

Understanding Material Safety Data Sheet Language¹

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Awareness of the importance of safety has increased in the pesticide and pest control industry over the past several decades. This awareness has grown in response to activities by the government and the public as well as the news media, including coverage of major chemical accidents. The Occupational Safety and Health Administration (OSHA) in 1989 expanded its Hazard Communication Standard to cover all employees who could potentially be exposed to hazardous chemicals in their work areas — regardless of the place of employment or the nature of the work. The Hazard Communication Standard requires that chemical manufacturers and importers thoroughly evaluate chemicals. Any chemical that is determined to be hazardous must have a material safety data sheet (MSDS) developed to communicate the hazard potential to users. Their purpose is to provide handlers of chemicals, including pesticides, with the proper procedures for handling and working with the chemical. People who are primary users of a MSDS would include employees who handle a certain material in their daily occupations, those who store chemicals at their place of business, and emergency response crews who need to understand procedures associated should an emergency happen to occur. The

MSDS is not designed for someone who may apply a lawn and garden pesticide once or twice a year. They are written in an occupational fashion for those who handle a material routinely.

A large amount of pesticide hazard information is generated in the course of fulfilling regulatory requirements for product registration. The Environmental Protection Agency requires more than 120 various tests, yielding primarily toxicological, environmental and physical property data, much of which can be used in the MSDS.

Chemical manufacturers are required by the Hazard Communication Standard to provide an MSDS to the purchaser of the product at the time of the first order and, thereafter, anytime the MSDS is significantly revised. In other words, a chain of supply begins with the manufacturer and funnels downward to dealers and eventually end buyers of their products. The MSDS may be included with the pallet on which the product is shipped, or it may be submitted electronically or delivered by mail. As the pesticides are further distributed to satellite suppliers, dealers, or users, a copy of the MSDS must accompany their original orders.

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There are several sources of MSDS. In a workplace, there should be a copy on file of the MSDS for each product that the business uses. Many land grant university Extension pesticide safety and education programs will have a website containing links to such documents, chemical distributors will have them and internet or software subscriptions may be purchased.

Although the MSDS is a necessary part of the Hazard Communication Standard, there is no specific format prescribed for the presentation of its contents. Therefore, MSDS's from various manufacturers may differ dramatically in organization and appearance yet still present the required data. To help bring order to the MSDS format, the American National Standards Institute has published a voluntary standard prescribing the division of MSDS data into 16 sections. The sequence and titles of the sections as specified in the standard would create consistency from manufacturer to manufacturer. For data sheets prepared in accordance with the standard, the 16 section titles and their order of appearance is the same from manufacturer to manufacturer, but the amount of information *within a given section* is left to the discretion of each individual manufacturer.

This publication presents the 16 sections of the MSDS with a brief interpretation of the section contents.

Note: The examples that follow were taken from numerous MSDS from various manufacturers; it is important to note that these examples do not represent an actual MSDS for any one product.

Section 1. Product and company identification.

MSDS contents (sample)	Explanation
Product name Acme Insecticide Concentrate	Product's brand name.
Manufacturer Acme Agrosiences P.O. Box 12345 9330 Chemical Way Indianapolis, IN	Company's identification and where to obtain information.
Telephone number for information (800) 123-4567	Non-emergency information regarding the product.
CHEMTREC (800) 424-9300	CHEMical TRAnsportation Emergency Center phone number for transportation emergencies.
EPA registration number 264-945	EPA assigns each registered product its own identity number.
Date prepared March 1, 2005	Date on which the MSDS was prepared.
Code number 000897	Identification number assigned by the manufacturer.
Chemical family Pyrethroid pesticide	A classification of pesticides.
MSDS number S000-10000	Specific product identification assigned by the manufacturer.

Section 2. Composition/information on ingredients.

MSDS contents (sample)	Explanation
Chemical ingredients Active ingredient propachlor, 2,3-diethyl — 20 percent Inert ingredient attapulgite — 80 percent	The active ingredient is responsible for controlling or repelling the pest. Inert ingredients can help make the product safer, more effective and easier to handle. Both the active and inert ingredients must be listed if they are known to contribute to the product's hazard potential unless they are a trade secret. Some manufacturers may also include the active ingredient's molecular formula and weight in this section.
CAS Reg. No propachlor 1919-16-7 attapulgite 8031-13-3	Active and inert ingredients are also identified by their Chemical Abstract Service (CAS) number. This service is a chemical substance listing clearinghouse that includes millions of chemical names.

Section 3. Hazards identification.

MSDS contents (sample)	Explanation
Emergency overview Brown liquid, aromatic odor. Causes substantial but temporary eye injury. Harmful if absorbed through skin.	This information is intended for emergency response personnel.
Potential health effects Acute eye: causes redness, irritation, tearing. Acute skin: nonirritating. Acute inhalation: may cause respiratory tract irritation. Acute ingestion: may cause loss of coordination, burns to mouth and esophagus.	Acute effects occur immediately upon exposure to the substance through the eyes, skin, by inhalation or ingestion.
Chronic effects This product contains ingredients that are considered to be probable or suspected human carcinogens (see Section 11 — Chronic).	Chronic effects are those due to long-term exposure to the substance.

Section 4. First aid measures.

MSDS contents (sample)	Explanation
Eyes Hold eyelids open and flush with a steady, gentle stream of water for at least 15 minutes. Seek immediate medical attention, preferably with an ophthalmologist.	What to do if the product gets into the eyes.
Skin exposure In case of contact, wash with plenty of soap and water. Seek medical attention if irritation develops or persists.	What to do if the product gets on the skin.
Inhalation Remove the victim from immediate source of exposure and assure that the victim is breathing. If breathing is difficult, administer oxygen, if available. If victim is not breathing, administer CPR (cardiopulmonary resuscitation). Seek medical attention.	What to do if the product is breathed into the lungs.
Ingestion If victim is conscious and alert, give 2 to 3 glasses of water to drink and do not induce vomiting. Seek immediate medical attention.	What to do if the product is swallowed.
Notes to physician All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred. Treat symptomatically. No specific antidote available. This material is an acid. The primary toxicity of this product is due to its irritant effects on mucous membranes.	Specific instructions to the physician, including what to administer, if anything. Users should be familiar with where this is found on the MSDS so that in an emergency, the information can be given to the physician quickly. Any treatment listed in this section should not be attempted by a non-medical person.

Section 5. Fire fighting measures.

MSDS contents (sample)	Explanation
Flash point 63 degrees C/145 degrees F	The minimum temperature at which a liquid gives off vapor in sufficient concentration to ignite near the surface of the liquid or in the test vessel used.
Lower explosive limit 2.6 percent Upper explosive limit 12.6 percent	The upper and lower explosive limits are concentrations in air that will produce a flash of fire when an ignition source is present.
Extinguishing media Recommended: foam, water, carbon dioxide, dry chemical.	Specific instructions to firefighters on how to extinguish a fire involving the chemical.
Personal protective equipment Wear self-contained breathing apparatus (pressure-demand MSHA/NIOSH approved or equivalent) and full protective gear.	Description of safety equipment that firefighters should use in case of fire involving the chemical.
Special procedures Contain runoff. Remain upwind. Avoid breathing smoke. Use water spray to cool containers exposed to fire.	Safety instructions to emergency personnel responding to the fire.
Unusual fire and explosion hazards Product will burn under fire conditions.	Additional safety information for emergency personnel.
Hazardous decomposition materials (under fire conditions) hydrogen chloride, oxides of carbon.	By-products formed due to fire that may pose a risk to emergency personnel and the environment.

Section 6. Accidental release measures.

MSDS contents (sample)	Explanation
Evacuation procedures and safety Wear appropriate protective gear for the situation. See personal protection information in Section 8.	Actions to take when dealing with a spill.
Containment of spill Stop leak if it can be done without risk. Dike spill using absorbent or impervious materials such as earth, sand or clay.	
Cleanup and disposal of spill Absorb with vermiculite or other inert absorbent. Shovel up into an appropriate closed container (see Section 7: Handling and Storage). Decontaminate tools and equipment following cleanup.	
Environmental and regulatory reporting If spilled on the ground, the affected area should be removed to a depth of 1 to 2 inches and placed in an appropriate container for disposal. Prevent material from entering public sewer system or any waterways. Spills may be reported to the National Response Center (800-424-8802) and to state and/or local agencies.	

Section 7. Handling and Storage.

MSDS contents (sample)	Explanation
Minimum/maximum storage temperatures 0 to 50 degrees C (32 to 122 degrees F)	Temperature range for storing the product in order to prevent chemical separation, inactivation, crystallization, coagulation or other breakdown.
Handling Do not breathe vapors and mists. Do not get on skin or in eyes. Do not ingest. Use handling, storage and disposal procedures that will prevent contamination of water, food or feed. Avoid freezing. If freezing occurs, thaw and remix before using.	Procedures to minimize the risks of accidental exposure or release of the product.
Storage Store in an area that is away from ignition sources.	Procedures that minimize potential storage hazards.

Section 8. Exposure controls/personal protection.

MSDS contents (sample)	Explanation
Ingestion Prevent eating, drinking, tobacco usage and cosmetic application in areas where there is a potential for exposure to the material. Always wash thoroughly after handling.	Protective measures to reduce the likelihood of swallowing.
Eye contact To avoid eye contact, wear safety glasses with side shields or chemical goggles.	Protective measures to reduce the likelihood of the pesticide getting in the eyes.
Skin contact To avoid skin contact, wear rubber gloves, rubber boots, long-sleeved shirt, long pants and a head covering.	Protective measures to reduce the possibility of getting the pesticide on the skin.
Respiratory protection To avoid breathing dust, use a particulate filter, NIOSH-approved per 42 CFR Part 84. Select N or R or P type as appropriate for the oil characteristics of any other air contaminants present. Filter efficiency may range from 95 percent to 99.7 percent as appropriate for the size distribution of dusts present.	The type of respirator, if any, needed when handling this product.
Engineering controls If needed, use local exhaust to keep exposures to a minimum.	Procedures used to maintain airborne levels below TLV (Threshold Limit Value) or PEL (Permissible Exposure Limit).
Exposure guidelines BenomyI: PEL (OSHA): 15 mg/m ³ , total dust, 8 hr. TLV (ACGIH): 0.84 ppm, 10 mg/m ³ , 8 hr.	PEL and TLV identify the concentration of chemical in the air, below which workers would not be expected to experience health problems during a 40-hour work week.

Section 9. Physical and chemical properties.

MSDS contents (sample)	Explanation
Color Yellow liquid.	Describes the physical appearance of the chemical.
Odor characteristic Kerosene odor.	Describes the product odor for detection purposes.
pH 4.1 Aqueous solution.	pH values ranging from 0 to 2 and from 12 to 14 are usually corrosive to skin and eyes. This also indicates that it may be helpful to neutralizing a chemical spill.
Specific gravity (Water = 1) 0.95	The weight of the chemical compared to the weight of an equal volume of water.
Vapor density (Air = 1) 4.8	Weight of the chemical's vapor compared to air. Vapors with weight values less than 1 rise. Those with weight values greater than 1 sink and concentrate.
Vapor pressure 3 mm Hg @ 25 degrees C/77 degrees F	Measurement of the potential of the chemical to convert to a gaseous form.
Boiling point 176 degrees C (349 degrees F)	Temperature at which a liquid becomes a vapor.
Solubility in water 0.1 ppm	A measurement of the amount of material that will dissolve in water. Materials with a value of 100 ppm and less are considered to be relatively insoluble, while those with values greater than 1,000 ppm are considered very soluble.

Section 10. Stability and reactivity.

MSDS contents (sample)	Explanation
Chemical stability Stable at normal temperatures and storage conditions.	Usually general terms to describe the chemical's stability. At times, temperatures will be listed at which the chemical becomes unstable.
Hazardous polymerization Will not occur.	This is a statement that states if the product will react dangerously with itself to form other products.
Conditions to avoid Avoid freezing temperatures.	Describes conditions under which the product or its container may become damaged or cause a hazardous condition.
Chemical incompatibility Oxidizing agents.	Describes other materials which may react with the product.
Hazardous decomposition products HCl, HF, NO ₂ during combustion.	A list of by-products that are formed when the product burns or is subjected to other conditions.

Section 11. Toxicological information.

MSDS contents (sample)	Explanation
Acute Data	
Eye irritation Rabbit: substantial irritation.	Consequences of short-term exposure to eyes.
Skin irritation Rabbit: severe irritation.	Consequences of short-term exposure to skin.
Oral LD₅₀ Rat: 3600 mg/kg	Toxicity of short-term exposure from ingestion. The LD ₅₀ is the dose level that is expected to cause the death of 50 percent of the test animals.
Dermal LD₅₀ Rabbit: >5000 mg/kg	Toxicity by absorption through the skin.
Inhalation LC₅₀ Rabbit: 11 mg/L for 4 hr	Toxicity from breathing dusts, fumes or vapors. The LC ₅₀ is the concentration of dust, fume or mist that is expected to kill 50 percent of the test animals.
Skin sensitization Guinea pig: sensitizing.	An allergic reaction on tissue after repeated exposure.
Chronic Data	
Chronic toxicity studies Liver (alteration and enlargement) and thyroid effects (hormone imbalances) at high dose levels (rats); decreased body weight gains.	Adverse health effects resulting from long-term exposure to a chemical or long-term effect from short exposures.
Mutagenicity data This product does not pose a mutagenic hazard.	Effects of exposure to a substance that may change the genetic material in a living cell.
Reproductive/teratology data No birth defects were noted in rats and rabbits given dithiopyr technical orally during pregnancy. No effects were seen on the ability of male or female rats to reproduce when fed dithiopyr technical for two successive generations.	Effects of exposure that may affect the ability to reproduce viable offspring or cause birth defects.
Carcinogenicity data Benign thyroid tumors (species-specific). The U.S. EPA lists prodiamine as a possible human carcinogen based on limited evidence from animal studies.	The ability of a substance to cause cancer.

Section 12. Ecological information.

MSDS contents (sample)	Explanation
Eco-acute toxicity Bluegill sunfish, 96-hour LC ₅₀ : 0.47 mg/l Rainbow trout, 96-hour LC ₅₀ : 0.46 mg/l Daphnia magna, 48-hour LC ₅₀ : 5.2 mg/l Bobwhite quail, 5-day dietary LC ₅₀ : >5620 ppm Mallard duck, 5-day dietary LC ₅₀ : >5620 ppm Bobwhite quail, Acute oral LC ₅₀ : >2250 mg/kg Honeybee, LD ₅₀ : 81 g/bee	This section describes indicator species that were used in toxicity testing and values.

Section 12. Ecological information.

MSDS contents (sample)	Explanation
Environmental fate Photolysis: Unstable, half-life less than 1 hour. Hydrolysis: Stable soil half-life: 2 months.	The breakdown processes of a chemical when exposed to various environmental elements. Photolysis: Exposure to sunlight. Hydrolysis: Exposure to water.

Section 13. Disposal considerations.

MSDS contents (sample)	Explanation
Procedures For disposal, incinerate this material at a facility that complies with local, state and federal regulations.	Directions and limitations for disposal of the material.

Section 14. Transportation information.

MSDS contents (sample)	Explanation
Proper shipping name Organophosphorous pesticide, liquid, toxic, flammable (Methyl parathion, Aromatic solvent naphtha).	The official shipping name and description that should appear on U.S. Department of Transportation (DOT) shipping papers.
Primary hazard class Class 6.1.	DOT recognizes 9 classes of hazardous materials. Typically, the lower the number, the more hazardous the material.
Identification No. UN 3082	The number assigned for identification by the United Nations (UN) convention.
Special information Marine pollutant.	Special provisions for a particular hazardous material.
Packing group II.	Specifies one or more packing groups for the material based on the hazard of great (I), medium (II), or minor (III) significance. May assist in selecting the proper packaging materials and labels.

Section 15. Regulatory information.

MSDS contents (sample)	Explanation
Workplace classification This product is considered hazardous under the OSHA Hazard Communication Standard (29 CFR 1910.1200).	The Occupational Safety and Health Administration's interpretation of the product's hazard to workers.
SARA Title 3 Section 311/312 Categorizations (40 CFR 372): This product is a hazardous chemical under 29 CFR 1910.1200, and is categorized as an immediate and delayed health, and flammability physical hazard.	Superfund Amendment and Reauthorization Act (SARA) category. SARA requires reporting any spill of any hazardous substance.
TSCA status Exempt from TSCA.	Toxic Substances Control Act statement regarding its regulation. This law covers the production and distribution of commercial and industrial chemicals in the United States.

Section 15. Regulatory information.

MSDS contents (sample)	Explanation
RCRA classification Reactive	Resource Conservation and Recovery Act's classification. RCRA regulates hazardous waste generators and transporters.
CERCLA reportable quantity This material contains no hazardous or extremely hazardous substances as defined by CERCLA.	Comprehensive Environmental Response, Compensation and Liability Act's classification. CERCLA provides EPA authority to respond to releases of hazardous substances.

Section 16. Other information.

MSDS contents (sample)	Explanation
National Fire Protection Association (NFPA) ratings Health = 2; Flammability = 1; Reactivity = 0.	NFPA's scale: 0 = least; 1 = slight; 2 = moderate; 3 = high; 4 = extreme. Classification and properties of hazardous chemical data.
Issue date 1/2/92	Original MSDS publishing date.
Revised date 2/28/2005	Date that MSDS was amended.
Supersedes 2/3/99	Date of previous MSDS.
Responsibility for MSDS Acme Agrosiences	Manufacturer.
Address P.O. Box 12345 9330 Chemical Causeway Indianapolis, IN 12345	Location of manufacturer.
Telephone 800-555-1234	Manufacturer's telephone. Manufacturers generally man this line 24 hours per day.