

N-Methylpyrrolidone (NMP)

N-Methylpyrrolidone (NMP) harms the developing fetus when tested in pregnant animals. It is toxic to the reproductive system of male and female test animals. The reproductive effects of NMP in humans have not been studied. Based on the animal tests, you should treat NMP as a potential human reproductive hazard. Overexposure to NMP irritates the eyes, skin, nose, and throat. It can also affect the central nervous system or brain causing symptoms of drunkenness similar to the effects of drinking alcohol. NMP is easily absorbed through the skin. It is widely used to replace methylene chloride and other chlorinated solvents that harm the environment and health. HESIS is issuing this Health Hazard Advisory to inform workers and employers of the potential health hazards of NMP and how to protect against them. NMP is not regulated to protect workers.

Health

Hazard

Advisory

How to find out if you are working with NMP

NMP is a solvent. It is used for many different purposes. Some of these include stripping paint, cleaning in the electronics industry and other industries, removing graffiti, and making a variety of chemicals and products.

Your employer must tell you if you are working with NMP, and must train you to use it safely, under California's Hazard Communication Standard and Injury and Illness Prevention Program (see page 4). If you think you may be exposed to NMP on the job, ask to see the Material Safety Data Sheets (MSDSs) for the products you are using. The MSDS for a product that contains NMP is required to identify it in Section 2, by the Chemical Abstract Service (CAS) number 872-50-4. Some MSDSs do not fully describe the hazards of the product.

How NMP enters your body

NMP enters your body when it touches your skin, and when you breathe its vapors or droplets of spray in the air.

Your risk of health effects depends on the amount of NMP that enters your body. That depends mainly on the amount (the concentration) of NMP you breathe, how much touches your skin, and how long you are exposed to NMP.

How NMP can affect your health

The toxic effects of NMP in humans have not been well studied. Most of the information comes from animal testing, not from human use of NMP. Animal tests are often used to determine effects of chemicals on human health.

HEALTH HAZARD
ADVISORY



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California Department of Health Services • California Department of Industrial Relations

REPRODUCTIVE SYSTEM

NMP caused delayed growth in the offspring of animals exposed during pregnancy in several studies. Some of these effects were seen at exposure levels as low as 116 parts per million (116 “ppm”) of NMP in the air. NMP caused reduced fertility in male rats and increased the time for female rats to become pregnant.

The effects of NMP on reproduction have not been studied in humans. In one report, a worker’s exposure to NMP during the first trimester of pregnancy was linked to abnormal growth of the fetus (intrauterine growth retardation) and stillbirth.

NERVOUS SYSTEM

NMP, like other organic solvents, can affect your brain. Breathing excessive amounts for a short period of time causes headache, nausea, dizziness, clumsiness, drowsiness and other effects like those of being drunk. Drinking alcohol within a few hours of exposure increases these effects and makes them last longer, because the effects of alcohol and solvents add together. The symptoms of short-term exposure usually clear up within hours after exposure stops.

Repeated, frequent overexposure to NMP and other solvents over months or years can have long-lasting and possibly permanent effects on the nervous system. The symptoms of these long-term effects include fatigue, sleeplessness, poor coordination, difficulty in concentrating, loss of short-term memory, and personality changes such as depression, anxiety, and irritability.

EYES, NOSE, THROAT, AND SKIN

NMP is irritating to the eyes, nose, and throat. It is quickly absorbed into your body through your skin. NMP also dissolves the natural protective oils on your skin and can cause dermatitis (dry, rough, red, cracked skin).

LIVER AND KIDNEYS

NMP is unlikely to cause liver or kidney damage if there is no noticeable effect on the nervous system. However, like other solvents, long-term exposure to NMP and drinking alcohol can increase your risk of liver damage.

CANCER

NMP did not cause cancer when tested in animals. It also did not cause genetic mutations in several tests.



HOW TO REDUCE YOUR EXPOSURE

Even though there is no Permissible Exposure Limit (PEL) for NMP (see page 4), California Division of Occupational Safety and Health (Cal/OSHA)'s Title 8, Section 5141 requires your employer to protect you from being exposed to chemicals at levels that harm your health. See www.dir.ca.gov/title8/5141.html.

Cal/OSHA and the Cal/OSHA Consultation Service can help you and your employer – see “Where to Get Help” on the last page.

- ▶ **Substitution.** The best way to reduce exposure is to switch to products that do not contain NMP. Do not use products if you do not have MSDSs and information on health hazards. Make sure you understand the health hazard information.

Switch to soy-based products or use mechanical methods, such as wheat starch blasting, to remove paint and graffiti, when possible. If it is not possible to switch to solvent-free paint strippers, benzyl alcohol may be a safer substitute. Unlike NMP, it does not cause reproductive and developmental damage in test animals. It also does not pose risks of cancer like methylene chloride does. Benzyl alcohol is absorbed through the skin. It may also cause allergic dermatitis. Water-based cleaners often can be substituted for products containing NMP and toxic solvents like 1-bromopropane, for cleaning in the electronics industry and other industries.

If you cannot switch to products that are free of NMP or other solvents, take other steps to limit exposure.

- ▶ **Using Less.** Use as little as possible of solvent-containing products. Keep containers closed between uses.
- ▶ **Ventilation.** Make sure there is good ventilation. “Local exhaust ventilation” is most effective. It captures NMP vapors at the source before workers breathe them. General ventilation using a fan-powered or heating, ventilation, and air conditioning (HVAC) system is the next best

way to bring fresh air into the work area. Relying only on open doors and windows usually will not provide enough fresh air. Indoor fans that blow NMP-contaminated air around without removing it from the work area are not effective.

- ▶ **Respiratory Protection.** Cal/OSHA permits the use of respirators to control harmful exposures only if ventilation and other control methods are not effective or feasible. A half-face respirator with organic vapor cartridges can reduce exposure. In spraying operations, this should be combined with a mist pre-filter. A dust mask does not remove NMP vapors from the air and will not protect workers. Employers must comply with the Cal/OSHA Respiratory Protection Standard (Title 8, Section 5144). Requirements include making sure that respirators fit properly and workers are medically fit to wear a respirator. See www.dir.ca.gov/title8/5144.html.
- ▶ **Skin Protection.** Wear chemical protective utility gloves such as butyl rubber when using products that contain NMP. Replace gloves often. Use chemical protective clothing such as aprons, sleeves, boots, and head and face protection if NMP can contact your skin at areas other than your hands. Clean the equipment thoroughly after each use. Cal/OSHA regulation requires employers to supply gloves and any other necessary protective equipment. See www.dir.ca.gov/title8/sb7g2a10.html.



Legal exposure limits

Cal/OSHA does not have a Permissible Exposure Limit (PEL) for workplace exposure to NMP. Neither the National Institute for Occupational Safety and Health (NIOSH) nor the American Conference of Governmental Industrial Hygienists (ACGIH) has developed exposure limits. The American Industrial Hygiene Association's Workplace Environmental Exposure Level (WEEL) for NMP is 10 ppm averaged over an eight-hour work period. NMP eight-hour exposure exposure limits set by 14 other countries range from 1 ppm to 100 ppm. Most of the limits have skin notations, indicating skin absorption of NMP.

Recommended exposure limits

HESIS recommends that workplace exposure to NMP be kept to a minimum and below 5 ppm (averaged over an eight hour work period) until a safe level has been determined. HESIS also recommends a skin notation to require protection against skin contact exposure.

Measuring your exposure

The amount of NMP in the air in your workplace can and should be measured. However, until NMP is regulated by Cal/OSHA, there may not be any legal standard to which the results can be compared.

Are there medical tests for exposure and health effects?

NMP and its major breakdown products, 5-hydroxy-N-methyl-2-pyrrolidone (5-HNMP) and 2-hydroxy-N-methylsuccinimide (2-HMSI) have been measured in the urine and blood of exposed workers and volunteers in several studies. The results compared well with air levels of NMP. The use of urine and blood tests for monitoring workplace exposure to NMP is still being studied.

If you work regularly with NMP or other hazardous substances, you should be given a complete physical exam, which includes a medical and work history, and periodic follow-up examinations.

Regulations that help to protect workers

HAZARD COMMUNICATION STANDARD.

Under this standard (Title 8, Section 5194), your employer must tell you if any hazardous substances are used in your work area, must train you to use them safely, and must make MSDSs available. See www.dir.ca.gov/title8/5194.html.

INJURY AND ILLNESS PREVENTION PROGRAM.

Every employer must have an effective, written Injury and Illness Prevention Program (IIPP). Major elements include: methods for identifying and quickly correcting workplace hazards; health and safety training; a health and safety communication system; and record-keeping. See www.dir.ca.gov/title8/3203.html.

ACCESS TO MEDICAL AND EXPOSURE RECORDS.

You have the right to see and copy your own medical records, and any records of toxic substance exposure monitoring in your work area. (Title 8, Section 3204). These records are important in determining whether your health has been affected by your work. Employers who have such records must keep them for at least 30 years after the end of your employment. See www.dir.ca.gov/title8/3204.html.



DO YOU USE ANY OF THESE PRODUCTS?

9051 Bio-Blast Bottom Paint Remover
Baycor® 300 Fungicide Spray
Bayleton® 125 EC Fungicide
Biostrip
Citrus Brake Cleaner
CS Stripping Gel
D10e Degreasing Solvent Aerosol
Desert Brand Paver Tile Sealer
Enviro Klean Enviro Strip NMC
Fast Adhesive Gun Cleaner
Hercules Multipurpose Plastic Pipe
Cement
Lyondell N-Methyl-2-Pyrrolidone-
Electronic Grade
Peel Away 7
PI 2555
Ready Strip Pro
Safety-Kleen N-Methyl Pyrrolidone
Soy Clean® Graffiti Remover
(Paint Stripper)
Soy-Gel™ Professional Stripper
Soy-Strip™
SurTec 430
TURCO 5668
United 572
Wash-Away™
X-GAL-IPTG Solution

These are some products with MSDSs showing that they contain NMP. However, products like these can change their ingredients quite often. Be sure to check the current MSDS for whatever products you are using.



WHERE TO GET HELP

- ▶ **HESIS** answers questions about NMP and other workplace hazards, and has many free publications available.

For information on workplace hazards (Toll Free in CA): **866-282-5516**. Please leave a message and your call will be returned.

For HESIS Publications (Toll Free in CA): **866-627-1586**. Call, or visit our website www.dhs.ca.gov/ohb, or write to HESIS, 850 Marina Bay Parkway, Building P, 3rd Floor, Richmond, CA 94804.

- *HESIS Guide to Solvent Safety*. Discusses health and safety hazards and protective measures.
- *Workplace Chemical Hazards to Reproductive Health: A Resource for Worker Health and Safety Training and Patient Education*. Explains how chemicals can affect reproduction.
- *HESIS Publication List*. Fact sheets, booklets, and medical guidelines on workplace hazards including chemicals, repetitive motion, and infectious diseases. Visit our website, call, or write for the list.

- ▶ **Institute for Research and Technical Assistance (IRTA)** has information on safe alternatives for solvent-based products. Call **(818) 244-0300** or visit the IRTA website at www.irta.us.

- ▶ **California Division of Occupational Safety and Health (Cal/OSHA)** investigates workers' complaints, makes enforcement inspections, and answers questions about workplace health and safety regulations. Complainants' identities are kept confidential. Call the nearest Cal/OSHA district office to your workplace, which you can find at www.dir.ca.gov/DOSH/districtoffices.htm.

- ▶ **Other resources for employees** may include your supervisor, your union, your company health and safety officer, your doctor, or your company doctor.

- ▶ **Cal/OSHA Consultation Service** helps employers who want free, non-enforcement help to evaluate the workplace and improve the health and safety conditions. Employers can call **(800) 963-9424**. The Consultation Service also has free publications which can be ordered or downloaded at www.dir.ca.gov/DOSH/PubOrder.asp.

- ▶ **Occupational health services** can be found at:

- University of California (UC)
San Francisco: (415) 885-7580
- UC Davis: (530) 754-7635
- UC Irvine: (949) 824-8641
- UC San Diego: (619) 471-9210
- UCLA: (619) 794-8144



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