Benzene

Training on the hazards of benzene in the workplace

Developed by the Division of Occupational Safety & Health (DOSH) for employee training

May, 2009
Benzene

What this training will cover:

Health hazards of benzene
How you are exposed to benzene
Control of your benzene exposure
How to protect yourself from benzene
Use of respirators
Medical surveillance & medical removal
WISHA rules on benzene
Benzene is a clear liquid solvent made from petroleum.

It used to be used as an all-round solvent until it was found to cause cancer. It is now mostly used to make other chemicals. It is highly flammable.

“What is Benzene?”

“Benzene has a recognizable odor described as “pleasant and sweet”"
“Gasoline contains 1% to 4% benzene which is the reason it is found at refineries. The amount in gasoline has been reduced in recent years. A greater percentage of benzene is found in crude oil. It is also used in other chemical plants in large amounts to make such products as plastics, resins, nylon, rubbers, and lubricants. It was formerly used as a solvent in a variety of products, but has since been removed from nearly all of them. Rarely, it may still be found as an ingredient in some products, usually in small amounts. You can check the product material safety data sheet if you suspect it contains benzene. Another word for benzene sometimes used in Europe is “benzol.” It is sometimes found at hazardous waste sites, especially those where solvents were released into the soil or groundwater. Benzene is also a known ingredient in tobacco smoke.”
Benzene in our workplace

[List locations where benzene is stored or used]
“Like most solvents, benzene affects the central nervous system and breathing high levels will make most people feel dizzy, drowsy or high or give them a headache. At extremely high levels, it could actually cause death. However, at lower levels it can affect the bone marrow where red blood cells are made and cause anemia or even leukemia, a type of blood cancer that is often fatal. Benzene is also suspected of causing cancer of the lymph system and of the bladder. Benzene is also extremely flammable and a spill of benzene would be a real fire hazard around open flame or other ignition source. Benzene liquid will also irritate the skin.”
Benzene Exposure
How can benzene get into you body?

The main way benzene would enter your body is by inhaling vapors.

Benzene is a liquid, but it easily evaporates into the air.

Some benzene can be absorbed through your skin.

“Benzene is quite volatile and a spill would quickly evaporate into the air where it could be inhaled. Fortunately, unlike some other solvents, only a small amount of benzene is absorbed through the skin. For that reason and the fact that benzene will remove the natural oil from your hands and eventually cause chapping, rubber gloves are necessary if you handle liquid benzene or a liquid containing benzene.”
Imagine for a moment there are 1 million molecules or dots of air in this slide. The red dot represents one molecule or dot of benzene in the slide. Actually, it would be much smaller. DOSH has two permissible limits – 1 ppm averaged over 8 hours, but no more that 5 ppm in any 15 minute interval. These are the limits of benzene allowed in the air you breathe at work. The first is called the “time-weighted average” or “TWA”, the second is called a “short term exposure limit” or “STEL. Suffice it to say, both are very small amounts of benzene in the air. The permissible limit is set really low to prevent leukemia.”

Some people may begin to smell the sweet odor of benzene at around 5 ppm in the air, but many will not, so they would not know by the sense of smell that they are breathing benzene. In other words, the odor is not a good way of knowing if you are exposed to benzene above the permissible limit.
Air Monitoring

We do regular air monitoring of benzene in the air.

Air monitoring is done in the breathing zone by attaching air sampling devices to employees exposed to benzene.

Results of our air monitoring are as follows:

“We are required to breathing zone air monitoring similar to that shown in the photo, when benzene was first used in the workplace, at least once a year if the levels are between 0.5 ppm and 1 ppm, every 6 months if the levels are above 1 ppm, and as often as necessary if the short term levels are above 5 ppm.

You or your designated representatives are allowed to observe this monitoring."

You will be notified of air monitoring results within 5 days after we get them. We will notify you by: (describe posting location, or other way you will notify them)

[Employer: Air monitoring results can be kept in a accessible location or passed out as a handout. The results should be compared to the action limit and the Permissible Exposure Limits (PEL).]
Exposure Controls

We use the following controls to reduce the amount of benzene you are exposed to:

[Describe ventilation or other exposure controls here by work area or provide a handout that lists the controls]

[Employer: If there are no feasible controls, then the only way to protect workers from exposure is through the use of respirators, gloves and protective clothing. However, other methods of control must be explored first, such as exhaust ventilation or completely closing or isolating an operation or process where benzene is used.]

“Controls help keep the source emissions low or limit the amount of exposure to the employee. Controls include ventilation systems that capture the contaminant at the source, or process changes to minimize the amount of time the employee spends around exposure sources.”
“The areas where benzene levels are above the permissible exposure limit of 1 ppm are called “exposure control areas” These areas may change depending on the type of work that is done and the measured level of benzene in the air. The boundaries of the exposure area are marked in the following way: [Instructor: describe the method] These are area where exposures are dangerous without proper protection and training. If you aren’t authorized and trained to use a respirator, you can’t enter these areas.”
[Employer: Use this slide if you have areas where benzene levels exceed the PEL. These areas must be identified with the posted signs described on the previous slide and respirators must be worn by employees working in the control area.]
Remember, you must wear a respirator in designated “exposure control areas” – the areas with the warning signs. If you will work in these areas you’ll need to follow our respirator program specifications before you can be issued a respirator. Program specifications require medical evaluations, fit-testing, training, and proper use and care.

If benzene liquid could splash on you skin or eyes, you’ll need to wear protection. We’ll provide you training on what types of eye protection and chemical gloves to use and how to properly use and care for them. [see DOSH training kits on both eye and hand protection on the DOSH website]

Don’t eat, drink or smoke in the work area where you are exposed to benzene. We have a separate area or room for those activities.”

Cover containers when they aren’t in use. The rule points out that this helps prevent unnecessary vapor exposure and helps prevent spills.”
“As we mentioned earlier, benzene has a pleasant sweet odor which most people detect at a level above the permissible limit. If you can smell it, it probably means you have been overexposed to it. If you smell it while wearing your respirator, then your respirator is leaking and either needs to be fit properly or the reason for the leak determined. If you develop any symptoms commonly associated with benzene exposure, we will make a medical exam available to you.”
“Do not remain in the release area. If you are required to clean-up minor spills, you will receive additional training through our Hazard Communication program training. If benzene is spilled on you, or if you think you may have inhaled benzene in the incident, we will make a medical exam available to you.

If we had a significant spill or release, we are required to make sure benzene vapor concentration have returned to normal levels, which we would do by air monitoring”.

How to Protect Yourself

In the case of large spill or release of benzene:

Leave the area immediately,

Do not attempt to clean up the spill,

Notify your supervisor.
Required work practices at this worksite

[List worksite-specific work practices that reduce or control exposures here.]
“In certain areas or work situations, we cannot reduce the amount of benzene in the air below the permissible exposure limit. In those cases, respirators are required to be worn if the amount in the air is more than the Permissible Exposure Limit (PEL). Paper dust masks do not filter out benzene. Either cartridge type respirators or respirators that supply clean air must be worn. Cartridge type respirators like the top photo must have cartridges that capture “organic vapors” which include benzene. You can identify it by the black strip as well as the wording. The cartridges must be replaced on a regular basis. You must wear a supplied air respirator like the lower photo, if the amount of benzene in the air is above 10 ppm.”
Taking your respirator off just for minute can overexpose you to benzene in the air. Respirators are only as good as they fit. If they leak, you will have a false sense of protection. A medical evaluation is required because respirators themselves cause some stress to the body, especially if a person has lung or heart problems.” This medical evaluation starts with a medical questionnaire.”
“A beard, facial hair, side burns and moustaches can interfere with sealing surface of the respirator and prevents a tight fit. Even a day’s growth may cause leakage. You must be clean shaven to wear a tight-fitting respirator. As mentioned before, although benzene has an odor, most people can smell it only at levels well above the permissible limit. So if you had a leak in your respirator because of facial hair, you would probably not notice it by odor. We will cover the use of respirators in separate training.”

[Instructor: If your employees wear respirators, they will need further training on their use, limitations and maintenance.]
[Instructor: Show or describe the respirators used at the specific jobsite or task. Include any emergency or escape respirators, if employees will be required to use these. Training on the use of these respirators can be done here or separately.]
We are required to make a medical exam available to you even if you wear a respirator. The purpose of the medical exam is to make sure you are not having any health problems from inhaling too much benzene. Medical exams are also made available if a large spill or other emergency exposure occurs. “0.5 (one half) ppm is the “action level” amount of benzene in the air. This is half of the 8-hour average permissible limit amount of 1 ppm. Medical monitoring is also required if the short-term limit of 5 ppm is exceeded more than 10 days per year. You can only decline the exam by signing a “declination” form. [Employer: you can make medical monitoring a condition of hiring and employment.] We have passed out a copy of what must be included in the medical evaluation.”
“As we stated earlier, benzene can affect the bone marrow where red blood cells are made. Overexposure to benzene may show up as damage to these red blood cells, or a reduction in the number of red blood cells, making you anemic. In many cases, stopping your exposure to benzene will result in recovery of the bone marrow increase in red blood cells to normal levels.”
As stated earlier, exposure to benzene can result in severe blood damage or leukemia, which is much more serious and recovery does not always occur. In these cases, a doctor may recommend permanent removal from a job where you are exposed to benzene.

Permanent Medical Removal

Permanent medical removal may be required because of the potential serious health effects of benzene.

Depending on your medical condition, you may not be able to return to your original position.

If the doctor recommends permanent job removal, we will seek a job transfer for you.

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Worksite Medical Surveillance Program
[Describe details of your worksite specific medical surveillance program here.]
Records

Medical and Air Monitoring Records

You have the right to see any of your medical records related to benzene.

You also have the right to see results of any air sampling for benzene we have done.

“Medical records are kept at [name location] and you can see them.” [Employer: If you have any records of air samples taken at the job site, inform your employees where these results can be viewed or post them, or give copies to affected employees.]
“The points we have covered here are required in this standard. We have given you copies of additional information about benzene which covers the health effects of benzene, what to do in an emergency and other requirements of the standard plus additional information about the physical characteristics of this chemical. You can also get a copy of the standard at the following location:”