NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND

SUPPORTING DOCUMENTATION FOR

*** 2-BUTANONE ***

NIOSH/OSHA Draft Technical Standard and Supporting Documentation for 2-BUTANONE

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 2-BUTANONE.

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 2-BUTANONE

1910.93 2-BUTANONE

(a) DEFINITIONS - For the purpose of this section,

(1) "Permissible Exposure" means inhalation of 2-butanone in concentrations not in excess of 200 parts per million (ppm) (590 milligrams per cubic meter, mg/cu.m.) averaged over an 8-hour work shift.

(2) "Action Level" means a level of exposure to airborne concentrations of 2-butanone in excess of 100 ppm (295 mg/cu.m.) averaged over an 8-hour work shift. (b) MONITORING

(1) DETERMINATION OF REQUIREMENT FOR MONITORING. Each employer who has a place of employment in which 2-butanone is released into the workplace air shall determine if any employee may be exposed to 2-butanone in excess of the action level. This determination shall be made within six months and again whenever there has been a production, process or control change resulting in possible increase in the quantity of 2-butanone released or when the employer has any reason to suspect that an employee may be exposed in excess of the action level. An employee will be presumed to be exposed in excess of action level if: (i) Observations and calculations made by the employer

reveal that a potential exposure exists. (Example: if 2-butanone vapor is released into a workplace with a volume of 10,000 cu.ft. (285 cu.m.) at a rate in excess of 1.8 pints (0.9 liters) per 8-hour work shift); as if

(ii) Any information, such as measurements of air concentrations or clinical signs and symptoms commonly associated with the toxic effects of 2-butanone (See Appendix A) reveal that an employee may be exposed in excess of the action level; or if

(iii) The employer has been advised in writing by OSHA or NIOSH that an employee may be exposed in excess of the action level.

(2) INITIAL MEASUREMENT. If, as a result of the determination under (B)(1), any employee is presumed to be exposed in excess of the action level the exposure of the employee likely to have the greatest exposure shall be measured during a maximum exposure work shift.

(3) EMPLOYEE MONITORING PROGRAM - If, as a result of the initial measurement, or based on any other information, the employer has reason to believe that an employee is exposed to 2-butanone in excess of the action level, the employer shall design and implement a monitoring program which shall identify and measure the exposure of all employees exposed to 2-butanone in excess of the action level. (See Appendix B)

(4) TERMINATION OF MONITORING. If an employee monitoring program measurement reveals that an employee is not exposed in excess of the action level, and if the next consecutive employee monitoring program measurement, made not less than five working days later, also reveals that the employee is not exposed in excess of the action level, the employee monitoring program may be terminated for that employee.

(5) NORMAL MONITORING. If an employee monitoring program measurement reveals that an employee is exposed in excess of the action level

but not in excess of the permissible exposure, the exposure of that employee shall be measured not less frequently than once every two months.

(5) NORMAL MONITORING. If an employee monitoring program measurement reveals that an employee is exposed in excess of the permissible exposure, the exposure of that employee shall be measured not less frequently than once every month, control measures required by paragraph (c) shall be initiated and the employee shall be notified as required by paragraph (h).

(7) EXPOSURE MEASUREMENT. An employee's exposure will be obtained from the results of a single long-periodsample or some series of short-period samples which represent the average exposure over an eight-hour work shift. The method of measurement shall have an accuracy of not less than plus or minus 50% from 50 to 100 ppm, plus or minus 35% from over 100 through 200 ppm and plus or minus 25% over 200 ppm. Accuracy must be determined in a manner consistant with the requirements of 42 CFR 84 or as defined in the "NIOSH Monitoring Manual".

(c) Methods of Compliance

(1) Controls. Exposure to 2-Butanone by inhalation in excess of the permissible exposure shall be controlled to no greater than the permissible exposure by methods under 29 CFR 1910.94, other mechanical ventilation, isolation or modification of the process, or discontinuance of the use of 2-Butanone.

(2) Mechanical Ventilation Measurements. When any mechanical ventilation system is used to control exposure to no greater than the permissible exposure, measurements such as hood velocity, static pressure or air volume, which demonstrate that the system is operating effectively shall be made by (date), at least every three months thereafter, and whenever any change in process or control may result in a reduction in the control of the contaminant.

(3) Special and Emergency Procedures.

(i) All electrical installations and utilization equipment in atmospheres containing 2-Butanone shall be installed in accordance with the requirements of 29 CFR 1910.309. For the purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electrical Code shall be Class I Group D.

(ii) The selection of portable fire extinguishing units for the protection against liquid 2-Butanone fire hazards shall be in accordance with 29 CFR 1910.157. For the purposes of complying with the requirements of 29 CFR 1910.157, 2Butanone liquid shall be classified as a Class B fire hazard.

(iii) The selection and use of power operated industrial trucks in atmospheres containing 2-Butanone and classified as hazardous locations in accordance with Article 500 of the National Electrical Code shall be in accordance with the requirements of 29 CFR 1910.178. Only trucks approved for use in Class I Group D hazardous locations shall be permitted to operate in those areas where 2-Butanone may be present.

(iv) The handling, storage, and use of 2-Butanone shall be done in accordance with the requirements of 29 CRF 1910.106, 29 CFR

1910.107 and 29 CRF 1910.108 as appropriate. For purposes of complying with the requirements of 29 CFR 1910.106, 2-Butanone shall be classified as a Class I B flammable liquid. Sources of ignition such as smoking, open flames, sparking tools, and hot surfaces shall be prohibited in areas where 2-Butanone may be present in the atmosphere in concentrations greater than 25% of Lower Explosive Limit.

(v) In the design of ventilation systems as required in 29 CFR 1910.94(d), a 2-Butanone open surface tank operation at ambient temperature shall be classified as B-1. Where a fan is located in any duct work where 2-Butanone may be present in concentrations greater than 25% of the Lower Explosive Limit, the fan rotating element shall be nonsparking or the casing shall consist of or be lined with nonsparking material. There shall be sufficient clearance between the fan rotating element and the fan casing so as to prevent contact.

(d) Respiratory Protection

(1) Compliance with the permissible exposure limit may not be achieved by the use of respirators except: (i) During the time period necessary to install the controls required by paragraph (c) of this section.

(ii) For non-routine operations such as a brief exposure to concentrations in excess of the permissible exposure concentration as a result of maintenance or repair activities; or

(iii) In emergencies where air concentrations of 2-Butanone may exceed the permissible exposure limit.

(2) Where a respirator is permitted by subparagraph (1) of this paragraph, it shall be selected from among those jointly approved by the Bureau of Mines, Department of the Interior, and the National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare, under the provisions of 30 CFR 11. The employer shall provide the respirator selected and shall ensure that the employee uses the respirator provided. A respiratory protection program meeting the requirements of 29 CFR 1910.134 shall be established and enforced by the employer. Only appropriate respirators as described in Table 1 shall be used.

(3) Where an emergency may develop which could result in employee injury from over exposure to 2-Butanone, the employer shall provide an escape device as listed in Table 1.

TABLE 1. RESPIRATORY PROTECTION FOR 2-BUTANONE

Condition	Permissible Respiratory Protection
Vapor Concentration	
Egual to or Less than 1000 ppm	Any chemical cartridge respirator with an organic vapor cartridge (30 CFR 11.150).
Equal to or Less	Any supplied-air respirator

than 2000 ppm	(30 CFR 11.110(a)(1)(3) & (5)).
Equal to or Less than 5000 ppm	Gas mask, chin style organic vapor canister (30 CFR 11.90(a)(3)).
Equal to or Less than 20,000 ppm	Gas mask, front or back counted organic vapor canister (30 CFR 11.90(a)(1)). Any supplied-air respirator with a full facepiece or hood (30 CFR 11.110(a)(1)(3) & (5)). Any self-contained breathing apparatus with a full facepiece (30 CFR 11.70).
Greater than 20,000 ppm or, Entry and Escape from Unknown Concentrations	Any self-contained breathing apparatus with a full facepiece operated in the pressure-demand (positive pressure) mode (30 CFR 11.70(a)(2)(ii)). A combination respirator which includes a self-contained breathing apparatus and a Type C respirator operated in the pressure-demand (positive pressure) mode (30 CFR 1170(b)).
Escape	Any gas mask providing protection against organic vapors (30 CFR 11.90). Any escape self-contained breathing apparatus (30 CFR 11.70).

(e) Personal Protection

(1) The employer shall ensure that splash-proof safety goggles be worn by employees whenever there is a likelihood of liquid 2-Butanone coming in contact with the eyes. Eye protection equipment shall be in accordance with 29 CFR 1910.133.

(2) Where repeated splashes or skin contact to liquid 2-Butanone occur, employers shall require that employees wear impervious clothing, gloves, face shields (full length, eight inch minimum) or other coverings to protect the area of the body likely to come in contact with 2-Butanone. Clothing contaminated with 2-Butanone shall be removed promptly and laundered, or rinsed, and dried before re-use.

(f) Housekeeping

(1) Spills of 2-Butanone shall be cleaned up immediately after eliminating potential sources of ignition and providing available ventilation.

(2) 2-Butanone shall not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

(g) Sanitation

(1) Where the eyes of any person may be exposed to liquid 2-Butanone, suitable facilities for flushing the eyes shall be provided within the work area for immediate emergency use.

(h) Informing the employee

(1) An employer shall not store, distribute, make available, furnish, or supply 2-butanone or products containing 2-butanone, for use by his employees, or make available, or allow to be made available, a work area containing 2-butanone, unless a copy of this Regulation is kept in such a location that it will be readily available for examination by employees. Employees shall be instructed as to the location of such information.

(2) If an employee is exposed to 2-butanone above the action level, or if an employee is at risk of injury from a 2-butanone fire or explosion, the employer must annually review and advise those employees of the information contained on the Substance Safety Data Sheet for 2-butanone (Appendix A), and must further provide training necessary to insure that those employees understand the hazard, emergency procedures, correct use of protective equipment and medical and environmental monitoring requirements for 2-butanone. Such review, advice, and training must be provided at the expense of the employer during the employee's normal work hours.

(3) In order to inform the employee of the hazards, safe use, handling and storage of 2-butanone, the employer shall maintain for technical reference, information contained on the Substance Technical Guidelines (Appendix B).

(i) Medical Surveillance

(1) General. The employer shall within 6 months of the publication of this section implement a program to provide or make available, at no cost to the employee, medical procedures as required by this paragraph.

(2) Pre-placement procedures:

(i) The employer shall require from each employee who is to be exposed to 2-butanone above the action level a statement for the medical record as to whether or not not he has a history of the following: (a) renal disease (b) liver disease (c) chronic respiratory disease (d) chronic skin disease

(ii) If the employee provides a history of any of the conditions named in (i)(2)(i), the employer shall obtain a physician's written opinion based on a medical examination (see Section (6)) stating whether or not the employee has any detected medical conditions which would place him at increased risk from exposure to 2-butanone.

(iii) No employee shall be exposed to 2-butanone if such exposure could place the employee at increased risk because of pre-existing medical conditions.

(3) Periodic Examinations:

(i) Routine periodic medical examinations are not required. However, the employer shall periodically (but not less than annually) inform all employees exposed to 2-butanone in excess of the action level that should any employee develop

any sign or symptom commonly associated with such exposure or become aware of medical conditions listed in Section (i)(2)(i) above, the employee should notify the employer.

(ii) Upon such notification, the employer shall obtain a physician's written opinion based upon a medical examination stating whether or not the employee has any detected medical conditions which would place him at increased risk to further exposure to 2-butanone.

(iii) No employee shall continue to be exposed to 2-butanone if such exposure could directly or indirectly aggravate any detected medical condition or otherwise place the employee at increased risk.

(4) Interim Examinations If the employee is accidently or otherwise exposed by ingestion, inhalation or by skin or eye contact under conditions known or suspected to be hazardous or for any reason develops signs and symptoms commonly associated with toxic exposure to 2-butanone, the employer shall provide appropriate emergency and follow up medical treatment and obtain a physician's recommendation regarding medical examinations which may be indicated to monitor for the acute and long-range effects of such exposure. The employer shall inform the employee in writing of the physician's recommendation and shall make available to the employee the medical examinations recommended.

(5) Information Provided to the Physician The employer shall provide to the examining physician the following information: (i) a copy of the medical surveillance requirements set forth herein

(ii) a brief description of the routes of absorption and toxic effects of overexposure to 2-butanone

(iii) if the physician so requests, available information from previous medical examinations on the employee being examined

(iv) such other information regarding the nature of the employee's work exposure, including the need to wear special protective equipment, particularly respirators which the physician should know in order to render his opinion

(6) Physician's Written Opinion

(i) The physician's written opinion shall be a signed statement by the examining physician specifically stating whether or not the employee has any detected medical condition that could be directly or indirectly aggravated by exposure to 2-butanone or that could significantly interfere with the ability of the employee to follow recommended or required procedures, including the use of personal protective clothing and respirators, for protecting himself or others from unusual or emergency exposure. The written opinion, shall not reveal specific medical findings or diagnoses unrelated to exposures to 2-butanone. However, the employer shall advise the physician that any medical conditions detected during the examination of the employee requiring further medical evaluation or treatment are to be explained to the employee at the time of the examination.

(ii) The employer shall inform the physician that if any special precautions or limitations are indicated to protect the employee from exposure to 2-butanone, the physician shall include such recommendations as part of his written opinion.

(iii) The employer shall provide the employee a copy of the physician's written opinion.

(7) Refusal of the Employee to be Medically Examined If the employee refuses any required medical examination because of religious or other reasons, except where such is necessary for the protection of the health or safety of others, the employer shall inform the employee of possible health consequences of his refusal and obtain a witnessed, signed statement from the employee indicating that he understands the risks involved but refuses to be examined. This signed statement shall be kept as part of the employee's record. If the employee's job is such that the state of the employee's health could endanger the health and safety of other employees, and he refuses to be medically examined, the employer shall not permit the employee to be exposed to 2-butanone.

(J) Recordkeeping

(1) Records Required. Every employer shall maintain the following records and shall make these records available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health, or to authorized representatives of either.

(i) A record of the determination of the requirement for monitoring as required by (b)(1) which shall include the date such determination took place, the work site, operations that occur at that work site, and the method used in determining if an exposure above the action level existed. These records shall be maintained for a period of at least one year.

(ii) A record of the initial measurement and any measurements made in a monitoring program as required by (b)(5) or (6). This record shall include the subparagraph which required this measurement, the substance measured, date of the measurement, operation, location within work site, sampling and analytical method, duration of sample, concentration measured, name and social security number of employee whose exposure was measured and the exposure of that employee.

These records shall be maintained for the last five years of the employee's employment and for at least one year thereafter.

(iii) A record of the effectiveness of mechanical ventilation as required by (c)(2). These records shall be maintained for a period of at least one year.

(iv) A record indicating that employees have received the annual review, advice and training as required by (h)(2). These records shall be maintained for a period of at least two years.

(V) A record of any statement, opinions or medical examination required by (i). These records shall be retained for the

last 5-year period of the employee's employment and for at least one year thereafter.

(2) Employee Access. Except for medical records, every employee or former employee or his designated representative shall have reasonable access to any record required to be maintained by subparagraph (1)(i) of this paragraph, which indicates the employee's own exposure. Upon the request of any employee or former employee or any representative specifically designated for this purpose by the employee or former employee, the contents of the records of any medical examination required by Medical Surveillance paragraph (i) shall be furnished to any physician designated by the employee or his representative.

(3) Employee Notification. Any employee found to have been exposed at any time in excess of the permissible exposure shall be notified in writing of the exposure as soon as practicable, but not later than five days after the finding. The employee shall also be timely notified in writing of the action being taken to reduce the exposure to not in excess of the permissible exposure.

(4) Employee Observation. Each employee or his representative shall be permitted to observe any monitoring or measuring of the exposure of that employee.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET

2-BUTANONE

I. SUBSTANCE IDENTIFICATION

Substance: 2-BUTANONE (Methyl Ethyl Ketone - MEK)

Permissible exposure: 200 parts of vapor per million parts of air (ppm) (0.02%).

Appearance and odor: You can generally smell 2-BUTANONE (MEK) at levels lower than the standard. 2-BUTANONE (MEK) is a colorless liquid with a fragrant, mintlike, moderately sharp odor.

II. HEALTH HAZARD DATA

COMMENTS: The health hazard of 2-BUTANONE (MEK) is low.

WAYS IN WHICH THE CHEMICAL AFFECTS YOUR BODY: 2-BUTANONE (MEK) can affect your body if you inhale it or if it comes in contact with the skin. 2-BUTANONE (MEK) may also affect your body if you happen to swallow it.

Effects of Overexposure:

A. Short-term (acute) overexposure: The vapors of 2-BUTANONE (MEK) may irritate your eyes, nose and throat, and may cause headache, dizziness, upset stomach and vomiting. At very high air levels this chemical vapor may cause unconsciousness in a short time.

B. Long-term (chronic) overexposure: Prolonged or repeated skin contact may cause dryness and irritation of your skin.

C. Reporting symptoms: You should inform your employer if you develop any of the symptoms associated with 2-BUTANONE (MEK).

III. EMERGENCY FIRST AID PROCEDURES

EYE AND FACE EXPOSURE: If you get 2-BUTANONE (MEK) liquid or vapor in your eyes wash it out immediately with large amounts of water. Remove contact lenses, if worn. Call a doctor as soon as possible.

SKIN EXPOSURE: If 2-BUTANONE (MEK) is spilled on your clothing or skin, remove the contaminated clothing at once and wash skin with large amounts of water immediately. Wash contaminated clothing before you wear it again.

BREATHING: If you or any other person breathes in large amounts of 2-BUTANONE (MEK), get the exposed person to fresh air at once. Call a doctor as soon as possible.

SWALLOWING: If the person is not unconscious, and 2-BUTANONE (MEK) has been swallowed, you should try to make the person vomit immediately

by giving him large amounts (one pint or more) of warm salt solution (2 tablespoons of salt per pint of water) or if necessary, have the victim stick his finger down his throat. Call a doctor as soon as possible.

IV. PROTECTIVE CLOTHING AND EQUIPMENT

RESPIRATORS: Respirators can only be required for routine use if your employer is in the process of installing controls. You must wear respirators for non-routine activities or in emergencies if you are likely to be exposed to levels of 2-BUTANONE (MEK) above the permissible exposure. If respirators are worn, they must have a U.S. Bureau of Mines (BM) or National Institute for Occupational Safety and Health (NIOSH) approval label. If you can smell 2-BUTANONE (MEK) while wearing a respirator, the respirator is not working correctly. If you experience difficulty breathing while wearing a respirator, tell your employer.

PROTECTIVE CLOTHING: You must wear impervious protective clothing (such as boots, gloves, sleeves, aprons, etc.) over any part of your body that is exposed to 2-BUTANONE (MEK).

EYE AND FACE PROTECTION: You must wear splash proof safety goggles if it is possible that 2-BUTANONE (MEK) may get into your eyes. In addition, you should wear a face shield if your face gets splashed often with 2-BUTANONE (MEK) liquid.

V. PRECAUTIONS FOR SAFE USE, HANDLING, AND STORAGE

2-BUTANONE (MEK) is flammable. It should be stored in tightly closed containers in a cool, well-ventilated area. 2-BUTANONE (MEK) vapors may form explosive mixture in air. All sources of ignition must be controlled. Fire extinguishers, where provided, must be readily available and you should know where they are located and how to operate them. You should use non-sparking tools when opening or closing 2-BUTANONE (MEK) containers. You must ground or bond metal 2-BUTANONE (MEK) containers. Smoking is prohibited in areas where 2 BUTANONE (MEK) is used or stored. Ask your supervisor where this chemical is used in your work area and for any additional plant safety rules.

I have read the above, and it has been explained to me.

_____ _____

Employee's Signature Date

The above has been read and explained to the employee.

_____ _____

Supervisor's Signature Date

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SUBSTANCE TECHNICAL GUIDELINES

2-BUTANONE (MEK)

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Methyl Ethyl Ketone (MEK), Ethyl Methyl Ketone 2. Formula: $CH_3COCH_2CH_3$

B. Physical Data

1. Boiling Point (760 mm hg): 79.6 C (175 F)
2. Specific Gravity (H_2O = 1): 0.806
3. Vapor Density (air = 1): 2.5
4. Melting Point: -86.3 C (-122.8 F)
5. Vapor Pressure @ 20 C (68 F): 70 mm hg
6. Solubility in Water, % by weight @ 20 C (68 F): 27.1 (moderate)
7. Evaporation Rate (Butyl Acetate = 1): 5.7
8. Appearance and Odor: clear and colorless liquid with fragrant, mintlike, moderately sharp odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash Point: -6.1 C (21 F) (closed cup)
2. Autoignition Temperature: 515.5 C (959 F)
3. Flammable Limits in Air, % by volume: Lower 2% upper: 10%
4. Extinguishing media: carbon dioxide or dry chemical for small fires; alcohol foam for large fires.
5. Special Fire-fighting Procedures: Do not use solid stream of water; stream will scatter and spread fire.
6. Unusual Fire and Explosion Hazards: 2-BUTANONE is a flammable liquid. Its vapors can form explosive mixtures over a fairly wide range of concentrations. It also is quite volatile and the vapor, which is heavier than air, may accumulate in low spots or travel along the ground and be ignited by open flames or sparks at locations remote from the handling site.
7. MEK is classified as a I-B flammable liquid. For the purpose of conforming to the requirements of 29 CFR 1910.106, A concentration exceeding 5,000 ppm is considered a potential fire or explosion hazard. Locations where 2-BUTANONE may be present are Class I Group D for the purposes of conforming to the requirement of 29 CFR 1910.309.

B. Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibility: very strong oxidizing agents.
3. Hazardous decomposition products: toxic gases and vapors (such as carbon monoxide and formaldehyde)

III. SPILL OR LEAK PROCEDURES

A. Steps to be taken if the material is released or spilled: Large amounts of water spray should be used to flush the spills. Do not flush 2-BUTANONE into a confined space, such as a sewer, because of the explosion danger. Remove all ignition sources. Ventilate enclosed spaces.

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

C. Waste Disposal Method: Disposal methods must conform to other jurisdictional regulations. If allowed, 2-BUTANONE may be disposed of: (a) by absorbing it in dry sand or earth and disposing in a sanitary land fill; (b) if small quantities, by removing it to a safe location away from buildings or other combustibles, pouring it on dry sand or earth and cautiously igniting it; (c) if large quantities, by atomizing into a suitable combustion chamber.

IV. MONITORING AND MEASUREMENT PROCEDURES

A. Normal Monitoring Program: Measurements taken for the purpose of determining employee exposure under this section are best taken in a fashion such that the average 8-hour exposure may be determined from a single sample or two (2) 4-hour samples. Short time 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 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 detector tubes certified by NIOSH under 42 CFR 84, portable direct-reading instruments, gas and vapor adsorption tubes with subsequent chemical analyses, dosimeters or with continuous monitoring systems that can sample and analyze those areas most likely to represent the highest airborne concentrations of 2-BUTANONE where employees are exposed. The analytical method must determine the concentration of 2-BUTANONE to plus or minus 35%.

B. Increased Monitoring Program: The monitoring under this section should be essentially the same as described above, except that portable direct-reading instruments should be NIOSH-certified and should receive regular maintenance and calibration. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The analytical method must determine the concentration of 2-BUTANONE to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

A. High exposures to 2-BUTANONE can occur when transferring the liquid from one container to another. Such operations should be well ventilated and good work practices should be established to avoid spills.

B. Non-sparking tools should be used to open containers which should then effectively be grounded and bonded prior to pouring.

C. Employer should advise employees of all plant areas and operations in which high exposures to 2-BUTANONE could occur. A few of the more common uses are as a solvent for plastics, gums, resins, lacquers, varnishes, and waxes. It is also used in the manufacture of pharmaceuticals, cosmetics, and synthetic rubber.

REFERENCES AND SOURCES
2-BUTANONE
1910.93

(f) Personal Protective Equipment, and (h) Sanitation

Eye: Grant, "Toxicology of the Eye;" Patty, "Industrial Hygiene and Toxicology;" Carpenter and Smyth, "Chemical Burns of the Rabbit Cornea," Am. J. Ophth., 29, 1363-72 (1946)

Skin; Fairhall, "Industrial Toxicology;" Deichmann and Gerarde, "Toxicology of Drugs and Chemicals;" Patty, "Industrial Hygiene and Toxicology;" "2-Butanone" Shell Chemical Corporation

Ingestion: Deichmann and Gerarde, "Toxicology of Drugs and Chemicals;" Patty, "Industrial Hygiene and Toxicology;" Henson, Edward, "Toxicology of Some Aliphatic Ketones," J. of Occ. Med. vol. 1, pg.607 (Nov. 1959)

COMMENTS

Eye - Classification: 2
Output statement number: 10
Exceptions: None

Grant states that "testing of liquid butanone on rabbit eyes indicated moderate reversible injuriousness graded 5 on a scale of 10 after 24 hours." According to Carpenter and Smyth, grade 5 indicates that 0.005 ml undiluted causes less than severe injury while 0.02 ml causes severe injury after 24 hours. Grant continues "the effect of a splash in the eyes should be similar to that of In a previous article, Grant notes "a splash of liquid acetone in the human eye commonly causes an immediate stinging sensation . and injury to the epithelium, characterized by the presence of micorscopic gray dots of foreign body sensation." He adds, "several drops (Of acetone) squirted in the eyes of anesthetized rabbits and washed out two minutes later with water caused temporary edema and irregularities of the corneal epithelium and grayness of the Patty reports, "butanone has a greater capacity to cause edema of the cornea than acetone."

Since any injury caused, as concluded by Grant, is reversible and moderate in nature, the substance is assigned a classification of 2.

Skin - Classification: 2
Output statement numbers: 2,21,7b,16i
Exceptions: None

Fairhall reports that "disabling skin dermatoses may develop in sensitive individuals exposed to this material." Deichmann and Gerarde state "prolonged or repeated contact of butanone with the skin will cause defatting, dehydration and dermatosis." This leaves the skin dry and chapped and renders it more susceptible to infection. Patty notes, "moderate skin irritation has been observed as the result of a 24 hour exposure of rabbits in which butanone was confined to the skin." He continues, "minor skin contacts in humans have been shown to cause no evidence of irritation." The Shell Chemical Corp. reports "although absorption of butanone through the skin may occur, it has been

shown that it is low in toxicity by this route, the LD50 being greater than 8 ml/kg for rabbits." Deichmann and Gerarde list a rabbit skin penetration LD50 of greater than 10 ml/kg. T substance has a vapor pressure of 70 mm Hg at 20 degrees C. It is 27.1% soluble in water and has a flash point of 21 degrees F.

Since "minor skin contacts in humans have been shown to cau evidence of irritation," a classification of 2 is appropriate to prevent repeated or prolonged contact which may result in dermat or the possibility of excessive skin absorption. Statement 20a not felt necessary, given the minor effects of contact and the c derable vapor pressure of the substance.

Ingestion - Classification: 0
Output statement numbers: None
Exceptions: None

Henson gives an oral rat LD50 of 3.98 g/kg. Deichmann and Gerarde state, "pharmacologically butanone is a central nervous system depressant and large doses may cause transient liver and kidney injury." They list an oral rat LD50 of 6.86 g/kg. Patty gives a rat single oral dose toxicity of 3.3 g/kg.

The information given above clearly indicates that 2-butanone is at most moderately toxic by ingestion. Since it also has a considerable vapor pressure, it is concluded that unintentional ingestion in the context of this standard would not be a problem in the industrial environment.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: 2-Butanone
D. O. L. STANDARD: 200 ppm
WARNING PROPERTIES:

Odor Threshold: Summer and Staub report odor thresholds for 2-butanone of 25 ppm and 4.8 respectively. Patty reports an odor threshold less than 25 ppm.

Irritation Levels: The Documentation of TLV's states that "Nelson et a reported slight nose and throat irritation at 100 ppm, and mild i irritation in some subjects at 200 ppm."

Evaluation of Warning Properties: Through its odor and irritant effect 2-butanone can be detected at the permissible exposure limit. For the purposes of this standard, therefore, 2-butanone is trea as a material with adequate warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 3000 ppm

Basis for IDLH Value: Patty states that "Smyth has reported that a 2-hour exposure of rats to 2000 ppm caused no deaths. Four of 6 rats exposed to 4000 ppm for a 2-hour period died."

Other Toxicological Information: Patty reports that "the toxicity of methyl ethyl ketone (2-butanone) when inhaled has been determine on both rats and guinea pigs. Patty and co-workers have reporte that a 10 per cent concentration (100,000 ppm) in air caused no deaths of guinea pigs exposed for a few minutes. An exposure of 1 hour to a 1 per cent concentration (10,000 ppm) was without serious disturbance. At this level, irritation of the eyes and nose occurred soon after the start of the exposure and narcosis

was observed in 4 to 5 hours. Smyth has reported that a 2-hour exposure of rats to 2000 ppm caused no deaths. Four of 6 rats exposed to 4000 ppm for a 2-hour period died."

Deichmann and Gerarde report that an 8-hour exposure to 8000 ppm 2-butanone killed 3 out of 6 rats within 14 days.

LFL: 18,000 ppm
VAPOR PRESSURE AT 20 C: 70 mm Hg
SATURATED CONCENTRATION AT 20 C: 92,110 ppm

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for 2-BUTANONE

USE/EXPOSURE AND CONTROL DOCUMENT
2-BUTANONE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Release of vapor during spray application of vinyl and acrylic coatings on or inside tanks, etc.	A	Local exhaust ventilatio respiratory protective equipment
2.	Release of vapor during surface spreading of nitrocellulose and vinyl resins on coated fabric process	A	Local exhaust ventilatio
3.	Release of vapor during surface coating operations in dip tanks	A	Local exhaust ventilatio
4.	Release of vapor and skin contact during application of adhesives for artificial leather, etc.	A,B	Dilution gentilation and of gloves or barrier cre
5.	Release of vapor during mixing, batching, and packaging of surface coating preparations	A	Local exhaust ventilatio
6.	Release of vapor during force drying of thermosetting furniture and other finishes	A	Local exhaust ventilatio
7.	Release of vapor during preparatory formulations of lacquers	A	Local exhaust ventilatio
8.	Skin contact during sponge or brush applications of solvent for cleaning operations	B	Personal protective equi
9.	Release of vapor during petroleum dewaxing operations	A	Local exhaust ventilatio
10.	Release of vapor and skin contact during mixing of dye solutions	A,B	Local exhaust ventilatio personal protective equi
11.	Skin contact with solvent during mixing preparation of water-proofing compounds	B	Personal protective equi

12.	Release of vapor during dewaxing of textile woolens	A	Local exhaust ventilatio
13.	Release of vapor during application as a chemical intermediate	A	Local exhaust ventilatio
14.	Release of vapor and skin contact during laboratory work	A,B	Local exhaust ventilatio and personal protective equipment

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

------ JES2 JOB STATISTICS ------

963 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

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*** JES2 NJE *A*     FWMMITS  OSH     JOB 1673    END    PRINTER8   MITS-PERIF-0205     2.11.49
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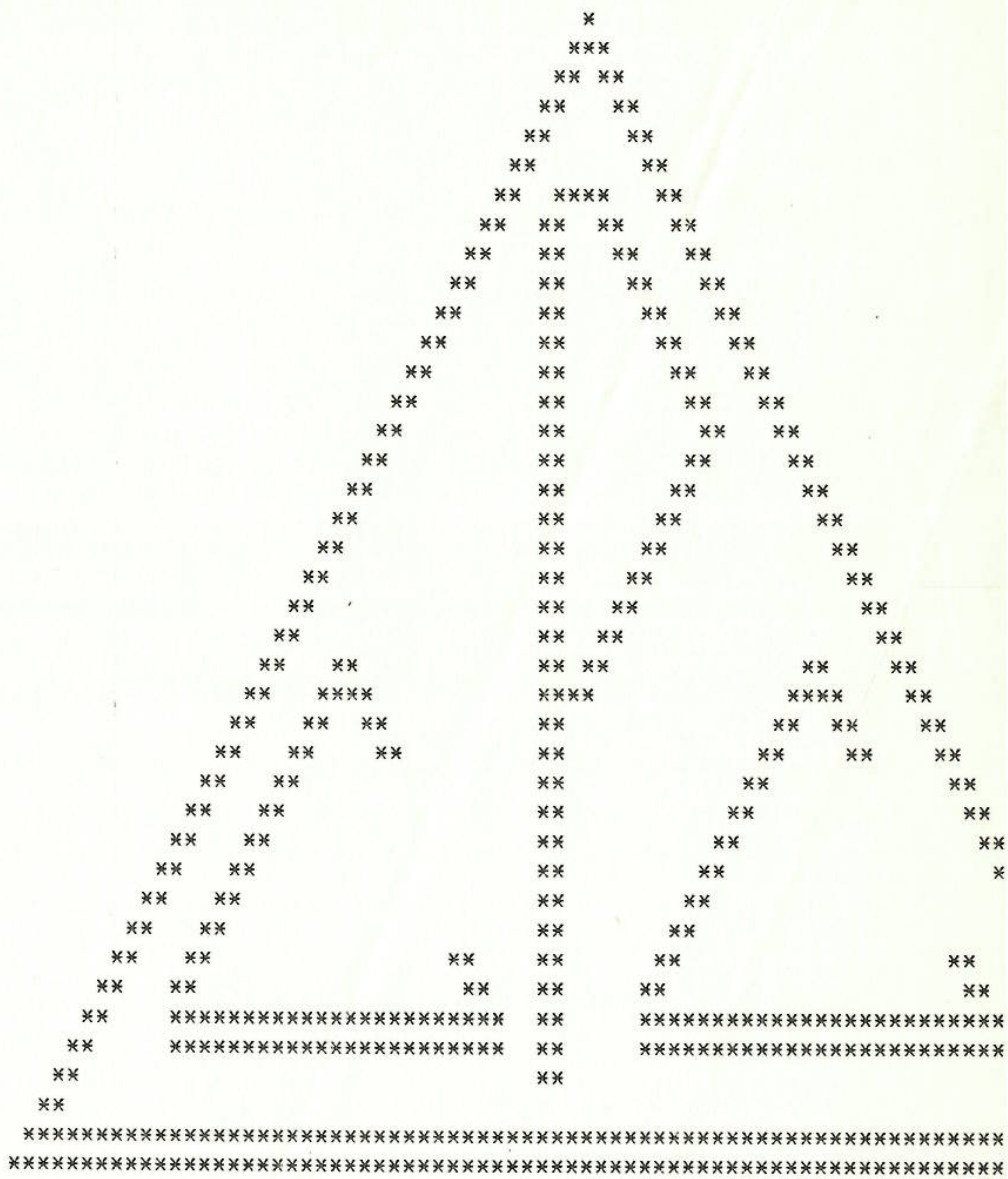

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