



PUBLIC HEALTH STATEMENT

3,3'-DICHLOROBENZIDINE

CAS#: 91-94-1

Division of Toxicology

September 1998

This Public Health Statement is the summary chapter from the Toxicological Profile for 3,3'-Dichlorobenzidine. It is one in a series of Public Health Statements about hazardous substances and their health effects. A shorter version, the ToxFQATM is also available. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present. For more information, call the ATSDR Information Center at 1-888-422-8737.

This public health statement tells you about 3,3'-dichlorobenzidine and the effects of exposure.

The Environmental Protection Agency (EPA) identifies the most serious hazardous waste sites in the nation. These sites make up the National Priorities List (NPL) and are the sites targeted for long-term federal cleanup activities. 3,3'-Dichlorobenzidine has been found in at least 32 of the 1,467 current or former NPL sites. However, the total number of NPL sites evaluated for this substance is not known. As more sites are evaluated, the sites at which 3,3'-dichlorobenzidine is found may increase. This information is important because exposure to this substance may harm you and because these sites may be sources of exposure.

When a substance is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. This release does not always lead to exposure. You are exposed to a substance only when you come in

contact with it. You may be exposed by breathing, eating, or drinking the substance or by skin contact.

If you are exposed to 3,3'-dichlorobenzidine, many factors determine whether you'll be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with it. You must also consider the other chemicals you're exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

1.1 WHAT IS 3,3'-DICHLOROBENZIDINE?

3,3'-Dichlorobenzidine is a gray-to-purple colored crystalline solid. It changes from a solid to a gas very slowly. 3,3'-Dichlorobenzidine salt, the major form in actual use, is a stable, off-white colored crystalline solid that does not evaporate. Neither 3,3'-dichlorobenzidine nor its salt occur naturally in the environment. They are manufactured for use in the production of pigments for printing inks, textiles, plastics and enamels, paint, leather, and rubber. Whether 3,3'-dichlorobenzidine or the salt is present as such depends on the acidity of the soil or water as well as other factors. In most environmental samples, such as water and soils, 3,3'-dichlorobenzidine would be expected to exist in the free amino form, not as the salt.

1.2 WHAT HAPPENS TO 3,3'-DICHLOROBENZIDINE WHEN IT ENTERS THE ENVIRONMENT?

3,3'-Dichlorobenzidine breaks down rapidly when exposed to natural sunlight. In air and sunshine, it is estimated that half of the chemical breaks down within 9.7 hours. In water exposed to natural sunlight, 3,3'-dichlorobenzidine is expected to break down rapidly, with half being removed in

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approximately 90 seconds. In soil, where no sunlight is present, the compound may last for several months. Under certain conditions, 3,3'-dichlorobenzidine can break down in soil to form another compound, benzidine, which is toxic.

1.3 HOW MIGHT I BE EXPOSED TO 3,3'-DICHLOROBENZIDINE?

3,3'-Dichlorobenzidine is used to make pigments (substances used to give color to something, for example, paint). You are most likely to be exposed to 3,3'-dichlorobenzidine if you work inside plants where the chemical is manufactured or used. However, employers have limited workers' exposure to the chemical by using closed systems for processing as well as other methods for reducing its concentration in the air to very low levels and by requiring workers to wear protective clothing and use special equipment. If you were exposed in such a workplace, it would probably be by breathing in the dust or by getting the chemical on your skin. Careless handling or accidental spillage of the chemical could result in exposure to potentially hazardous levels of 3,3'-dichlorobenzidine. People may be exposed to the chemical if they live or work near land where plant wastes have been stored or buried, or close to lakes, streams, or rivers near where plants discharge process water or store wastes. Most people do not live near a source of the chemical. The Canadian government has published calculations that show that exposure of the Canadian general population to 3,3'-dichlorobenzidine in air, soil, or water is extremely low. If you do live in areas near a source of the chemical (such as a hazardous waste site that contains dye or pigment manufacturing wastes), some exposure could occur if you or a child accidentally or purposely ingested small amounts of

contaminated soil, drank contaminated water, or ate fish caught in waters near the source. However, studies of water and fish taken from locations near dye-manufacturing plants did not find the chemical.

3,3'-Dichlorobenzidine has no agricultural or food chemical uses, so exposure to it by eating contaminated food is not likely.

1.4 HOW CAN 3,3'-DICHLOROBENZIDINE ENTER AND LEAVE MY BODY?

In the workplace, 3,3'-dichlorobenzidine may enter the body when workers breathe dust contaminated by 3,3'-dichlorobenzidine and through skin contact. You are not likely to be exposed to 3,3'-dichlorobenzidine unless you drink water or eat dirt contaminated with 3,3'-dichlorobenzidine in the vicinity of a hazardous waste site where 3,3'-dichlorobenzidine has been stored and leakage has occurred. When 3,3'-dichlorobenzidine does enter the body, very little of it leaves the body unchanged. Most of it (over 90%) is changed to related chemical substances called metabolites, which leave the body, mainly in urine and to a lesser extent in feces, within 72 hours after exposure.

1.5 HOW CAN 3,3'-DICHLOROBENZIDINE AFFECT MY HEALTH?

Some workers exposed to the salt form of 3,3'-dichlorobenzidine complained of sore throat, respiratory infections, stomach upset, headache, dizziness, caustic burns, and dermatitis (an inflammation of the skin). However, with the exception of dermatitis, it is not certain that 3,3'-dichlorobenzidine causes these health effects because the workers were also exposed to other

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chemicals at the same time. There is no evidence that 3,3'-dichlorobenzidine affects the nervous system, the ability to fight disease, or the ability of people to have children.

To protect the public from the harmful effects of toxic chemicals and to find ways to treat people who have been harmed, scientists use many tests.

One way to see if a chemical will hurt people is to learn how the chemical is absorbed, used, and released by the body; for some chemicals, animal testing may be necessary. Animal testing may also be used to identify health effects such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method to get information needed to make wise decisions to protect public health. Scientists have the responsibility to treat research animals with care and compassion. Laws today protect the welfare of research animals, and scientists must comply with strict animal care guidelines.

Death has occurred in laboratory animals that ate very high levels of 3,3'-dichlorobenzidine mixed in their food for short periods of time. Laboratory animals exposed to moderate levels of 3,3'-dichlorobenzidine mixed with food for a long time suffered mild injury to the liver.

Studies show that 3,3'-dichlorobenzidine caused cancer of the liver, skin, breast, bladder, and tissues that form blood (leukemia), and other sites in laboratory animals that ate 3,3'-dichlorobenzidine in their food. There is no evidence that 3,3'-dichlorobenzidine has caused cancer in people who worked with it or who were exposed to it unknowingly or by accident for a short or long time. However, because of the many types of cancer that

3,3'-dichlorobenzidine has caused in different tissues of many types of laboratory animals, 3,3'-dichlorobenzidine should be thought of as probably capable of causing human cancer if exposure to the chemical is sufficiently high.

The Environmental Protection Agency (EPA) has determined that 3,3'-dichlorobenzidine is a "probable human carcinogen." The U.S. Department of Health and Human Services (DHHS) has determined that 3,3'-dichlorobenzidine and its salt may reasonably be expected to be cancer-causing substances (carcinogens). The International Agency for Research on Cancer (IARC) has determined that 3,3'-dichlorobenzidine is possibly carcinogenic to humans.

1.6 HOW CAN 3,3'-DICHLOROBENZIDINE AFFECT CHILDREN?

This section discusses potential health effects from exposures during the period from conception to maturity at 18 years of age in humans. Potential effects on children resulting from exposures of the parents are also considered.

Children might be exposed to 3,3'-dichlorobenzidine if they eat small amounts of soil contaminated with 3,3'-dichlorobenzidine. However, studies suggest that it is very difficult to release 3,3'-dichlorobenzidine once it becomes attached to soil. Exposure via contaminated soil may occur if they live in an area near a source of the chemical (such as a hazardous waste site that contains 3,3'-dichlorobenzidine). Children can also be exposed if the parents work at chemical facilities where 3,3'-dichlorobenzidine is handled and bring home contaminated clothing or tools or if they do

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not shower before coming home. There are no known unique exposure pathways for children.

There have been no studies of health effects in children exposed to 3,3'-dichlorobenzidine. We have no information on whether 3,3'-dichlorobenzidine causes birth defects in children. It is unknown whether birth defects would occur in the offspring of pregnant animals that breathed or eaten 3,3'-dichlorobenzidine, or had it on their skin. In studies in which pregnant mice were injected with high amounts of 3,3'-dichlorobenzidine under the skin, the kidneys of their babies did not develop properly and some babies developed renal tumors. However, it is highly unlikely that humans will encounter such exposure conditions.

There is no information to determine whether children are different in their sensitivity to the health effects of 3,3'-dichlorobenzidine from adults. There is indirect evidence that 3,3'-dichlorobenzidine or its breakdown products can cross the placenta, but we do not know for certain whether it can be transferred to the young via the mother's breast milk. Sometimes when children have been exposed to chemicals before they are born, the chemical or its breakdown products can be found in amniotic fluid, meconium, cord blood, or neonatal blood; however, no information about such measurements was found for 3,3'-dichlorobenzidine.

1.7 HOW CAN FAMILIES REDUCE THE RISK OF EXPOSURE TO 3,3'-DICHLOROBENZIDINE?

If your doctor finds that you have been exposed to significant amounts of 3,3'-dichlorobenzidine, ask your doctor if children may also be exposed. When

necessary your doctor may need to ask your state Department of Public Health to investigate.

3,3'-Dichlorobenzidine has no agricultural or food chemical uses, so exposure to it by eating contaminated food is not likely. It is sometimes possible to carry 3,3'-dichlorobenzidine from work on your clothing, skin, hair, tools, or other objects removed from the workplace. This has happened in factories that produce 3,3'-dichlorobenzidine. In this way, you may contaminate your car, home, or other locations outside work where children might be exposed to 3,3'-dichlorobenzidine. You should know about this possibility if you work with 3,3'-dichlorobenzidine.

Your occupational health and safety officer at work can and should tell you whether chemicals you work with are dangerous and likely to be carried home on your clothes, body, or tools. Ask if you should shower and change clothes before you leave work, store your street clothes in a separate area of the workplace, or launder your work clothes at home separately from other clothes. The Occupational Safety and Health Administration (OSHA) requires Material Safety Data Sheets (MSDSs) for many chemicals used at your place of work. MSDS information should include chemical names and hazardous ingredients, and important information such as fire and explosion data, potential health effects, how you get the chemical(s) in your body, how to properly handle the materials, and what to do in the case of emergencies. Your employer is legally responsible for providing a safe workplace and should freely answer your questions about hazardous chemicals. U.S. OSHA or your state OSHA-approved occupational safety and health program can answer any further questions and help your employer identify and correct

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problems with hazardous substances. OSHA or your state OSHA-approved occupational safety and health program will listen to your formal complaints about workplace health hazards and inspect your workplace when necessary. Employees have a right to seek safety and health on the job without fear of punishment.

1.8 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO 3,3'-DICHLOROBENZIDINE?

Exposure to 3,3'-dichlorobenzidine can be determined by finding the chemical or its metabolites in urine. The test is not commonly available to the general population, but it is available to workers who may be exposed to potentially hazardous levels of the chemical in the workplace (for example, by careless handling or accidental spills). The test is accurate and provides evidence that exposure has occurred. However, since 3,3'-dichlorobenzidine does not remain long in the body, the test must be performed very soon after the possible exposure. Also, measured urine levels of 3,3'-dichlorobenzidine or its metabolites do not tell you whether it will affect your health.

1.9 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

Federal agencies that develop regulations for toxic substances include the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA). Recommendations provide valuable guidelines to protect public health but cannot be enforced by law. Federal organizations

that develop recommendations for toxic substances include the Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH).

Regulations and recommendations can be expressed in not-to-exceed levels in air, water, soil, or food that are usually based on levels that affect animals; then they are adjusted to help protect people. Sometimes these not-to-exceed levels differ among federal organizations because of different exposure times (an 8-hour workday or a 24-hour day), the use of different animal studies, or other factors.

Recommendations and regulations are also periodically updated as more information becomes available. For the most current information, check with the federal agency or organization that provides it. Some regulations and recommendations for 3,3'-dichlorobenzidine include the following:

EPA has determined that 3,3'-dichlorobenzidine is a "probable human carcinogen" and has placed several limits on the chemical in the environment to protect human health. Under the Clean Water Act of 1977, EPA controls discharges of 3,3'-dichlorobenzidine to industrial waste waters. The agency has listed 3,3'-dichlorobenzidine as a hazardous waste and requires that any spill of one pound or more be reported to the National Response Center.

Although the FDA has classified 3,3'-dichlorobenzidine as a carcinogen, no regulatory guidelines have been enacted. The FDA has concluded that the food supply is not in danger from 3,3'-dichlorobenzidine.

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3,3'-Dichlorobenzidine is one of a number of compounds regulated by OSHA. To control exposures to 3,3'-dichlorobenzidine in workplace air and to protect the health of workers, OSHA's regulatory standards provide strict guidelines for handling, using, and storing the compound. They also include the requirements for personal protective equipment, training, labeling, and posting and engineering controls. OSHA also requires that initial medical screening and regular medical examinations be made available to any employee who is exposed to 3,3'-dichlorobenzidine at potentially hazardous levels.

NIOSH considers 3,3'-dichlorobenzidine a "potential occupational carcinogen" and recommends workplace practices and controls to reduce exposures to the lowest possible level. NIOSH defines potential occupational carcinogens as substances which may cause an increased incidence of benign and/or malignant neoplasm, or a substantial decrease in the latency period between exposure and onset of neoplasms in humans.

1.10 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns, please contact your community or state health or environmental quality department or:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333

Information line and technical assistance:

Phone: 888-422-8737
FAX: (770)-488-4178

ATSDR can also tell you the location of occupational and environmental health clinics. These clinics specialize in recognizing, evaluating, and treating illnesses resulting from exposure to hazardous substances.

To order toxicological profiles, contact:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Phone: 800-553-6847 or 703-605-6000

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 1998. Toxicological profile for 3,3'-dichlorobenzidine. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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