Long-term effects of toxic materials remain uncertain

By BOB ANDERSON
and MIKE DUNNE
Advocate staff writers

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"Toxic chemicals have been linked to reproductive problems, but the effects of the relatively low levels commonly found in air pollution remain an unknown, reproduction and genetic experts say.

There is reason for concern and investigation in localities where large amounts of toxic air pollutants are emitted and communities suspect reproductive problems, several experts interviewed indicated.

The evidence linking toxic chemicals and reproductive problems has come from laboratories, where animals can be exposed and carefully studied, and to a lesser extent in the workplace, where levels of toxic chemicals can be much higher than in the surrounding community.

What happens to individuals outside of plants who are exposed to a variety of toxic air pollutants at the parts-per-billion level remains a scientific unknown, though one that concerns some scientists.

"Intentionally synthesized compounds, along with thousands that are inadvertantly generated, are increasingly polluting our air, water and food," the late Dr. Sergio Fabro, then director of the Reproductive Toxicology Center at Georgetown University, wrote in 1982.

"Since many of these chemicals are novel structures not previously existing in nature, their long-term effects in biologic systems in

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general, and in the human in particular, are not known," he wrote.

Studies from Sweden and Finland have suggested a correlation between spontaneous abortion and living near sites that emit cadmium, lead and arsenic, said Ellen K. Silbergeld, chief of toxic science for the Environmental Defense Fund.

There have been reports in British journals suggesting a relationship between solvents and problems in pregnancy, she said.

A study published by National Institute of Occupational Safety and Health 11 years ago noted "significant excess of fetal mortality among wives of males, who were occupationally exposed to vinyl chloride," and said "observations of a significant excess of children born with birth defects were reported among populations residing proximate to vinyl chloride polymerization facilities."

But the report said additional epidemiological study was needed to see if such a pattern held true in other

communities. Current scientific literature on the substance still leaves questions about its effects on communities around plants.

Vinyl chloride has become much more tightly regulated in the last decade, and discharges and leaks from plants have been significantly reduced, officials said.

Experts interviewed for this series agreed that impacts of such substances beyond the fence lines of plants is unknown, and that allegations of high miscarriage rates in areas where toxics are emitted need to be investigated.

"It's a very sticky scientific problem," says Dr. Dorothy Warburton, a professor of genetics at Columbia University College of Physicians and Surgeons. "It keeps coming up all over the country with various pollutants."

While there is good reason to expect such a link, there is no study that proves such a connection with any material other than lead from smelters, she says.

That lack of proof should not be taken as proof that no relationship between air pollutants and reproductive problems exist, Warburton said.

From what is known about toxic chemicals, "it isn't any big jump of the imagination to think they can be causing reproductive problems," said Dr. Anthony Scialli, the current director of the Georgetown University Reproductive Toxicology Center.

"There's no question that people have a right to be concerned," if a number of these chemicals are being found in their air, even at low levels, Scialli said.

About 5 percent of reproductive problems are being linked to some type of toxic exposure, including drugs, he said. But, he adds, that since the cause for 50 percent of reproductive problems are unknown, the possibility exists that a portion of the unknowns also have a chemical link.

The kinds of studies needed to determine if such a link exists, will be difficult and time-consuming, Warburton said.

Epidemiological research is lacking and laboratory research is falling further behind the production of new chemicals, experts said.

"We've been so concerned about cancer that we haven't looked so much at teratogens," said Barbara Shane, an expert in mutagens for the LSU Institute of Environmental Studies. A teratogen is substance that can cause developmental malformations.

Research on toxic chemicals by the U.S. Environmental Protection Agency has been skewed toward looking at cancer, and has failed to look at the possible relationship between such chemicals and many other health effects, including reproductive disorders, said Jerry Poje, an environmental toxicologist with the National Wildlife Federation.

"We have to be extremely cautious in allowing the public to be exposed" to even low levels of toxic chemicals until more is known about what those chemicals can do to humans at low levels.

"Another concern is what effects they may have when mixed with low levels of hundreds of other chemicals in the air," he says.

The ways in which chemicals might effect the reproductive process are numerous, according to Silbergeld.

"Reproduction is such a complex process."

As further research is done, "we expect to find the reproduction system to be vulnerable to toxics, because there are so many possibilities for something to go wrong," she said.

The relationship between toxic chemicals and reproduction "is the emerging issue in environmental toxicology," she said.

In addition to actual reproductive problems, there are also questions being raised about childhood cancer and chemical exposures of parents, she said.

Dr. Vilma Hunt of the Department of Epidemiology at Harvard has studied possible relationships between episodes of high air pollution and infant mortality, but says it is even more difficult to determine if there is a relationship between miscarriages and air pollutants.

"There are so many causes for those events (miscarriages) that to sort them out is a practicable impossibility, but that's not to say they are not being caused by a contaminant," she said.

"To do a reproductive analysis of a community is difficult and time consuming," Hunt said.

Still, she believes it is very important for a community to have its concerns answered.

Scialli said at least 15 percent of pregnancies in the nation end in miscarriage. Warburton said something in the 15 to 20 percent range is normal.

But neither one can say what part chemicals might play in such rates or in other reproductive problems.

"This complex issue is made more difficult because advances in our understanding of the reproductive toxicity of chemicals have not kept pace with the introduction into the environment significant proportions of reproductive wastage [illegible] etiology (cause)," Fabro wrote in the American Journal of Industrial Medicine in 1983.

Several of the substances emitted into the air in East Baton Rouge, Iberville and Ascension parishes are known to have reproductive or mutagenic effects, according to studies conducted by the National Institute of Occupational Safety and Health.

However, the effects have been shown either for laboratory animals or for workers and not for the general public.

"Epichlorohydrin has been shown to induce a significant increase in chromosomal aberrations found in the white blood cells of workers occupationally exposed," according to NIOSH.

In studies, epichlorohydrin has been shown to induce sterility in rats and "a genetic risk for man exists following exposure." In another study, epichlorohydrin did not decrease sperm counts or affect hormonal activity in workers, although NIOSH said the data have not been statistically analyzed.

Studies have also found a "significant increase" in chromosomal aberrations connected to workers associated with vinyl chloride.

"Further evidence for the mutagenicity of vinyl chloride has been provided by investigations showing an increase in fetal wastage among wives of male workers following occupational exposure to vinyl chloride," NOISH said.

Ethylene dichloride is reported to cross the placental barrier, accumulate in the placenta and fetal tissues and cause abnormal development of the fetus in rat studies, according to NIOSH.

NIOSH also cited one study that showed possible fetal and maternal toxicity in rats and mice exposed to perchloroethylene during gestation.

Studies have also indicated that ethylene oxide can cause "chromosomal breakage in workers and animals," NIOSH said.

"Recent experiments in mammals have demonstrated adverse reproductive effects," NIOSH said.

The agency issued guidelines for exposure to ethylene oxide in the workplace that included a call for a reproductive history study as part of worker monitoring.

Some pollutants in area air

East Baton Rouge — Ascension, Iberville, Parishes

16[illegible]	150,000	**Chlorine** — Has a high toxic and hazard level. It is an extreme irritant to the mucus membrance, the eyes and respiratory tract. A concentration of 3.5 parts per million(ppm) produces a detectable odor, 15 ppm causes immediate irritation of the throat, 50 ppm can be dangerous even for short exposures and at 1,000 ppm, it can be fatal. ACGIH: 1 ppm.
30,000	818,000	**Hydrogen chloride** — is considered very toxic and is a irritant to the skin, eyes and mucus membranes. It is an experimental mutagen. ACGIH: 5 ppm.
4,792,000	16,000	**Hydrogen sulfide** — It is very high level irritant to the eyes and mucus membrance. Low level exposure may cause eye irritation and higher concentrations may result in headache, dizziness, excitement and other effects. It is a central nervous system depressant. ACGIH: 10 ppm.
12,000	36,178,000	**Ammonia** — A powerful irritant to eyes, skin, respiratory tract and mucus membrance. ACGIH: 22 ppm.
806,000	410,000	**Propylene** — A simple asphyxiant but can react vigorously with other materials.
220,000	12,000	**1-3 Butadiene** — The vapors are an irritant to the eyes and the mucus membrane. Inhalation of high concentrations can cause unconsciousness and death. ACGIH: 10 ppm.
0	56,000	**Ethylene Oxide** — A suspected carcinogen and an experimental teratogen, and mutagen. It is a powerful irritant to skin, eyes and mucus membrane. ACGIH: 1 ppm.
0	120,000	**Propylene Oxide** — An experimental mutagen and carcinogen. It is a moderate skin and eye irritant. It is a food additive permitted in food for human consumption and an insecticidal fumigant. ACGIH: 20 ppm.
0	288,000	**Methylene chloride** — An experimental carcinogen. It is very dangerous to the eyes and has a high narcotic effect. Has been used in Europe as an anesthetic. Used as a food additive permitted in food for human consumption. ACGIH: 100 ppm.
22,000	256,000	**Chloroform** — An experimental carcinogen and teratogen. It is a central nervous system poison and a skin and eye irritant. Well known anesthetic. ACGIH: 10 ppm.
14,000	634,000	**Carbon tetrachloride** — A potential human carcinogen, teratogen and damages the human central nervous system, pulmonary system and gastrointestinal system. It has a very narcotic effect. ACGIH: 5 ppm.
0	84,000	**Methyl chloroform** — Causes psychotropic effects, gastrointestinal effects and central neverous system effects. A skin and eye irritant. ACGIH: 300 ppm.
0	235,000	**Ethylene dichloride** — An experimental carcinogen and mutagen and a suspected human carcinogen. It is a skin and eye irritant and is a central nervous system hazard. Can cause headaches, mental confusion, depression and fatigue. ACGIH: 10 ppm.
0	116,000	**Perchloroethylene** — An experimental carcinogen and mutagen and a toxic inhalant. ACGIH: 50 ppm.
0	286,000	**Vinyl chloride** — A human carcinogen and a severe irritant dangerous to the eyes, skin and muous membranes. In experiments, chronic exposure can cause liver damage. Circulatory and bone chnages noted in the fingertips of some workers handling unpolymerized materials. ACGIH: 5 ppm.

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0	210,000	**Vinylidene chloride** — An experimental mutagen and severe irritant. Effects similar to vinyl chloride. ACGIH: 5 ppm.
576,000	26,000	**Epichlorohydrin** — A suspected human carcinogen and an experimental mutagen, carcinogen, tumorigenic agent. Very dangerous to the human eyes. It can cause sterility and chronic exposure can cause kidney, eye and lung damage. ACGIH: 2 ppm.
86,000	226,000	**Toluene** — An experimental mutagen and a human carcinogen with psychotropic effects. A skin and eye irritatnt. Repeated small doses can cause headache, nausea, eye irritation, loss of appetite, impaired coordination. ACGIH: 100 ppm.
200,000	0	**Styrene** — An experimental carcinogen, mutagen and tumorigenic agent. An eye and skin irritant. ACGIH: 50 ppm.
0	24,000	**Phenol** — An experimental carcinogen, mutagen and tumorigenic agent. An irritant to the skin and eyes. ACGIH: 5 ppm.
0	2,000	**Chlorobenzene** — Strong nacrotic effects and mild irritant. ACGIH: 75 ppm.
18,000	0	**Benzene** — A human carcinogen and recognized leukemogen. Poisonous if inhaled. ACGIH: 10 ppm
220,000	0	**Xylene** — An eye irritant. OSHA and ACGIH: 100 ppm.
2,000	0	**Acrylonitrile** — A suspected carcinogen (brain) and a skin and eye irritant. It inhibits oxygen absorption. Not rapidly fatal. ACGIH: 2 ppm.
7,162,000 **Totals**	40,150,000	Effects based on information from Rapid Guide to Hazarodus Chemicals in the Workplace by N. Irving Sax and Richard Lewis Sr. and Dangerous Properties of Industrial Materials by N. Irving Sax.
SOURCE: Department of Environmental Quality		ACGIH: This is the threshold limit value as used by the American Conference of Governmental Industrial Hygienists. The threshold limit value is considered the level at which a worker can be exposed for eight hours per day during a 40-hour week and suffer no ill effects.