grouped with joint (f)(4) violations and with associated (h)(2) violations.	S
(h)(1)(iii) Respiratory protection–General.	Violations of (h)(1)(iii) are not cited alone but instead are cited in conjunction with violations of the respiratory protection requirement under (g)(1)(ii). These violations are grouped in turn with joint (f)(4) violations and with associated (h)(2) violations.	
(h)(1)(iv) Respiratory protection–General.	Violations of (h)(1)(iv) are grouped joint (f)(4) violations and with associated (h)(2) violations.	S
(h)(2) Respiratory protection--Respirator selection.	Violations of (h)(2)(i) through (h)(2)(iii) that are related to (h)(1)(i) provisions are grouped due to the close relationship. These violations are grouped in turn with violations of (h)(1)(i) and with violations of (f)(4) that are joint violations of (h)(1)(i). Violations of (h)(2)(i) through (h)(2)(iii) that are related to (h)(1)(ii) provisions are grouped due to the close relationship. These violations are grouped in turn with violations of (h)(1)(ii) and with violations of (f)(4) that are joint violations of (h)(1)(ii).	S
(h)(2) Respiratory protection--Respirator selection.	Violations of (h)(2)(i) through (h)(2)(iii) that are related to (h)(1)(iii) and (g)(1)(ii) provisions are grouped due to the close relationship. These violations are grouped in turn with violations of (h)(1)(iii), with associated violations of (g)(1)(ii) and with violations of (f)(4) that are joint violations of (h)(1)(iii) and (g)(1)(ii).	

29 CFR 1910.1018	INSTRUCTIONS FOR GROUPING	RECOMMENDED CLASSIFICATION
(h)(2) Respiratory protection-- Respirator selection. –Continued	Violations of (h)(2)(i) through (h)(2)(iii) that are related to (h)(1)(iv) provisions are grouped due to the close relationship. These violations are grouped in turn with violations of (h)(1)(iv) and with violations of (f)(4) that are joint violations of (h)(1)(iv). Violations of (h)(2)(i) through (h)(2)(iii) that are related to the (f)(4) provision but construed to be unrelated to (h)(1) provisions are grouped due to the close relationship. These violations are grouped in turn with (f)(4) violations construed not to be joint violations of (h)(1).	
(h)(3)(i)-(ii) Respiratory protection–Respirator Usage.	Violations of (h)(3)(i) and (h)(3)(ii) are grouped due to their close relationship. There is no additional grouping of these violations.	S
(h)(3)(iii) Respiratory protection–Respirator usage.	Violations of (h)(3)(iii) are not grouped with other violations.	S
(h)(3)(iv) Respiratory protection-- Respiratory program.	Violations of (h)(3)(iv) are not grouped with other violations.	S
~~(h)(4) Respiratory protection-- Respirator program.~~	~~Violations of (h)(4)(i) through (h)(4)(iii) are grouped due to the close relationship. There is no additional grouping of (h)(4) violations.~~	~~S~~
~~(h)(5)(i) Respiratory Protection-- Commencement of respiratory use.~~	~~Violations of (h)(5)(i) are not grouped with other violations.~~	~~S~~
~~(h)(5)(ii) Respiratory Protection-- Commencement of respirator use.~~	~~Provision (h)(5)(ii) is not citable.~~	~~S~~
~~(h)(5)(iii) Respiratory Protection-- Commencement of respiratory use.~~	~~Violations of (h)(5)(iii) are not grouped with other violations.~~	~~S~~
(j)(1)(i) through (j)(1)(iii) Protective work clothing and equipment–Provision and use.	Violations of (j)(1)(i) through (j)(1)(iii) are grouped due to the close relationship. These violations are grouped in turn with joint violations of the requirement under (g)(1)(ii) to use other necessary personal protective equipment and with associated of (m)(6).	S

29 CFR 1910.1018	INSTRUCTIONS FOR GROUPING	RECOMMENDED CLASSIFICATION
(j)(1)(iv) Protective work clothing and equipment--Provision and use.	Violations of (j)(1)(iv) are grouped with joint violations of the requirement under (g)(1)(ii) to use other necessary personal protective equipment and with associated violations of (m)(6).	S
(j)(2)(i) through (j)(2)(iii) Protective work clothing and equipment–Cleaning and replacement.	Violations of (j)(2)(i) through (j)(2)(iii) are grouped due to the close relationship. There is no additional grouping of these violations.	S
(j)(2)(iv) Protective work clothing and equipment--Cleaning and replacement.	Violations of (j)(2)(iv) are not grouped with other violations.	S
(j)(2)(v) Protective work clothing and equipment–Cleaning and replacement.	Violations of (j)(2)(v) are not grouped with other violations.	S
(j)(2)(vi) Protective work clothing and equipment--Cleaning and replacement.	Violations of (j)(2)(vi) are not grouped with other violations.	S
(j)(2)(vii) Protective work clothing and equipment--Cleaning and replacement.	Violations of (j)(2)(vii) are not grouped with other violations.	S
(j)(2)(viii) Protective work clothing and equipment--Cleaning and replacement.	Violations of (j)(2)(viii) are not grouped with other violations.	S
(k)(l) Housekeeping--Surfaces.	Violations of (k)(l) are not grouped with other violations.	S
(k)(2) Housekeeping--Cleaning floors.	Violations of (k)(2) are not grouped with other violations.	S
(k)(3) Housekeeping--Vacuuming.	Violations of (k)(3) are not grouped with other violations.	S
(k)(4) Housekeeping--Housekeeping plan.	Violations of (k)(4) are not grouped with other violations.	S
(k)(5) Housekeeping--Maintenance of equipment.	Violations of (k)(5) are not grouped with other violations.	S

29 CFR 1910.1018	INSTRUCTIONS FOR GROUPING	RECOMMENDED CLASSIFICATION
(m)(1) Hygiene facilities and practices--Change rooms.	Violations of (m)(1) are grouped with associated violations of the construction deadline under (u)(5).	S
(m)(2)(i) Hygiene facilities and practices-- Showers.	Violations of (m)(2)(i) are not grouped with other violations.	S
(m)(2)(ii) Hygiene facilities and practices-- Showers.	Violations of the various provisions under (m)(2)(ii) are grouped due to the close relationship. These violations are grouped in turn with associated violations of the construction deadline under (u)(5).	S
(m)(3)(i) Hygiene facilities and practices–Lunchrooms.	Violations of (m)(3)(i) are grouped with associated violations of the construction deadline under (u)(5).	S
(m)(3)(ii) Hygiene facilities and practices--Lunchrooms.	Violations of (m)(3)(ii) are not grouped with other violations.	S
(m)(4) Hygiene facilities and practices–Lavatories.	Violations of the various provisions under (m)(4) are grouped due to the close relationship. These violations are grouped in turn with associated violations of the construction deadline under (u)(5).	S
(m)(5) Hygiene facilities and practices-- Vacuuming clothes.	Violations of (m)(5) are not grouped with other violations.	S
(m)(6) Hygiene facilities and practices–Avoidance of skin irritation.	Violations of (m)(6) that are associated with violations of all or part of (j)(1)(i) through (j)(1)(iii) are grouped with these violations and with associated violations of the requirement under (g)(1)(ii) to use other necessary personal protective equipment. Violations of (m)(6) that are associated with violations of (j)(1)(iv) are grouped with (j)(1)(iv) violations and with associated violations of the requirement under (g)(1)(ii) to use other necessary personal protective equipment.	S

29 CFR 1910.1018	INSTRUCTIONS FOR GROUPING	RECOMMENDED CLASSIFICATION
(n)(1)(i) Medical surveillance--General-- Employees covered.	Violations of the general requirements under (n)(1)(i) are not cited alone but instead are cited in conjunction with the joint violations of the interrelated specific requirements under the rest of paragraph (n).	
(n)(1)(ii) Medical surveillance--General--Examination by physician.	Violations of (n)(1)(ii) are grouped with joint (n)(1)(i) violations.	S
(n)(2) Medical surveillance--Initial examinations.	Violations of (n)(2)(i) through (n)(2)(ii)(D) are grouped due to the close relationship. These violations are grouped in turn with joint (n)(1)(i) violations.	S
(n)(3) Medical surveillance--Periodic examinations.	Violations of (n)(3)(i) through (n)(3)(iii) are grouped due to the close relationship. These violations are grouped in turn with joint (n)(1)(i) violations.	S
(n)(4) Medical surveillance--Additional examinations.	Violations of (n)(4) are grouped with joint (n)(1)(i) violations.	S
(n)(5) Medical surveillance--Information provided to the physician.	Violations of (n)(5)(i) through (n)(5)(v) are grouped due to the close relationship. These violations are grouped in turn with joint (n)(1)(i) violations.	S
(n)(6) Medical surveillance--Physician's written opinion.	Violations of (n)(6)(i)(A) through (n)(6)(iii) are grouped due to the close relationship. These violations are grouped in turn with joint (n)(1)(i) violations.	S
(o)(1) Employee information and training–Training program.	Violations of (o)(1)(i) through (o)(1)(ii)(F) are grouped due to the close relationship. There is no further grouping of (o)(1) violations.	S
(o)(2)(i) Employee information and training–Access to training materials.	Violations of (o)(2)(i) are not grouped with other violations.	O
(o)(2)(ii) Employee information and training–Access to training materials.	Violations of (o)(2)(ii) are not grouped with other violations.	O
(p)(1)(i) Signs and labels--General.	Provision (p)(1)(i) is not citable.	

29 CFR 1910.1018	INSTRUCTIONS FOR GROUPING	RECOMMENDED CLASSIFICATION
(p)(1)(ii) Signs and labels General.	Violations of (p)(1)(ii) that relate to (p)(2)(i) are grouped with (p)(2)(i) violations; violations of (p)(1)(ii) that relate to (p)(3) are grouped with (p)(3) violations.	S
(p)(2)(i) Signs and Labels--Signs.	Violations of (p)(2)(i) are grouped with related (p)(1)(ii) violations.	S
(p)(2)(ii) Signs and labels--Signs.	Violations of (p)(2)(ii) are not grouped with other violations.	S
(p)(3) Signs and labels--Labels.	Violations of (p)(3) are grouped with related (p)(1)(ii) violations.	S
(q)(1)(i) through(q)(1)(ii)(E) Recordkeeping -- Exposure monitoring.	Violations of (q)(1)(i) through (q)(1)(ii)(E) are grouped due to the close relationship. There is no additional grouping of these violations.	O
(q)(1)(iii) Recordkeeping--Exposure monitoring.	Violations of (q)(1)(iii) are not grouped with other violations.	O
(q)(2)(i) through (q)(2)(iii)~~(II)~~(E) Recordkeeping–Medical surveillance.	Violations of (q)(2)(i) through (q)(2)(iii)~~(II)~~(E) are grouped due to the close relationship. There is no additional grouping of these violations.	O
(q)(2)(iv)Recordkeeping--Medical surveillance.	Violations of (q)(2)(iv) are not grouped with other violations.	O
(q)(3)(i) Recordkeeping--Availability.	Violations of (q)(3)(i) are not grouped with other violations.	O
(q)(3)(ii)Recordkeeping--Availability.	Violations of (q)(3)(ii) are not grouped with other violations.	O
~~(q)(3)(iii) Recordkeeping--Availability.~~	~~Violations of (q)(3)(iii) are not grouped with other violations.~~	~~O~~
(q)(4)(i) Recordkeeping--Transfer of records.	Violations of (q)(4)(i) are not grouped with other violations. The citation for violation of (q)(4)(i) is issued against the successor employer unless the successor employer can show that the predecessor employer refused to turn over the records. In that event, a citation is issued against the	O

	predecessor employer for intent of retrieving the records.	
29 CFR 1910.1018	INSTRUCTIONS FOR GROUPING	RECOMMENDED CLASSIFICATION
(q)(4)(ii) Recordkeeping-- Transfer of records.	Violations of (q)(4)(ii) are not grouped with other violations. Violations of (q)(4)(ii) cannot occur before the employer ceases to do business. When (q)(4)(ii) is violated, a citation is issued for intent of retrieving the records.	O
(q)(4)(iii) Recordkeeping-- Transfer of records.	Violations of (q)(4)(iii) are not grouped with other violations.	O
(r)(l) Observation of monitoring-- Employee observation.	Violations of (r)(1) are not grouped with other violations.	O
(r)(2)(i) Observation of monitoring--Observation procedures.	Violations (r)(2)(i) are not grouped with other violations.	S
(r)(2)(ii) Observation of monitoring– Observation procedures.	Violations of (r)(2)(ii)(A) through (r)(2)(ii)(C) are grouped due to the close relationship. There is no additional grouping of (r)(2)(ii) violations.	O
(u)(5) Startup dates-- Hygiene and lunchroom facilities (deadline for completion of construction plans).	Violations of the deadline under (u)(5) for completion of construction plans are not grouped with other violations.	S
(u)(5) Startup dates–Hygiene and lunchroom facilities (construction deadline).	Violations of the construction deadline under (u)(5) are not cited alone but instead are cited in conjunction with joint violations of (m).	S

OSHA Sampling Data Sheet

(Solid Aerosols Only)

August 1978

Substances:

aluminum orthoarsenate
ammonium orthoarsenate
ammonium monohydrogen orthoarsenate
ammonium dihydrogen orthoarsenate
ammonium metaarsenite
ammonium calcium arsenate
ammonium magnesium arsenate
arsenic
orthoarsenic acid
arsenic pentoxide
arsenic trioxide
arsenic pentaselenide
arsenic disulfide
arsenic pentasulfide
arsenic trisulfide
arsenic thioarsenate
arsenious selenide
barium orthoarsenate
barium arsenide
bismuth orthoarsenate
cadmium arsenide
calcium arsenate
calcium arsenide
calcium arsenite
chromium monoarsenide
cobalt orthoarsenate
cobalt arsenic sulfide
copper acetoarsenite
copper arsenate
copper arsenite
copper triarsenide
ferric orthoarsenate
ferric orthoarsenite
ferrous orthoarsenate
ferrous orthoarsenite
ferrous pyroarsenite
iron arsenide
iron diarsenide
lead orthoarsenate
lead arsenite
lithium orthoarsenate
magnesium orthoarsenate
magnesium orthoarsenite
manganese monoarsenide
dimaganese arsenide
trimanganese diarsenide
manganous arsenate
mercurous monohydrogen orthoarsenate
mercuric orthoarsenate
nickel orthoarsenate
nickel arsenide
platinum arsenide
potassium arsenate
potassium arsenite
potassium thioarsenate
potassium thioarsenite
silver orthoarsenate
silver orthoarsenite
sodium arsenate
sodium metaarsenite
sodium thioarsenate
strontium orthoarsenite
strontium orthoarsenite
tin pyroarsenate
tungsten arsenide
zinc orthoarsenate
zinc arsenide
zinc metaarsenite

Note: Also any other arsenic-containing, inorganic compounds with equilibrium vapor concentrations (as arsenic) of less than 1 microgram per cubic meter at 30 degrees C.

Standard**:**

29 CFR 1910.1018, Occupational Exposure to Inorganic Arsenic, Federal Register, May 5, 1978.

Permissible Exposure Limit**:**

8-hour time-weighted average (TWA)	10 micrograms per cubic meter (as arsenic)

General Sampling and Analytical Method**:**

An air pump is fastened to the employee and connected by plastic tubing to a 3-piece, closed-face, 37-millimeter cassette containing an 0.8-micron pore size, cellulose acetate-cellulose nitrate filter. The cassette is fastened to the employee's clothing (to the collar lapel, if possible) near the breathing zone. The face of the cassette must be facing downward so that uptake of particulate matter by the cassette inlet orifice will simulate the inhalation of particulate matter through the nostrils. A metered volume of air is drawn through the filter in order to collect the airborne particulate of interest. The cassette and filter are then sent to the Salt Lake City Analytical Laboratory (SLCAL) [now Salt Lake Technical Center (SLTC)] and quantitative analysis of arsenic is performed by either the arsine generation, atomic absorption spectrophotometric method, or the flameless atomic absorption spectrophotometric method.

Sampling Equipment:

1. 3-piece, closed-face, 37-millimeter diameter filter cassette.

2. 37-millimeter diameter, cellulose acetate-cellulose nitrate filter with an 0.8-micron pore size.

3. 37-millimeter diameter, cellulose filter support pads.

4. A calibrated personal sampling air pump capable of drawing air at a flow rate of 2 liter per minute (lpm) through the above type filter.

Sampling Parameters:

Desired Measurement	Flow Rate	Sampling Duration Per Filter
8-hour TWA	2 lpm	7-8 hours (Use a shorter duration if the filter begins loading up.)

Noncompliance Assurance Factor:

The concentration determinations must be a minimum of 1.25 times the numerical limit being accessed in order to provide sufficient assurance the limit is exceeded.

Sampling Strategy:

1. When exposure occurs continuously or intermittently over a 7- to 8-hour period, a minimum of 7 hours of continuous sampling is necessary to establish an 8-hour TWA exposure.

2. When all the exposure occurs in less than a 7-hour span, it is necessary to sample only during this lesser period in order to determine an 8-hour TWA exposure.

Flow Rate Validations:

Flow rates should be validated in the general locality of the workplace prior to each day of sampling. Follow the procedure presented in the Industrial Hygiene Field Operations Manual (IHFOM), Chapter V, Part I.[OSHA Technical Manual, Appendix II:1-3].

Sampling Procedure:

Follow the "Sampling Procedure" presented in the IHFOM, Chapter V, Part II [OSHA Technical Manual, Section II]. With respect to II.B.11., also determine and record the barometric pressure (unadjusted to sea level).

Reporting Air Volume to SLCAL:

1. Convert volumes of air sampled to corresponding volumes at 25C and 760 mm Hg before reporting them to SLCAL. These "standard volumes" are calculated from the following formula:

   $V_o = 298VP/760T$

   where, V_o = standard volume in liters.
   V = indigenous volume of sampled air in liters.
   P = ambient pressure in millimeter of mercury (mm Hg). Note: The pressure referred to here is the actual barometric pressure. It is not the barometric pressure adjusted to sea level.
   T = ambient temperature in degrees Kelvin (273 + ambient temperature in degrees Celsius = degree K).

2. Example calculation:

   Indigenous volume of sampled air, 960 liters.
   Ambient temperature, 30 degrees C = 273 + 30 = 303 degrees K.
   Ambient pressure, 600 mm Hg.

   $V_o = 298VP/760T = (298)(960)(600)/(760)(303) = 745$ liters.

Blank**:**

Follow the instructions given in the IHFOM, Chapter V, subparagraph II.B.15 [OSHA Technical Manual, Section II, Chapter 1].

Bulk Sample**:**

SLCAL does not require any bulk samples in order to perform the analyses.

Shipping Instructions:

1. Ship the filter samples in their cassettes to SLCAL in accordance with the instructions given in the IHFOM, Chapter VII, paragraph IV.A [OSHA Technical Manual, Section II, Chapter 4, II].

2. Note on the Sample Identification Sheet what is being evaluated (e.g., the acceptability of a respirator that has a "condition of use" limitation of 100 micrograms arsenic per cubic meter, the 8-hour TWA permissible exposure limit, etc.)

3. Limit sample analysis requests to arsenic.

OSHA Sampling Data Sheet

August 1978

Substances:

Arsenic trichloride, arsenic trifluoride and arsenic pentafluoride.

Standard**:**

29 CFR 1910.1018, Occupational Exposure to Inorganic Arsenic, Federal Register, May 5, 1978.

Permissible Exposure Limit:

8-hour time-weighted average (TWA)	10 micrograms per cubic meter (as arsenic)

General Sampling and Analytical Method:

An air pump is fastened to the employee and connected by plastic. tubing or rubber hose to a midget bubbler containing 10 milliliters of 0.1 normal aqueous sodium hydroxide solution. The bubbler is fastened to the employee's clothing near the breathing zone. A metered volume of air is drawn through the solution to scrub out and collect the vapor or gas of interest. The solution is then sent to the Salt Lake City Analytical Laboratory (SLCAL) [now Salt Lake Technical Center (SLTC)] and quantitative analysis of arsenic is performed by either the arsine generation, atomic absorption spectrophotometric method, or the flameless atomic absorption spectrophotometric method.

Sampling Equipment:

1. Midget bubbler with porous glass fit on outlet end of intake stem.

2. 0.1 normal aqueous sodium hydroxide solution. (Distilled water and reagent grade or better sodium hydroxide are required.)

3. 10-milliliter, graduated pipette.

4. Distilled water.

5. A personal sampling pump capable of drawing air at a flow rate of 1 liter per minute (lpm) through the bubbler and solution.

Sampling Rate:

1.0 liter per minute.

Sampling Duration Per Bubbler:

1. The sampling duration per bubbler must be the same as the duration of the employee's exposure if the exposure is anticipated to be near the permissible limit. For example, if the exposure is 8 hours in duration, then the sampling duration per bubbler must be 7 to 8 hours; if the exposure is 4 hours in duration, then the sampling duration per bubbler must be 4 hours.

2. Ten milliliters of 0.1 normal sodium hydroxide solution contains sufficient reagent to collect a maximum amount of air contaminant corresponding to an 8-hour TWA concentration of 50 milligrams (as arsenic) per cubic meter of air. If the concentration of the air contaminant to be measured is anticipated to exceed an 8-hour TWA concentration (as arsenic) of 25 milligrams per cubic meter, then reduce the sampling duration per bubbler. For example, if the 8-hour TWA exposure concentration is anticipated to fall within the range of 25 to 50 milligrams (as arsenic) per cubic meter, then the sampling duration per bubbler should be one-half the duration of exposure; if the 8-hour TWA exposure concentration is anticipated to fall within the range of 50 to 100 milligrams (as arsenic) per cubic meter, then the sampling duration per bubbler should be one-fourth the duration of exposure.

3. Approximately 1 milliliter of water per hour will be lost by evaporation. Therefore, the pump should be briefly stopped at approximately 1-hour intervals in order to check the depletion of water. The pump should then be restarted and an appropriate amount of distilled water should be added by pipette through the stem of the bubbler.

Noncompliance Assurance Factor:

The concentration determinations must be a minimum of 1.25 times the numerical limit being accessed in order to provide sufficient assurance the limit is exceeded.

Sampling Strategy:

1. When exposure occurs continuously or intermittently over a 7- to 8-hour period, a minimum of 7 hours of continuous sampling is necessary to establish an 8-hour TWA exposure.

2. When all the exposure occurs in less than a 7-hour span, it is necessary to sample only during this lesser period in order to determine an 8-hour TWA exposure.

Flow Rate Validations:

Flow rates should be validated in the general locality of the workplace prior to each day of sampling. Follow, with appropriate modifications, the procedure presented in the Industrial Hygiene Field Operations Manual (IHFOM), Chapter V, Part I [OSHA Technical Manual, Appendix II;1-3].

Sampling Procedure:

1. Connect a midget bubbler containing 10 milliliters of 0.1 normal sodium hydroxide and a midget impinger in series with a short piece of Tygon or equivalent tubing. The bubbler precedes the impinger. The impinger serves as a trap for any absorbing solution that happens to flow out the side-arm of the bubbler flask.

2. Place each flask in a "swing-out" holster and fasten the holsters with large safety pins to the employee's clothing near his/her breathing zone.

3. Fasten the pump to the employee's belt. The pump should be located at the back of the employee.

4. Connect the pump inlet and the impinger side-arm with plastic tubing or rubber hose. For more information on fastening the pump and tubing or hose to the employee, see the Industrial Hygiene Field Operation Manual (IHFOM) Chapter V, Part II., Subpart B., Items 2., 3., 4., 5., 6.d. and 6.e [OSHA Technical Manual, Appendix II: 1-3].

5. Remove the dust cap from the bubbler stem, start the pump and record the time.

6. Determine and record the temperature and atmospheric pressure (unadjusted to sea level).

7. Stop the pump briefly at approximately 1-hour intervals and check the level of solution in the bubbler flask.

8. Restart the pump and add the appropriate amount of distilled water by pipette through the bubbler stem.

9. When sampling is complete, stop the pump, record the time, immediately remove the bubbler and place dust caps on the bubbler stem and side-arm.

10. If any absorbing solution entered the impinger flask, recover it and include it with the solution in the bubbler

11. Record the date, the location the sample was collected and the sample number.

Reporting Air Volume to SLCAL:

1. Convert volumes of air sampled to corresponding volumes at 25 degrees C and 760 mm Hg before reporting them to SLCAL. These "standard volumes" are calculated from the following formula:

   $V_o = 298VP/760T$
   where, V_o = standard volume in liters.
   V = indigenous volume of sampled air in liters.
   P = ambient pressure in millimeter of mercury (mm Hg). Note: The pressure referred to here is the actual barometric pressure. It is not the barometric pressure adjusted to sea level.
   T = ambient temperature in degrees Kelvin (273 + ambient temperature in degrees Celsius = degrees K).

2. Example calculation:

   Indigenous volume of sampled air, 480 liters.
   Ambient temperature, 30 degrees C = 273 + 30 = 303 degress K.
   Ambient pressure, 600 mm Hg.

   $V_o = 298VP/760T = (298)(480)(600)/(760)(303) = 373$ liters.

Blank

Prepare a blank by pipetting 10 milliliters of the absorbing solution into an extra bubbler flask at the same general time and location that absorbing solution for sampling is pipetted. No air is drawn through the blank. Otherwise, the blank is handled and shipped in the same manner as the samples.

Bulk Sample:

SLCAL [now SLTC] does not require a bulk sample in order to perform the analysis.

Shipping Instructions**:**

1. Ship the sample solutions to SLCAL [now SLTC] in accordance with the instructions given in the IHFOM, Chapter VII, Part IV, Subpart C [OSHA Technical Manual, Section II, Chapter 4].

2. Note on the Sample Identification Sheet what is being evaluated (e.g., the acceptability of a respirator that has a "condition of use" limitation of 100 micrograms arsenic per cubic meter, the 8-hour TWA permissible exposure limit, etc.).

Sample Analysis Requests:

Limit sample analysis requests to arsenic.

OSHA Sampling Data Sheet

(Combination of Solid Aerosol and Vapor)

August 1978

Substances:

Arsenic tribromide and arsenic triiodide.

Standard:

29 CFR 1910.1018, Occupational Exposure to Inorganic Arsenic, Federal Register, May 5, 1978.

Permissible Exposure Limit:

8-hour time-weighted average (TWA)	10 micrograms per cubic meter (as arsenic)

General Sampling and Analytical Method:

A 3-piece, closed-face, 37-millimeter cassette containing an 0.8-micron pore size, cellulose acetate-cellulose nitrate filter is connected in series with a midget bubbler and a midget impinger. The midget bubbler contains 10 milliliters of 0.1 normal aqueous sodium hydroxide solution. The midget impinger serves as a trap for any absorbing solution that happens to flow out of the side-arm of the bubbler flask. The cassette and filter precede the bubbler. The bubbler precedes the impinger. The cassette, bubbler and impinger are fastened to the employee's clothing. The cassette is fastened near the employee's breathing zone (to the collar lapel, if possible). The face of the cassette must be facing downward so that the uptake of particulate matter by the cassette inlet orifice will simulate the inhalation of particulate matter through the nostrils. An air pump is fastened to the employee and connected by plastic tubing or rubber hose to the side-arm of the impinger flask. A metered volume of air is drawn through the filter and absorbing solution. Solid aerosol contaminant is collected on the filter and vapor contaminant is scrubbed out and collected in the absorbing solution. After sampling is complete, the filter is removed from the cassette in uncontaminated air and transferred to the absorbing solution that was in concurrent use with the filter. This is done to minimize sample loss from the filter by vaporization. The solution and filter are then sent to the Salt Lake City Analytical Laboratory (SLCAL)[now Salt Lake Technical Center (SLTC)] and quantitative analysis of arsenic is performed by either the arsine generation, atomic absorption spectrophotometric method, or the flameless atomic absorption spectrophotometric method.

Sampling Equipment.

1. 3-piece, closed-face, 37-millimeter diameter filter cassette.

2. 37-millimeter diameter, cellulose acetate-cellulose nitrate filter with an 0.8-micron pore size.

3. 37-millimeter diameter, cellulose filter support pad.

4. Midget bubbler with porous glass fit on the outlet end of the intake stem.

5. 0.1 normal aqueous sodium hydroxide solution. (Distilled water and reagent grade or better sodium hydroxide are required.)

6. A personal sampling pump capable of drawing air at a flow rate of 2 liters per minute through the filter, bubbler and solution, and impinger.

7. 10-milliliter, graduated pipette.

8. Distilled water.

Sampling Rate:

2.0 liters per minute.

Sampling Duration:

1. The sampling duration per filter and the sampling duration per bubbler shall coincide.

2. The sampling duration per filter and per bubbler should be the same as the duration of the employee's exposure, if the exposure is not so great as to prohibit this approach. For example, if the exposure is 8 hours in duration, then the sampling duration per filter and per bubbler should be 7 to 8 hours; if the exposure is 4 hours in duration, then the sampling duration per filter and per bubbler should be 4 hours.

3. If the exposure is so great that sampling for the duration of an employee's exposure will either overload the filter with particulates or consume an excessive amount of the sodium hydroxide in the absorbing solution, then whichever will occur first will dictate the sampling duration per the filter and bubbler combination. That is, the sampling duration per the filter and bubbler combination must be so apportioned as to avoid the dominant problem.

4. Ten milliliters of 0.1 normal sodium hydroxide solution contains sufficient reagent to collect a maximum amount of vapor corresponding to an 8-hour TWA concentration of 25 milligrams (as arsenic) per cubic meter of air. If the concentration of the vapor to be measured is anticipated to exceed an 8-hour TWA concentration (as arsenic) of 15 milligrams per cubic meter, then reduce the sampling duration per bubbler and per filter. For example; If the 8-hour TWA vapor exposure concentration is anticipated to fall within the range of 15 to 25 milligrams (as arsenic) per cubic meter, then the sampling duration per bubbler and per filter should be one-half the duration of exposure unless the filter will overload in a shorter duration; if the 8-hour TWA vapor exposure concentration is anticipated to fall within the range of 25 to 50 milligrams (as arsenic) per cubic meter, then the sampling duration per bubbler and per filter should be one-fourth the duration of exposure unless the filter will

overload in a shorter duration.

5. Approximately 2 milliliters of water per hour will be lost by evaporation. Refer to this Sampling Data Sheet under the topic heading, Sampling Procedure, items 11., 12., 13., and 14., for the procedure for handling this problem.

Noncompliance Assurance Factor:

The concentration determinations must be a minimum of 1.25 times the numerical limit being accessed in order to provide sufficient assurance the limit is exceeded.

Sampling Strategy:

1. When exposure occurs continuously or intermittently over a 7- to 8-hour period, a minimum of 7 hours of continuous sampling is necessary to establish an 8-hour TWA exposure

2. When all the exposure occurs in less than a 7-hour span, it is necessary to sample only during this lesser period in order to determine an 8-hour TWA exposure.

Flow Rate Validations:

Flow rates should be validated in the general locality of the workplace prior to each day of sampling. Follow, with appropriate modifications, the procedure presented in the Industrial Hygiene Field Operations Manual (IHFOM), Chapter V, Part I [OSHA Technical Manual, Appendix II: 1- 3] .

Sampling Procedure**:**

1. Connect a filter and cassette, a midget bubbler containing 10 milliliters of 0.1 normal sodium hydroxide, and a midget impinger in series with short pieces of Tygon or equivalent tubing. The filter and cassette precedes the bubbler. The bubbler precedes the impinger. The impinger serves as a trap for any absorbing solution that happens to flow out the side-arm of the bubbler flask.

2. Place each flask in a "swing-out" holster and fasten the holsters with large safety pins to the employee's clothing near his/her breathing zone.

3. Fasten the cassette in the employee's breathing zone (to the collar lapel, if possible).

4. Fasten the pump to the employee's belt. The pump should be located at the back of the employee.

5. Connect the pump inlet and the impinger side-arm with plastic tubing or rubber hose. For more information on fastening the cassette, pump, and tubing or hose to the employee, see the Industrial Hygiene Field Operations Manual (IHFOM) Chapter V, Part II., Subpart B., Items 2., 3., 4., 5., 6a., 6.b. and 6.e. [OSHA Technical Manual, Appendix II: 1- 3].

6. Remove the dust cap from the bubbler stem.

7. Remove the plug from the cassette inlet orifice.

8. Start the pump and record the time.

9. Determine and record the temperature and atmospheric pressure (unadjusted to sea level).

10. Stop the pump briefly at approximately 1-hour intervals and check the level of solution in the bubbler flask.

11. Disconnect the tubing at the bubbler stem inlet and restart the pump.

12. Add the appropriate amount of distilled water by pipette through the bubbler stem.

13. Slip the tubing back over the inlet end of the bubbler stem.

14. When sampling is complete, stop the pump and record the time.

15. Remove the filter and cassette from the sampling system.

16. Immediately insert plugs into the cassette's inlet and outlet orifices.

17. Remove the bubbler from the sampling system.

18. Immediately place dust caps on the bubbler stem and bubbler side-arm.

19. Also, if any absorbing solution overflowed into the impinger, remove it from the sampling system and immediately place caps on its stem and side-arm.

20. Record the date, the location the sample was collected and the sample numbers.

21. In an uncontaminated area, transfer the filter to the same glass container that is going to be used to ship the bubbler's absorbing solution. Also include any absorbing solution that overflowed into the midget impinger. For details on transferring solution from an impinger or bubbler flask to another container, see the IHFOM, Chapter VII, Part IV., Subpart C [OSHA Technical Manual, Section II, Chapter 4, II.D.].

<u>Reporting Air Volume to SLCAL [now Salt Lake Technical Center (SLTC)]</u>:

1. Convert volumes of air sampled to corresponding volumes at 25 degrees C and 760 mm Hg before reporting them to SLCAL. These "standard volumes" are calculated from the following formula:

$V_o = 298VP/760T$

where, V_o = standard volume in liters.
V = indigenous volume of sampled air in liters.
P = ambient pressure in millimeter of mercury (mm Hg). Note: The pressure

referred to here is the actual barometric pressure. It is not the barometric pressure adjusted to sea level.

T = ambient temperature in degrees Kelvin (273 + ambient temperature in degrees Celsius = degrees K).

2. Example calculation:

Indigenous volume of sampled air, 960 liters.
Ambient temperature, 30 degrees C = 273 + 30 = 303 degrees K.
Ambient pressure, 600 mm Hg.

$V_o = 298VP/760T = (298)(960)(600)/(760)(303) = 745$ liters.

Blank

Prepare a blank for each day of sampling as follows:

1. Pipette 10 milliliters of the absorbing solution into an extra bubbler flask at the same general time and location that absorbing solution for sampling is pipetted into bubbler flasks.

2. Insert a filter into an extra cassette at the same general time and location that filters for sampling are inserted into cassettes.

3. Handle, transfer and ship the filter and absorbing solution in the same manner as the samples except as follows: Do not draw any air through them.

Bulk Sample:

SLCAL [now Salt Lake Technical Center (SLTC)] does not require a bulk sample in order to perform the analysis.

Shipping Instructions:

1. Ship the sample solutions to SLCAL in accordance with the instructions given in the IHFOM, Chapter VII, Part IV., Subpart C [OSHA Technical Manual, Section II, Chapter 4].

2. Note on the Sample Identification Sheet what is being evaluated (e.g., the acceptability of a respirator that has a "condition of use" limitation of 100 micrograms arsenic per cubic meter, the 8-hour TWA permissible exposure limit, etc.)

Sample Analysis Requests:

Limit sample analysis requests to arsenic.

Wipe Sampling Procedure

August 1978

Substances:

Arsenic and arsenic-containing, inorganic compounds

Standard:

29 CFR 1910.1018, Occupational Exposure to Inorganic Arsenic, Federal Register, May 5, 1978.

Sampling Procedure:

1. Using a clean, disposable glove, remove a 7 cm (2 3/4 inch) diameter Whatman 41 filter from the box.

2. Moisten the filter with distilled water. (Use a dry filter if sampling for a liquid residue of arsenic trichloride or arsenic trifluoride.)

3. Select a sampling area which is at least 100 cm^2. edge of the filter slightly raised, wipe

4. With the leading edge of the filter slightly raised, wipe the surface in a back and forth and up and down motion. A 10 cm X 10 cm wire frame can be used as a guide.

5. Pick up the filter paper, place it on a clean sheet of paper, fold the contaminated side inward and then make one more fold to form a 90 degree angle in the center of the filter.

6. Place the filter, angle first, into a glass vial and close the lid tightly.

7. Seal the vial lids with an OSHA-21 Seal.

Blank:

Send a vial containing a blank filter along with the wipe samples.

Shipping Instructions:

1. Package the vials for shipping in accordance with the instructions given in the Industrial Hygiene Field Operations Manual (IHFOM), Chapter VII, Part IV., D.1. 2 [OSHA Technical Manual, Section II, Chapter 4]. Send the samples to the Salt Lake City Analytical Laboratory [now Salt Lake Technical Center (SLTC)] for analysis.

Industry Profile

1. Introduction

This attachment lists some types of establishments where the potential for exposure to airborne arsenic and arsenic-containing, inorganic compounds exist. The information is intended to afford Regional and Area Offices assistance in programming inspections to assess compliance with 29 CFR 1910.1018. The inspections need not be restricted to the types of establishments listed if the Field Offices have knowledge of other relevant establishments.

2. Some Types of Establishments Where Exposure to Arsenic and/or Arsenic-Containing, Inorganic Compounds Occur

a. Primary copper, lead, zinc and gold smelters.

b. Secondary lead and copper smelters.

c. Loaders and unloaders of carriers of bulk arsenic ore and bulk arsenicals. Carriers involved are as follows:

(1) Sea freighters.

(2) Railcars.

(3) Highway bulk carriers.

d. Manufacturers of arsenical herbicides. Some examples of these products are as follows:

(1) Sodium arsenite.

(2) Monosodium methylarsonate (MSMA).

(3) Disodium methylarsonate (DSMA).

(4) Dimethylarsinic acid (cacodylic acid).

e. Manufacturers of arsenical pesticides. Some examples of these products are as follows:

(1) Calcium arsenate.

(2) Copper acetoarsenite (Paris green).

(3) Magnesium arsenate

(4) Sodium arsenite

(5) Zinc arsenate

(6) Zinc arsenite

(7) Zinc fluoroarsenate

f. Manufacturers of desiccants.

Example: Orthoarsenic acid.

g. Manufacturers of wood preservatives.

Some examples of these products are as follows:

(1) Ammoniacal copper arsenite

(2) Chromated copper arsenate.

(3) Mixture of chlorinated arsenate, fluoride and phenolic salts in aqueous solution.

(4) Zinc-chromium arsenate

(5) Copperized zinc-chromium arsenate

(6) Fluorochrome arsenate phenol

h. Manufacturers of feed additives.

Some examples of these products are as follows:

(1) Arsenic acid.

(2) 3-Nitro-4-hydroxyphenylarsonic acid.

(3) 4-Nitrophenylarsonic acid.

(4) 4-Ureido-1-phenylarsonic acid.

i. Manufacturers of pharmaceuticals for use in veterinary medicine.

Some examples of these products are as follows:

(1) Acetarsamide

(2) Carbarsone.

(3) Dichlorophenarsine.

(4) Lead arsenate

(5) Melarsonyl.

(6) Neoarsphenamine

(7) Thiacetarsamide (Caparsolate).

j. Manufacturers of glass that use arsenic trioxide as a refining agent and a decolorizer.

k. Manufacturers of alloys of nonferrous metals and arsenic.

Some examples of products manufactured from these alloys are as follows:

(1) Lead shot.

(2) Cable sheathing (lead and arsenic).

(3) Battery grids (lead and arsenic).

(4) Battery electrodes (lead and arsenic).

(5) Speculum metal.

(6) Boiler tubes (Copper and arsenic).

(7) Arsenic bronze.

(8) Special solders such as used on body joints and seams in the automobile industry.

(9) Arsenic brass.

(10) Arsenical Babbitt.

l. Users of solders that contain arsenic as a component in the alloy.

Example: Automobile and truck body manufacturers.

m. Manufacturers and/or users of arsenic-based flotation reagents.

n. Miscellaneous. Arsenic and/or arsenic-containing, inorganic compounds are used in each of the following types of establishments. However, every employer does not

necessarily use them.

(1) Leather tanneries.

(2) Manufacturers of ceramics and ceramic or vitreous enamel.

(3) Manufacturers of analine colors.

(4) Manufacturers of pyrotechnics.

(5) Manufacturers of semiconductors.