

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR ACETYLSALICYLIC ACID

INTRODUCTION

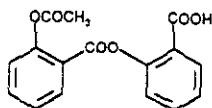
This guideline summarizes pertinent information about acetylsalicylic acid for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether new information is available.

SUBSTANCE IDENTIFICATION

• Formula



• Structure



• Synonyms

Aspirin, ASA, acetol, salicylic acid acetate, 2-acetoxybenzoic acid, acetophen, acetosalic acid, acetal, acetylin, acetylsal, acidum acetylsalicylicum, Asagran, Aspidrops, Entericin, Caprin, Colfarit, Duramax, Empirin, Measurin, Novid, Rhodine, Saletin, Solpyron

• Identifiers

1. CAS No.: 50-78-2
2. RTECS No.: V00700000
3. DOT UN: None
4. DOT label: None

• Appearance and odor

Acetylsalicylic acid is a noncombustible, crystalline, colorless to white powder. This substance is odorless; on contact with moisture, it develops the vinegarlike odor of acetic acid.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 180.2
2. Boiling point (at 760 mm Hg): 140°C (284°F) (decomposes)
3. Specific gravity (water = 1): 1.4 at 20°C (68°F)
4. Vapor density: Not applicable
5. Melting point: 135°C (275°F)
6. Vapor pressure at 20°C (68°F): Negligible
7. Solubility: Soluble in water, alcohol, chloroform, and ether; less soluble in absolute ether
8. Evaporation rate: Not applicable

• Reactivity

1. Conditions contributing to instability: None
2. Incompatibilities: Fires or explosions may result from contact of acetylsalicylic acid with strong oxidizers. Contact with alkali hydroxides or carbonates may cause decomposition.
3. Hazardous decomposition products: When heated to decomposition, toxic vapors and gases (such as partially oxidized hydrocarbons, carbon monoxide, and carbon dioxide) may be released.
4. Special precautions: None

• Flammability

The National Fire Protection Association has not assigned a flammability rating to acetylsalicylic acid; this substance is not combustible.

1. Flash point: Not applicable
2. Autoignition temperature: Not applicable
3. Flammable limits in air: Not applicable

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health
Division of Standards Development and Technology Transfer

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

4. **Extinguishant:** Acetylsalicylic acid will not burn. Use an extinguishant that is suitable for the materials involved in the surrounding fire.

Dispersed in air, the dust of acetylsalicylic acid is a serious explosion hazard. Firefighters should wear a full set of protective clothing (including a self-contained breathing apparatus) when fighting fires resulting from acetylsalicylic acid explosions.

EXPOSURE LIMITS

• OSHA PEL

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for acetylsalicylic acid is 5 mg/m³ of air as an 8-hr time-weighted average (TWA) concentration [29 CFR 1910.1000, Table Z-1-A].

• NIOSH REL

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) for acetylsalicylic acid of 5 mg/m³ as an 8-hr TWA [NIOSH 1992].

• ACGIH TLV®

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned acetylsalicylic acid a threshold limit value (TLV) of 5 mg/m³ as a TWA for a normal 8-hr workday and a 40-hr workweek [ACGIH 1991b].

• Rationale for limits

The limits are based on the risk of respiratory and gastric irritation associated with exposure to acetylsalicylic acid.

HEALTH HAZARD INFORMATION

• Routes of exposure

Exposure to acetylsalicylic acid can occur through inhalation, ingestion, and eye or skin contact.

• Summary of toxicology

1. **Effects on Animals:** Acetylsalicylic acid can damage the stomach lining and interfere with blood clotting; it is also fetotoxic and teratogenic in animals [Klaassen et al. 1986; NIOSH 1991]. Cats were orally administered total daily doses of either 33 to 63 mg/kg or 81 to 130 mg/kg for up to 35 days. The lowest dose induced toxic hepatitis in the treated animals, but both doses induced anorexia, weight loss, vomiting, depression, and death. Only animals receiving the high doses had hyperpnea (increased rate and depth of breathing), hyperthermia, and disturbances in their acid-base balance [NLM 1991]. Dogs administered oral daily doses of 100 to 300 mg/kg for 1 to 4 weeks vomited bloody emesis and had gastritis and gastric perforations [NLM 1991]. The oral LD₅₀ in rats ranges from 1,360 to 1,750 mg/kg

[NLM 1991]. Acetylsalicylic acid has been shown to be a developmental toxin in five species of animals; this substance also causes reproductive effects in both males and females [NIOSH 1991]. Teratogenic effects occurred when 125 mg/kg acetylsalicylic acid was administered orally to rats on day 12 of pregnancy; damage to the testes, epididymis, and sperm duct was observed in male rats dosed orally with 2.1 g/kg acetylsalicylic acid for 14 days [NIOSH 1991]. When administered orally or subcutaneously to pregnant rats, mice, rabbits, cats, and dogs, acetylsalicylic acid was fetotoxic or teratogenic [NIOSH 1991]. Chronic administration of a 300-mg/kg dose of acetylsalicylic acid inhibited ovulation in rats by depressing prostaglandin synthesis [NLM 1991].

2. **Effects on Humans:** In the occupational environment, acetylsalicylic acid is a systemic allergen and an irritant of the eyes, mucous membranes, upper respiratory tract, and skin. When in contact with the eyes, this substance causes irritation, conjunctival ulceration, and corneal injury [ACGIH 1991a; Grant 1986]. Aspirin-intolerant individuals develop hives, rhinorrhea, and bronchospasm when exposed to this substance; some persons (e.g., those who are glucose-6-phosphate dehydrogenase deficient) may be especially sensitive to aspirin's effects [Klaassen et al. 1986; Gosselin et al. 1984]. Ingestion of acetylsalicylic acid causes an increased tendency to bleed by interfering with platelet aggregation; this effect has been seen after the ingestion of as little as 150 mg of acetylsalicylic acid [ACGIH 1991a]. Acetylsalicylic acid produces an allergy-like response in about 0.2% of individuals; although aspirin intolerance mimics a true allergic response, this reaction is not believed to be immunologically based [Klaassen et al. 1986].

• Signs and symptoms of exposure

1. **Acute exposure:** Acute exposure to acetylsalicylic acid can cause redness and tearing of the eyes, runny nose, scratchy throat, and redness and swelling of the skin.

2. **Chronic exposure:** Chronic exposure to acetylsalicylic acid can cause headache, dizziness, and ringing in the ears; in aspirin-intolerant individuals, it can induce pseudoallergic responses (hives, runny nose, wheezing, and difficult breathing) and a permanent intolerance to this substance. Ingestion of aspirin may lead to an increase in clotting time.

• Emergency procedures

Keep unconscious victims warm and on their sides to avoid choking if vomiting occurs. Initiate the following emergency procedures:

1. *Eye exposure*: Irritation may result! *Immediately* flush the eyes with large amounts of water, occasionally lifting the upper and lower eyelids.
2. *Skin exposure*: Irritation may result. Wash contaminated skin with soap and water.
3. *Inhalation exposure*: If a large amount of acetylsalicylic acid is inhaled, move the victim to fresh air *immediately*.

If the victim is not breathing, clean any chemical contamination from the victim's lips and perform cardiopulmonary resuscitation (CPR); if breathing is difficult, give oxygen.

4. *Ingestion exposure*: Take the following steps if a large amount of acetylsalicylic acid is ingested:

—Have the victim rinse the contaminated mouth cavity several times with a fluid such as water.

—Have the victim drink a glass (8 oz) of fluid such as water.

—Induce vomiting by giving syrup of ipecac as directed on the package. If ipecac is unavailable, have the victim touch the back of the throat with a finger until productive vomiting ceases.

—Do *not* force an unconscious or convulsing person to drink fluid or to vomit.

5. *Rescue*: Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the material safety data sheet required by OSHA's hazard communication standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures and the location and proper use of emergency equipment.

EXPOSURE SOURCES AND CONTROL METHODS

The manufacture, handling, and packaging of aspirin tablets or related pharmaceutical products may result in worker exposures to this substance.

The following methods are effective in controlling worker exposures to acetylsalicylic acid, depending on the feasibility of implementation:

- Process enclosure
- Local exhaust ventilation
- General dilution ventilation
- Personal protective equipment

Good sources of information about control methods are as follows:

1. ACGIH [1992]. *Industrial ventilation—a manual of recommended practice*. 21st ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
2. Burton DJ [1986]. *Industrial ventilation—a self study companion*. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
3. Alden JL, Kane JM [1982]. *Design of industrial ventilation systems*. New York, NY: Industrial Press, Inc.
4. Wadden RA, Scheff PA [1987]. *Engineering design for control of workplace hazards*. New York, NY: McGraw-Hill.
5. Plog BA [1988]. *Fundamentals of industrial hygiene*. Chicago, IL: National Safety Council.

MEDICAL MONITORING

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, placement of workers in jobs that do not jeopardize their safety or health, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical monitoring program is intended to supplement, not replace, such measures. To place workers effectively and to detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

• Placement medical evaluation

Before a worker is placed in a job with a potential for exposure to acetylsalicylic acid, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the eyes, skin, and upper respiratory tract. Medical monitoring for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society [ATS 1987].

A placement medical evaluation is recommended to assess an individual's suitability for employment at a specific

job and to detect and assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to acetylsalicylic acid at or below the prescribed exposure limit. The licensed health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with drug allergies or aspirin intolerance or of diseases of the eyes, skin, or upper respiratory system; individuals using anticoagulant medications may also be at increased risk.

- **Periodic medical examinations and biological monitoring**

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to acetylsalicylic acid exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of acetylsalicylic acid on the eyes, skin, or upper respiratory tract or on blood clotting time. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for acetylsalicylic acid.

- **Medical examinations recommended at the time of job transfer or termination**

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of job placement should be repeated at the time of job transfer or termination. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

WORKPLACE MONITORING AND MEASUREMENT

A worker's exposure to airborne acetylsalicylic acid is determined by using a 37-mm glass fiber filter. Samples are collected at a maximum flow rate of 1.0 liter/min until a maximum air volume of 120 liters is collected. Analysis is conducted by high-performance liquid chromatography

using an ultraviolet detector. This method is included in the OSHA Laboratory In-House Methods File [OSHA 1989].

PERSONAL HYGIENE

If acetylsalicylic acid contacts the skin, workers should immediately wash the affected areas with soap and water.

Clothing contaminated with acetylsalicylic acid should be removed immediately, and provisions should be made for safely removing this chemical from these articles.

A worker who handles acetylsalicylic acid should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, or using toilet facilities.

Workers should not eat, drink, or use tobacco products in areas where acetylsalicylic acid or a solution containing acetylsalicylic acid is handled, processed, or stored.

STORAGE

Acetylsalicylic acid should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's hazard communication standard [29 CFR 1910.1200]. Containers of acetylsalicylic acid should be protected from physical damage and should be stored separately from strong oxidizers, alkali hydroxides, carbonates, moisture, and heat. Because containers that formerly contained acetylsalicylic acid may still hold product residues, they should be handled appropriately.

SPILLS AND LEAKS

In the event of a spill or leak involving acetylsalicylic acid, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup is complete. The following steps should be undertaken following a spill or leak:

1. Collect spilled material in the most convenient and safe manner and place the material in a covered container for reclamation or later disposal in an approved facility.
2. Absorb liquid containing acetylsalicylic acid in vermiculite, dry sand, earth, or similar material.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

- **Emergency planning requirements**

Acetylsalicylic acid is not subject to EPA emergency planning requirements [40 CFR 355.30].

- **Reportable quantity requirements for hazardous releases**

Employers are not required by the emergency release notification provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [40 CFR 355.40] to notify the National Response Center of an accidental release of acetylsalicylic acid; there is no reportable quantity for this substance.

- **Community right-to-know requirements**

Employers are not required by Section 313 of SARA [42 USC 11022] to submit a Toxic Chemical Release Inventory Form (Form R) to EPA reporting the amount of acetylsalicylic acid emitted or released from their facility annually.

- **Hazardous waste management requirements**

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24. Although acetylsalicylic acid is not specifically listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.], EPA requires employers to treat waste as hazardous if it exhibits any of the characteristics discussed above.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (800) 424-9346 or (202) 382-3000 in Washington, D.C. In addition, relevant State and local authorities should be contacted for information about their requirements for the waste removal and disposal.

RESPIRATORY PROTECTION

- **Conditions for respirator use**

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of acetylsalicylic acid exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair

activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should use only respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

- **Respiratory protection program**

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's respiratory protection standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the *NIOSH Respirator Decision Logic* [1987b] and the *NIOSH Guide to Industrial Respiratory Protection* [1987a].

PERSONAL PROTECTIVE EQUIPMENT

Protective clothing should be worn to prevent prolonged or repeated skin contact with acetylsalicylic acid; protective gloves are recommended when handling this substance. Chemical protective clothing should be selected on the basis of available performance data, manufacturers' recommendations, and evaluation of the clothing under actual conditions of use. No reports have been published on the resistance of various protective clothing materials to acetylsalicylic acid permeation. If permeability data are not readily available, protective clothing manufacturers should be requested to provide information on the best chemical protective clothing for workers to wear when they are exposed to acetylsalicylic acid.

If acetylsalicylic acid is dissolved in water or an organic solvent, the permeation properties of both the solvent and the mixture must be considered when selecting personal protective equipment and clothing.

Safety glasses, goggles, or face shields should be worn during operations in which acetylsalicylic acid might contact the eyes (e.g., through dust particles). Eyewash fountains and emergency showers should be available within the immediate work area whenever the potential exists for eye or skin contact with acetylsalicylic acid. Contact lenses should not be worn if the potential exists for acetylsalicylic acid exposure.

REFERENCES CITED

- ACGIH [1991a]. Documentation of the threshold limit values and biological exposure indices. 6th ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
- ACGIH [1991b]. 1991-1992 Threshold limit values for chemical substances and physical agents. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
- ATS [1987]. Standardization of spirometry—1987 update. American Thoracic Society. *Am Rev Respir Dis* 136:1285-1296.
- CFR. Code of Federal regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register.
- Gosselin RE, Smith RP, Hodge HC [1984]. Clinical toxicology of commercial products. 5th ed. Baltimore, MD: Williams & Wilkins.
- Grant WM [1986]. Toxicology of the eye. 3rd ed. Springfield, IL: Charles C. Thomas.
- Klaassen CD, Amdur MO, Doull J [1986]. Casarett and Doull's toxicology. 3rd ed. New York, NY: Macmillan Publishing Company.
- NIOSH [1987a]. NIOSH guide to industrial respiratory protection. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 87-116.
- NIOSH [1987b]. Respirator decision logic. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 87-108.
- NIOSH [1991]. Registry of toxic effects of chemical substances database: acetylsalicylic acid. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Division of Standards Development and Technology Transfer, Technical Information Branch.
- NIOSH [1992]. NIOSH recommendations for occupational safety and health: compendium of policy documents and statements. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health.
- NLM [1991]. The hazardous substances data bank: acetylsalicylic acid. Bethesda, MD: National Library of Medicine.
- OSHA [1989]. OSHA laboratory in-house methods file. Salt Lake City, UT: U.S. Department of Labor, Occupational Safety and Health Administration, OSHA Analytical Laboratory.