NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND

SUPPORTING DOCUMENTATION FOR

*** HYDROQUINONE ***

NIOSH/OSHA Draft Technical Standard and Supporting Documentation for HYDROQUINONE

The basic text of this document contains the draft technical standard approved by the Joint Review Committee of the NIOSH/OSHA Standards Completion Program and the supporting documentation for the substance HYDROQUINONE.

The SCP draft technical standards are recommendations to the Department of Labor for its consideration in rulemaking and have no legal status until final rules have been promulgated by that agency. This draft standard is provided for your information only.

The References and Sources, Respirator Table Documentation and Use/Exposure and Control Documentation are the working documents used by the various SCP working groups during the development of the draft technical standard and serve as the technical foundation for the standard. The classification for each substance and the regulatory statements were derived following a decision logic established for the various sections of the standard.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for HYDROQUINONE

(a) DEFINITIONS

(1) PERMISSIBLE EXPOSURE - "Permissible Exposure" means inhalation of hydroquinone in concentrations not in excess of 2 milligrams per cubic meter (mg/cu.m.) averaged over an eight hour work shift, as stated in section 1910.93, Table G-1.

(2) ACTION LEVEL - "Action Level" means one half (1/2) of the permissible exposure for hydroquinone.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which hydroquinone is present shall:

(1) STANDARD AVAILABILITY - Keep a copy of this section with its appendices A, B and C, at the workplace. This material shall be made readily available to affected employees; and

(2) PRESENCE OF HYDROQUINONE - Inform affected employees of the quantity, location, and manner of use or storage of hydroquinone.

(c) EXPOSURE MEASUREMENT

(1) INITIAL DETERMINATION - Each employer who has a place of employment in which hydroquinone is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of hydroquinone at or above the action level. The determination shall be made each time there is a change in production, process, or control measures which could result in an increase in airborne concentrations of hydroquinone. A written determination shall be made and it shall contain at least the following information:

(i) Any information, observations, or calculations which would indicate employee exposure to hydroquinone;

(ii) Any measurements of airborne concentrations of hydroquinone taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to hydroquinone; and

(iv) Date of determination, work being performed at the time, location within work site, name, and social security number of each employee considered.

(2) INITIAL EXPOSURE MEASUREMENT - If the employer determines that any employee may be exposed to airborne concentrations of hydroquinone at or above the action level, the exposure of the employee believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum exposure of the employee.

(3) INDENTIFICATION OF EXPOSED EMPLOYEES - If the exposure measurement taken under paragraph (c)(2) of this section reveals employee exposure to airborne concentrations of hydroquinone at or above the action level, the employer shall:

(i) Identify all employees who may be exposed at or above the action level; and

(ii) Measure the exposure of the employees so identified.

(4) EXPOSURE ABOVE THE ACTION LEVEL - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of hydroquinone at or above the action level, but not above the permissible exposure, the exposure of that employee shall be measured at least every two months.

(5) EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE - If an employee exposure measurement reveals that an employee is exposed to airborne

concentrations of hydroquinone above the permissible exposure, the employer shall:

(i) Inform the employee of the exposure as required by paragraph (N)(1) of this section; and

(ii) Measure the exposure of the employee at least monthly; and

(iii) Institute control measures as required by paragraph (E) of this section.

(6) TERMINATION OF EXPOSURE MEASUREMENT - If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to airborne concentrations of hydroquinone below the action level, the employer may terminate measurement for the employee. For purposes of this subparagraph, use of respirators shall not constitute reduction of employee exposure below the action level.

(d) METHODS OF MEASUREMENT - An employee's exposure shall be obtained by any combination of long term or short term samples which represents the employee's actual exposure averaged over an eight hour work shift (Appendix B (iv)). The method of measurement shall have an accuracy, to a confidence level of 95%, of not less than that given in Table 1 below.

Table 1

Concentration	Required Accuracy
Above permissible exposure	Plus or Minus 25%
At or below permissible exposure and above the action level	Plus or Minus 35%
At or below the action level	Plus or Minus 50%

(e) Methods of Compliance

(1) Engineering controls - No employee shall be exposed to hydroquinone above the permissible limit as defined in paragraph (a)(1) of this section. Engineering and work practice controls shall be used to reduce exposure to hydroquinone to at or below the permissible exposure.

(i) When mechanical ventilation is used to control exposure, measurements which demonstrate system efficiency (for example: air velocity, static pressure, or air volume) shall be made at least every three months. Measurements of system efficiency shall also be made within five work days of any change in production, process or control which might result in a reduction in control.

(2) Respirators

(i) Compliance with the permissible exposure may not be achieved by the use of respirators except:

(a) During the time period necessary to install engineering controls; or

(b) In work situations in which engineering controls are technically not feasible; or

(c) In work situations in which feasible engineering and work practice controls are insufficient to reduce employees exposure to at or below the permissible exposure. Where technically feasible engineering and work practice controls are not sufficient to reduce exposure to at or below permissible exposure, they shall

be used to reduce exposure to the lowest level feasible; or

(d) For operations not exceeding 40 hours per year; or

(e) In emergencies.

(ii) Respirators shall be jointly approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) and by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

(iii) Employers shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.

(iv) Employers shall institute a respiratory protection program in accordance with sections 1910.134(b),(d),(e) and (f).

TABLE 2. RESPIRATORY PROTECTION FOR HYDROQUINONE

Condition	Permissible Respiratory Protection
Concentration of Dust or (Quinone) Vapor	
Equal to or less than 100 mg/m3 of hydroquinone; or 20 mg/m3 (5 ppm) of quinone	A gas mask with a chin-style or front or back-mounted organic vapor canister and any fume or high efficiency particulate filter. Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece operated in pressure-demand (positive pressure) mode.
Equal to or less than 2 g/m3 of hydroquinone; or 400 mg/m3 (100 ppm) of quinone	operated in pressure-demand (positive pressure) mode or tinuous flow mode.
Greater than 2 g/m3 of hydroquinone; or 400 mg/m3 (100 ppm) of quinone; or Entry & Escape from Unknown Concentrations	A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-

Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand (positive pressure) mode.
Escape	A gas mask with a full facepiece providing protection against organic vapors and particulates. Any escape self-contained breathing apparatus.

(f) Fire and Safety

Employers shall familiarize themselves with the information contained in the Substance Technical Guidelines for hydroquinone which is contained in Appendix B in order to ensure the safe handling and use of hydroquinone.

(1) Electrical - For the purposes of compliance with section 1910.309, locations classified as hazardous locations due to the presence of hydroquinone shall be Class II Group G.

(2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, hydroquinone is classified as a Class B fire hazard.

(3) Powered industrial trucks - For the purposes of compliance with section 1910.178, locations classified as hazardous locations due to the presence of hydroquinone shall be Class II Group G.

(4) Sources of ignition - Sources of ignition such as smoking or open flames are prohibited where hydroquinone is handled, used or stored in a manner so as to create a potential fire or explosion hazard.

(5) Storage - Hydroquinone shall be stored so as not to come in contact with moisture, strong oxidizers or alkalies.

(g) Personal Protective Equipment

(1) Skin Contact

(i) Employers shall provide, and require employees to use, impervious clothing, gloves, face shields (8 inch minimum) and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact to solid hydroquinone or liquids containing hydroquinone. Face shields shall comply with section 1910.133(a)(6).

(ii) Employers shall ensure that employees whose clothing may have become contaminated with solid hydroquinone change into uncontaminated clothing before leaving the work premises.

(iii) Employers shall ensure that non-impervious clothing contaminated with solid hydroquinone or wet with liquids containing hydroquinone be removed promptly and not reworn until the hydroquinone is removed from the clothing.

(iv) Employers shall ensure that clothing contaminated with solid hydroquinone or wet with liquids containing hydroquinone is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of hydroquinone from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the hydroquinone, the employer shall inform the person performing the operation of the hazardous properties of hydroquinone.

(2) Eye Contact

(i) Employers shall provide, and require employees to use, splash-proof safety goggles (cup-cover type dust and splash safety goggles), which comply with section 1910.133(a)(6), where eye contact to liquids containing hydroquinone may occur.

(ii) Employers shall provide, and require employees to use, dust-resistant safety goggles (cup-cover type dust and splash safety goggles), which comply with section 1910.133(a)(6), where there is any possibility of solid hydroquinone contacting the eye.

(iii) Where there is any possibility that an employee's eyes may be exposed to hydroquinone dust employers shall provide an eye wash fountain within the immediate work area for emergency use.

(h) Spills

(1) Spills of hydroquinone shall be cleaned up immediately after eliminating potential sources of ignition and utilizing available ventilation.

(i) Sanitation

(1) Employers shall ensure that employees whose skin becomes contaminated with solid hydroquinone or wet with liquids containing hydroquinone promptly wash or shower as necessary to remove any hydroquinone from the skin.

(2) Employers shall ensure that employees do not eat or smoke in areas where solid hydroquinone is handled, processed or stored.

(3) Employers shall ensure that employees who handle hydroquinone wash their hands thoroughly with soap and mild detergent and water before eating, smoking or using toilet facilities.

(j) Training and Information - Each employer who has employees exposed to hydroquinone in excess of the action level, or employees who may have skin or eye contact with hydroquinone, or employees who work where accidental release, spill, fire, or explosion of hydroquinone may occur, shall annually:

(1) Substance Safety Data Sheet - Inform each employee of the information contained in the Substance Safety Data Sheet for hydroquinone, which is contained in Appendix A; and

(2) Medical -

(I) Advise employees as to the signs and symptoms of exposure to hydroquinone.

(II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to hydroquinone which are listed in Appendix A; and

(3) Procedures -

(I) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to hydroquinone.

(II) The procedures required by (j)(1), (2), and (3)(I) shall be provided to employees at the expense of the employer during the employee's normal working hours.

(k) Medical Surveillance

(1) The employer shall provide medical procedures as required by paragraph (k). These procedures shall be provided at no cost to the employee.

(2) Preplacement Examination - The employer shall make available to each employee who is to be exposed to hydroquinone dust in excess of the action level or is otherwise at risk to eye exposure from handling of the dust, a medical examination which shall include as a minimum the following:

(I) A medical history and physical examination with emphasis on the eyes.

(II) A determination of visual acuity.

(III) The visualization of the cornea by slit lamp illumination.

(3) The employer shall obtain from the physician, as a record of the examination, the following information:

(I) The physician's written opinion stating whether or not the employee has any detected medical conditions which would place him at increased risk from exposure to hydroquinone.

(II) A recording of visual acuity and the results of a slit lamp inspection of the eyes.

(4) Periodic Examinations - The employer shall make available to each employee exposed to hydroquinone in excess of the action level at 12 months from the date of the employee's first exposure, and at every 12 months of exposure thereafter, a medical examination which must include the following:

(I) A medical history and examination referable to the eyes.

(II) A determination of visual acuity.
(III) The visualization of the cornea by slit lamp illumination.

(5) The employer shall obtain from the physician, as a record of the periodic examination, the following information:
(I) The physician's written opinion stating whether or not the employee has any detected medical conditions which would place him at increased risk to further exposure to hydroquinone.

(II) A recording of visual acuity and the results of slit lamp inspection of the eyes.

(6) Exclusion or Removal from Exposure - No employee shall be exposed to hydroquinone if such exposure could place the employee at increased risk of material impairment of his health.

(7) Emergency Procedures - The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to hydroquinone.

(8) Informing the Physician - The employer shall provide to the examining physician the following information:

(I) A copy of this section with its Appendices A, B and C for hydroquinone;

(II) A description of the employee's duties as they relate to his exposure to hydroquinone;

(III) A description of any personal protective equipment, including respirators, required to be used;

(IV) The results of any employee's exposure measurement, if available;

(V) The employee's anticipated exposure level; and

(VI) Upon request of the physician, information from previous medical examination of the employee.

(9) Physician's Written Opinion

(I) The physician's written opinion shall be a signed statement by the examining physician specifically stating:

(A) Whether the employee has any detected medical conditions which could be directly or indirectly aggravated by exposure to hydroquinone or which could significantly interfere with the ability of the employee to follow recommended or required procedures for protecting himself from unusual or emergency exposure.

(B) Any recommended limitations on the employee's exposure to hydroquinone.

(C) The employee has been informed by the physician of any detected medical conditions which require further medical examination or treatment.

(II) The written opinion shall not reveal medical information unrelated to exposure to hydroquinone.

(10) Alternative Medical Examinations - If the examining physician chooses to use alternative medical examinations to those specified

in sections (2) and (4), the employer may accept such alternative medical surveillance examinations as meeting the requirements of this part provided that the employer:

(I) Obtains a statement from the examining physician setting forth the alternative medical examinations and the rationale for substitution and evidence that they will be equally effective.

(II) Informs each exposed employee of the fact that alternative medical examinations to those required in section (2) or (4) above are to be made available.

(11) Refusal to be Medically Examined - If an employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such refusal and obtain a signed statement from the employee indicating that the employee understands the risks involved by refusing to be examined.

(12) No medical procedure which would be performed pursuant to this section need be performed if records of a previous such procedure performed within the past six months are acceptable to the examining physician.

(l) Recordkeeping.

(1) Initial determination.

(i) The employer shall keep an accurate record of all initial determinations required to be made pursuant to paragraph (c)(1) of this section.

(ii) The record shall include the written determination and any supporting documentation as required in paragraph (c)(1) of this section.

(iii) This record shall be maintained until replaced by a more recent record.

(2) Exposure measurements.

(i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to hydroquinone.

(ii) This record shall include:

(a) The date of measurement;

(b) A reference to the subparagraph of this regulation which required the measurement, if any;

(c) Operations involving exposure to hydroquinone which is being monitored;

(d) Sampling and analytical methods used and evidence of their accuracy;

(e) Number, duration, and results of samples taken;

(f) Name, Social Security number, and exposure of the employee monitored.

(iii) This record shall be maintained until replaced by a more recent record but in no event for less than one year.

(3) Mechanical ventilation.

(i) When mechanical ventilation is used as an engineering control, the employer shall maintain a record of measurements

demonstrating the effectiveness of such ventilation as required by paragraph (e)(1)(i) of this section.

(ii) This record shall include:
(a) Date of measurement;
(b) Type of measurement taken;
(c) Result of measurement.

(iii) This record shall be maintained for at least one year.

(4) Annual training.

(i) The employer shall keep an accurate record of all employee training and advice required by paragraph (j) of this section.

(ii) The record shall include:
(a) Date of training;
(b) Name and Social Security number of employee trained;
(c) Substance of training provided.

(iii) This record shall be maintained until replaced by a more recent record.

(5) Medical records.

(i) The employer shall keep an accurate medical record for each employee.

(ii) The record shall include:
(a) Results of tests required in Section (k)(3) and (k)(5) of t
(b) Physician's written opinion;
(c) Any employee medical complaints relative to exposure to hyd
(d) A signed statement of any refusal to be examined;
(e) A copy of information provided to the physician pursuant to paragraph (k)(8) (ii) through (vi) of this section

(iii) This record shall be maintained for the duration of the employment of the affected employee.

(6) Access to records.

(i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary and the Director.

(ii) Employee exposure measurement records required to be maintained by this section shall be made available to employee and former employees and their designated representatives.

(iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.

(m) Observation of monitoring.

(1) Duty.

The employer shall give affected employees or their representatives an opportunity to observe any monitoring of employee exposure to hydroquinone which is conducted pursuant to this section.

(2) Exercise of opportunity to observe monitoring.

(i) When observation of the monitoring of employee exposure to hydroquinone requires entry into an area where the use of personal protective devices is required, the observer shall use such equipment and comply with all other applicable safety procedures.

(ii) Without interfering with the measurement, observers shall be entitled to:

(a) Receive an explanation of the measurement procedures;

(b) Visually observe all steps related to the measurement of exposure to hydroquinone that are being performed at the place of exposure.

(c) Record the results obtained.

(n) Employee notification.

(1) The employer shall notify in writing, within five work days, every employee who is found to be exposed to hydroquinone above the permissible exposure. The employee shall also be notified of the level of his exposure and corrective action being taken to reduce the exposure to at or below the permissible exposure.

(2) Pursuant to paragraph (k) of this Section, when an employee is medically examined the employer shall provide the employee with a copy of the physician's written opinion.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET

I. SUBSTANCE IDENTIFICATION

SUBSTANCE: Hydroquinone

PERMISSIBLE EXPOSURE: 2 milligrams of hydroquinone per cubic meter of air (mg/cu m).

APPEARANCE: Light tan, light gray or colorless crystals.

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: Hydroquinone can effect your body if it is swallowed, inhaled or if it comes in contact with your skin or eyes.

B. Effects of Overexposure:

1. Short-Term Overexposure: Exposure to the dust of hydroquinone may cause eye irritation and eye damage. Swallowing of hydroquinone may cause ringing of the ears, nausea, dizziness, a sense of suffocation, increased respiration, vomiting, paleness, muscular twitching, shortness of breath, a blue color of the lips, delerium, collapse and death. It may cause the urine to turn green or brown. Skin contact may result in a skin rash.
2. Long-Term Overexposure: Repeated exposure may cause staining of the white of the eye, permanent damage to the eyes or depigmentation of the skin.
3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with hydroquinone exposure.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If hydroquinone gets into your eyes, wash the eyes immediately with large amounts of water and continue flushing for 15 minutes, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

B. Skin Exposure: If hydroquinone gets on your skin, flush the contaminated skin with water. If liquids containing hydroquinone soak through your clothing, or if your clothing becomes contaminated with solid hydroquinone, remove the clothing and flush the

contaminated skin with water. Do not rewear the clothing until the hydroquinone has been removed. Replace or repair impervious clothing that has developed leaks. If there is skin irritation get medical attention.

C. Breathing: If you or any other person breathes in large amounts of hydroquinone remove the exposed person to fresh air at once. Other measures are usually unnecessary.

D. Swallowing: When hydroquinone has been swallowed get medical attention immediately. If medical attention is not immediately available get the affected person to vomit by having him touch the back of the throat with his finger or by giving him large amounts (one pint or more) of warm salt water (two tablespoons of salt per pint of water). Do not make an unconscious person vomit.

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

IV. RESPIRATORS AND PROTECTIVE CLOTHING

A. RESPIRATORS: Respirators are not the best way to control exposure to hydroquinone. You can only be required to wear them for routine use if your employer is in the process of installing controls or other control measures prove inadequate. You may be required to wear respirators for non-routine activities or in emergencies. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA)/National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines approval label.) If you experience difficulty breathing while wearing a respirator, tell your employer.

B. PROTECTIVE CLOTHING: You must wear impervious clothing, gloves, face shields and other appropriate protective clothing to prevent repeated or prolonged skin contact with solid hydroquinone or liquids containing hydroquinone.

C. EYE PROTECTION: You must wear dust resistant safety goggles (cup-cover type dust and splash safety goggles) where eye contact to liquids containing hydroquinone may occur or where there is any possibility of hydroquinone dust in concentrations in excess of the permissible exposure contacting your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

Store hydroquinone away from strong oxidizers. If your work clothing has any possibility of becoming contaminated with solid hydroquinone, you must change into uncontaminated clothing before leaving the work site. If your skin contacts solid hydroquinone, you must wash any area of your body that may have contacted hydroquinone at the end of the work day. If your skin becomes contaminated with solid hydroquinone or wet with liquids containing hydroquinone, you must promptly wash or shower as necessary to remove the hydroquinone from your skin. You must promptly remove any non-impervious clothing that becomes contaminated with solid hydroquinone or wet with liquids containing hydroquinone and this

clothing must not be reworn until the hydroquinone is removed from the clothing. You must not eat or smoke in areas where solid hydroquinone is handled, processed or stored. If you handled solid hydroquinone or liquids containing hydroquinone you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities. Fire extinguishers and eye flushing facilities, where provided, must be readily available and you should know where they are and how to operate them. Ask your supervisor where hydroquinone is used in your work area and for any additional plant safety and health rules.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
HYDROQUINONE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Quinol; 1,4-dihydroxybenzene; 1,4-benzenediol
2. Formula: $C_6H_6O_2$
3. Molecular weight: 110

B. Physical Data

1. Boiling point (760 mm Hg): 286 C (547 F)
2. Specific gravity (water = 1): 1.33
3. Vapor density (air=1 at boiling point of hydroquinone): 3.8
4. Melting point: 170 C (338 F)
5. Vapor pressure at 20 C (68 F): less than 0.001 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 7
7. Evaporation rate (butyl acetate = 1): data not available
8. Appearance and odor: Light tan, light gray, or colorless crystals

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 165 C (329 F) (closed cup)
2. Autoignition temperature: 516 C (960 F)
3. Flammable limits in air, % by volume: data not available
4. Extinguishing media: Dry chemical, alcohol foam, carbon dioxide
5. Special fire-fighting procedures: Do not use a solid stream of water since a stream may scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Hydroquinone is a combustible material. Fine dusts can be ignited by a spark or flame and can explode. All ignition sources must be controlled where hydroquinone powder is used or handled.
7. For purposes of complying with 29CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electric Code for hydroquinone shall be Class II, Group G.

B. Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizers may cause fire and explosion.

3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving hydroquinone.
4. Special precautions: None

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

A. If hydroquinone is spilled or leaked, the following steps should be taken:
1. Remove all ignition sources
2. Ventilate area of spill or leak
3. For small quantities, collect on paper or other suitable material, place in an appropriate container and burn in a safe place (such as a fume hood). Large quantities may be reclaimed; however, if this is not practical use a procedure similar to that for small quantities.

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

C. Waste disposal methods:
Hydroquinone may be disposed of:
1. By making packages of hydroquinone in paper or other combustible material and burning in a suitable combustion chamber.
2. By dissolving hydroquinone in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber.

IV. MONITORING AND MEASUREMENT PROCEDURES

a. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single sample or two (2) 4-hour samples. Short term interval samples (up to 30 minutes) may also be used to determine average exposure level if a minimum of five (5) measurements are taken in a random manner over the 8-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random equal duration samples taken on one (1) work shift is an estimate of an employee's average level of exposure for that work shift. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR Part 84, portable direct-reading instruments, liquid scrubber collection with subsequent chemical analyses or dosimeters. The method of measurement must determine the concentration of hydroquinone to plus or minus 35%.

b. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring under this section should be essentially the same as described under paragraph IV. a. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The method of measurement must determine the concentration of hydroquinone to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

A. Employers should advise employees of all plant areas and operations where exposure to hydroquinone could occur.

B. When hydroquinone is exposed to moisture, quinone vapor is formed and may present a more serious exposure hazard to employees than hydroquinone alone.

VI. COMMON OPERATIONS

Common operations in which exposure to hydroquinone is likely to occur are: preparation and use of photographic developer solutions; as an antioxidant and stabilizer; as a chemical intermediate; and as an ingredient in preparations used to control dutch elm disease.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; ingestion.

II. TOXICOLOGY

Hydroquinone is primarily hazardous to the eye. Acute exposure causes conjunctival irritation, while chronic exposure produces changes characterized as: (1) brownish discoloration of the conjunctiva and cornea confined to the intrapalpebral tissue; (2) small opacities of the cornea; and (3) structural changes in the cornea which result in loss of visual acuity. The pigmentation changes are reversible, but the more slowly developing structural changes in the cornea may progress. Although pigmentation may appear with less than five years of exposure, this is uncommon and usually is not associated with serious injury to the eye. Experimental animals develop methemoglobinemia, hemolysis and anemia from the oral administration of large doses of hydroquinone. The accidental ingestion of 1 gram by an adult has resulted in symptoms of central nervous system excitation leading to collapse, while 5 to 12 grams are fatal. Systemic effects from industrial exposure have not been reported. The risk of skin sensitization from the dry solid is negligible and is uncommon from exposure to dilute alkaline solutions such as photographic developers.

III. SIGNS AND SYMPTOMS

Eye irritation including conjunctivitis and keratitis. Ingestion of large amounts may result in central nervous system excitation and excretion of colored urine.

IV. SPECIAL TESTS

Preplacement and periodic ophthalmic examinations, including visual acuity and inspection of the cornea by slit lamp illumination.

V. TREATMENT

Remove from exposure. Wash eyes and contaminated skin with water. If swallowed and the person is conscious, induce vomiting. Give artificial resuscitation if indicated.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of hydroquinone are caused by its irritant impact on the eye. It is important that the physician becomes familiar with plant operating conditions in which exposure to

hydroquinone occurs. Protective eye equipment should be used by all persons exposed to hydroquinone.

B. PREPLACEMENT

The following medical examinations must be made available to each employee who is exposed to hydroquinone.

1. A medical history and physical examination with emphasis on the eyes; a determination of visual acuity; the visualization of the cornea by slit lamp illumination -- the surveillance of workers exposed to hydroquinone dust requires special attention to the eyes by means of a preplacement history of congenital or acquired eye defects, and ophthalmic examination including the determination of visual acuity and the inspection of the cornea by slit lamp illumination. Consideration should be given to excluding persons with poor visual acuity due to high degrees of astigmatism, keratoconus, or pre-existing corneal injury from repeated uncontrolled exposure to hydroquinone dust.

C. PERIODIC EXAMINATION

The above medical examinations are to be repeated on an annual basis in order to detect early eye changes and to prevent progression. Persistent or increasing staining and/or corneal opacities are significant indications for removal from further exposure.

References

1. American Conference of Governmental Industrial Hygienists: "Hydroquinone," (3d ed., 2d printing), Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, p. 133.

2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1965, pp. 1380-1383.

3. Grant, W. Morton: Toxicology of the Eye (2d ed.), Charles C. Thomas, Illinois, 1974, pp. 564-567.

4. Hygienic Guide Series: "Hydroquinone," Industrial Hygiene Association, 17:134,163, 1956.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for HYDROQUINONE

USE/EXPOSURE AND CONTROL DOCUMENT
HYDROQUINONE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of dust and skin and eye contact with liquid solutions during preparation and use of photographic developers	A,B	Personal protective equipment (gloves, goggles, aprons)
2.	Inhalation of dust and skin contact with liquid solutions during use as an antioxidant (for fats, oils, turpentine, furfural, formaldehyde, olefins, ethyl cellulose, isopropyl ether)	A,B	Local exhaust ventilation; personal protective equipment (gloves, goggles, aprons)
3.	Inhalation of dusts during synthesis of hydroquinone ethers, vitamin E, hydroquinone diacetate, p-methoxyphenol	A	Local exhaust ventilation
4.	Inhalation of dust during use as a chemical stabilizer for furan, vinyl acetate, vinyl chloride, styrene, methyl methacrylate	A	General dilution ventilation; personal protective equipment (gloves, goggles)
5.	Inhalation of dust during the synthesis and subsequent handling of hydroquinone powders	A	Local exhaust ventilation; personal protective equipment (goggles, gloves, aprons)
6.	Skin and eye contact with liquid solutions during use in dyeing and fur processing industry	B	Personal protective equipment (goggles, gloves, aprons)
7.	Inhalation of dust and skin and eye contact with solutions during use as an antioxidant in the rubber industry	A,B	Personal protective equipment (goggles, gloves, aprons)
8.	Inhalation of dust and skin and eye contact with solutions during control applications for dutch elm disease	A,B	Personal protective equipment (goggles, gloves, aprons)

A -- Inhalation
B -- Skin contact resulting in

localized irritation
C -- Ingestion
D -- Skin contact resulting in absorption and subsequent systemic poisoning