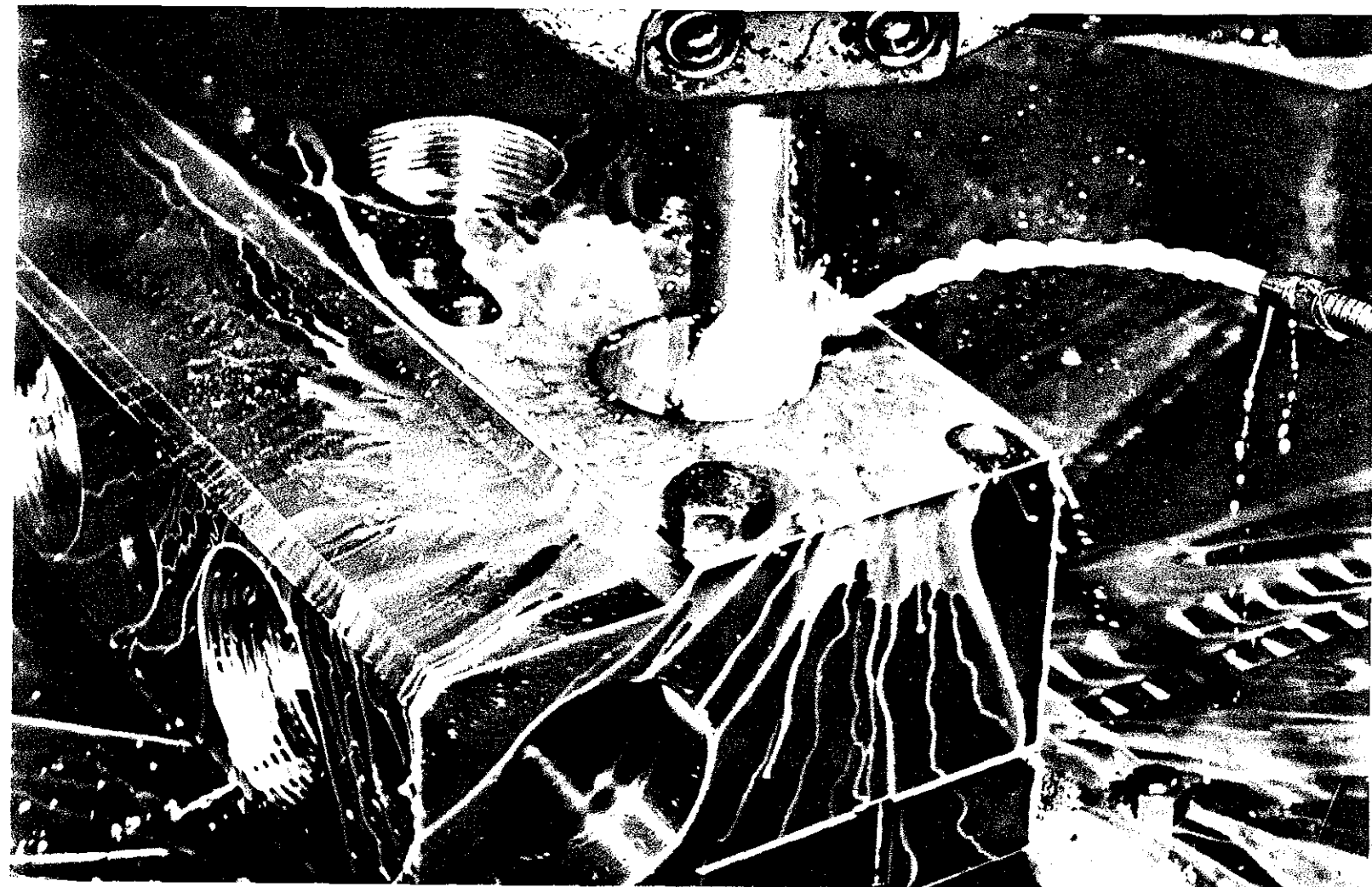


# **NITROSAMINES and other HAZARDS in the MACHINE SHOP**

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**A WORKERS GUIDE**



Recent studies have found extremely high levels of nitrosamines in cutting and lubricating oils used in machine shops. In some cases levels of 30,000 parts per million or 3% were found. One reason for this is the increased use of synthetic oils which contain additives. Unfortunately, many of these additives can be converted to nitrosamines, a group of dangerous chemicals.

## WHAT ARE NITROSAMINES ?

Nitrosamines are a family of chemicals. Approximately 80% of them are potent cancer causing agents. Though industries sometimes use nitrosamines directly in processing or manufacturing, most nitrosamine exposure comes from the chemical conversion of nitrite and other preservatives during processes which generate heat. The nitrites, nitrates, amines, and other nitrogen containing chemical preservatives have the potential to react with other chemicals in the oil and produce nitrosamines. This conversion will happen especially fast when the oil is hot and contains acid.

## WHERE ARE NITROSAMINES FOUND ?

Nitrosamines have been found in:

- cutting and lubricating oils
- cosmetics
- scotch and beer
- home and industrial pesticides
- animal feeds
- rubber and tire factories
- cooked meats which contain nitrites as preservatives

There was a great deal of publicity not very long ago about nitrosamines in bacon and luncheon meat. The nitrosamines were formed in the same way that they were formed in cutting oils - from the chemical conversion of nitrite preservatives. The levels of nitrosamines that can be formed in cutting oils, however, are hundreds, even thousands of times greater than that found in bacon!

# NITROSAMINES IN CUTTING OILS

In 1976, it was estimated that 780,000 workers were exposed to cutting oils. Cutting oils are used in drilling, gear cutting, grinding, bathing, milling and other machining operations. They are used for cooling, lubricating and removing metal or plastic chips, filings and cuttings from the contact area. Other names used for these oils are cooling, grinding, industrial, lubrication and synthetic oils or fluids.

These oils or fluids are usually divided into four groups:

1. Straight Oils

These contain mineral oil, fat and additives. They do not mix in water.

2. Soluble Cutting Oils

These are similar to the above oil but contain emulsifiers which enable water to be mixed in.

3. Semi-Synthetic Cutting Oils

These contain both a natural oil such as mineral oil and a synthetic base. Additives, emulsifiers and water are also used.

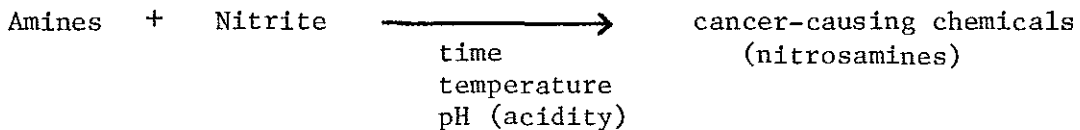
4. Synthetic Cutting Fluid

This is a completely artificial product. The soluble base provides the lubrication and additives are used to enhance its performance.

The uses of cutting fluid additives and their nitrosamine producing chemicals are listed below:

<u>Additives</u>	<u>Use</u>	<u>Nitrosamine Producing Chemicals</u>
emulsifiers	to mix oil & water	Amines
antimicrobial	to kill microbes	Nitrites
soluble base	lubrication	Amines
rust inhibitor	prevents metal corrosion	Nitrites

Remember this formula:



# HOW DANGEROUS ARE NITROSAMINES ?

In 1954, it was discovered that nitrosamines cause cancer. Since then numerous studies have shown that these compounds are extremely hazardous. However, no nitrosamine is currently regulated by OSHA. Here's a list of some nitrosamines and the organs they appear to affect.

<u>SOME CHEMICAL NAMES FOR NITROSAMINES</u>	<u>ORGANS THEY PRODUCE CANCER IN</u>
Dimethylnitrosamine	liver, kidney, lungs
Diethylnitrosamine	liver, lungs, esophagus
Dibutylnitrosamine	bladder, liver and lungs
Diketopropylnitrosamine	pancreas, liver and lungs
Methylphenylnitrosamine	esophagus
Methylamylnitrosamine	esophagus, liver
Nitrosopiperidine	esophagus, liver, nasal and
Streptozotocin	pancreas

## PREVENTION OF HAZARD

Whenever possible the best control solution is the prevention of the hazard. Here are some engineering solutions which will either reduce or eliminate nitrosamine formation.

1. **TEMPERATURE CONTROL:** By either cooling the oil with an oil cooler or by not allowing the oil to reach a certain temperature, you can prevent nitrosamine formation. A simple thermometer can be used to monitor this. If constant high temperatures are encountered then an oil cooler should be installed.
2. **ACID CONTROL:** The pH or the amount of acidity in an oil will greatly affect the rate of nitrosamine production. Nitrosamine formation is enhanced at a pH of less than 7. Testing for pH is very simple and inexpensive. Paper pH strips are available in most drug stores and which can be used to measure pH daily. If the acidity is high then the addition of a base such as lye can lower it. Also the addition of a buffer such as sodium bicarbonate (baking soda) can stabilize the acidity.
3. **SUBSTITUTION:** There are available a number of cutting fluids that do not contain nitrosamine producing chemicals, which are not only safer but cheaper. Some manufacturers' names are available from us on request.

A key question in working with or ordering cutting fluids is: do they contain nitrite preservatives? If they do then it is likely that nitrosamines will be produced.

4. **MAINTENANCE:** Changing the oil at regular intervals will prevent nitrosamine buildup.

# WHAT SHOULD YOU DO ?

If you work with cutting or lubricating oils your exposure will depend on the type of oil you are using. Remember, some nitrosamines such as nitrosoethanolamine may be added directly to cutting oils OR they may be formed in the oil while you are using it.

The best way to determine whether there are nitrosamines present requires air sampling and testing of the oils, usually with specialized equipment. Chemical analysis may be difficult and expensive to do. However, you can get a good deal of information without air sampling.

1. Read the labels: Look for such chemical names as nitrites, nitrates, amines, amides, aniline, and nitroso.
2. Request Material Safety Data Sheets (MSD/s): The oil manufacturers will have these sheets which will identify the additives used.
3. Schedules: If you suspect nitrosamines to be present there should be a schedule for air and oil sampling.

You can also:

1. Request a Health Hazard Evaluation (HHE) from NIOSH:  
Call your local NIOSH office and request a survey.
2. Request an OSHA inspection:  
Even though there is no Threshold Limit Value for Nitrosamines, OSHA can cite this hazard under the General Duty Clause.

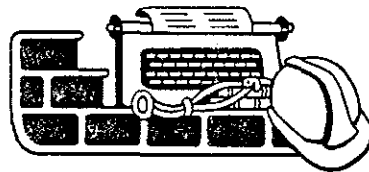
## REDUCING OCCUPATIONAL EXPSOURE:

1. Ventilation can be used to remove any airborne nitrosamines. Usually this means using local ventilation, such as a capture hood.
2. Respirators which are designed to remove airborne nitrosamines can be used but they must be designed to "filter out" nitrosamines. Not all respirators can do this. Check with the manufacturer or your regional NIOSH office to be sure.
3. Protective clothing will produce a physical barrier between you and the hazard. Gloves, aprons and barrier creams will reduce skin contact and absorption, but not eliminate it. Though nitrosamines can pass through gloves made of certain materials, thick gloves kept in good condition still offer the greatest protection.
4. Treatment processes may be used to rid the oil of nitrosamines by removing, converting or destroying the nitrosamines produced. These are usually specialized processes which may be expensive to purchase.
5. Isolation of the process which uses cutting or lubricating oils from crowded work areas will minimize exposure to non-users.

# OTHER HAZARDS IN THE MACHINE SHOP

In addition to a possible cancer threat, cutting fluids and lubricating oils can also pose a skin and respiratory hazard. But these are not the only potential dangers found in the machine shop, here's a list of some of the more common ones.

<u>HAZARD</u>	<u>SOURCE/USE</u>	<u>HEALTH THREAT</u>
1. PCB's (polychlorinated biphenyls)	hydraulic fluids heat exchanger	one of the most toxic chemicals known. PCB's cause cancer, birth defects, liver and skin disease among other problems.
2. Chromic acid and chromate	corrosion inhibitor plating metallurgy	Severe irritant to nose, throat and skin; also can cause lung cancer.
3. Cobalt	high-speed steels alloys, electro- plating	Pneumonia, causes lung and skin allergies.
4. Cresol	disinfectant, resins	Damages central nervous system, liver, kidney and lungs, dermatitis and gastrointestinal disturbances.
5. Formaldehyde	manufacture of metals	Respiratory and eye irritant, skin sensitizer and suspect carcinogen.
6. Hydroquinone	antioxidant	Affects the eyes.
7. Phenolic amines	dyes, disinfectants	Skin and respiratory sensitizer; nitrosamine precursors.
8. OTHER HAZARDS		
- noise		- heat stress
- ionizing radiation		- accidents



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