

July 22, 1975

cc: J. M. Quinn

TO: J. M. DeVoe
ICD Mfg. DAB-G

SUBJECT: Baton Rouge North
Vinyl Chloride Standard
Engineering Requirements

The Safety and Health Standards for employees subject to exposure to vinyl chloride was published by OSHA in the Federal Register on October 4, 1974, and are reproduced and attached including marginal notes which appeared as corrections in the Federal Register of December 4, 1974. These regulations went into effect on April 1, 1975, not January 1, 1975 by order of the court.

Paragraph 1910.93q(f) outlines the method of compliance and is reproduced below:

"(f) Methods of compliance. Employee exposures to vinyl chloride shall be controlled to at or below the permissible exposure limit provided in paragraph (c) of this section by engineering, work practice and personal protective controls as follows:

(1) Feasible engineering and work practice controls shall immediately be used to reduce exposures to at or below the permissible exposure limit.

(2) Wherever feasible engineering and work practice controls which can be instituted immediately are not sufficient to reduce exposures to at or below the permissible exposure limit, they shall nonetheless be used and shall be supplemented by respiratory protection in accordance with paragraph (g) of this section. A program shall be established and implemented to reduce exposures to at or below the permissible exposure limit, or to the greatest extent feasible, solely by means of engineering and work practice controls, as soon as feasible.

(3) Written plans for such a program shall be developed and furnished upon request for examination and copying to authorized representatives of the Assistant Secretary and the Director. Such plans shall be updated at least every six months.

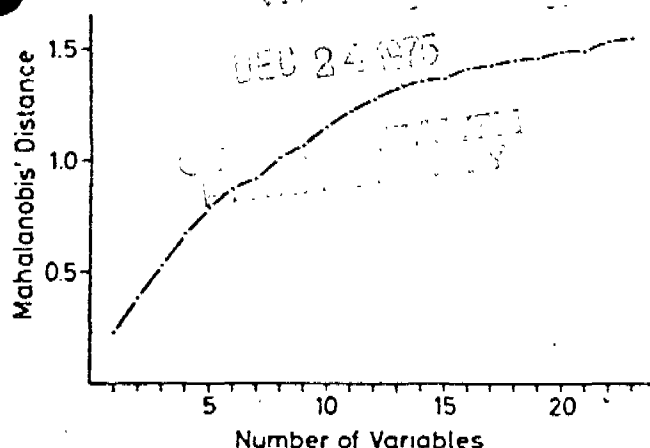
ORIGINAL
W. C. KOCH

W. C. Koch
Manager
Occupational Health &
Product Safety

WCK/smm

ASI 00022730

Attachment



the discrimination of vector of means can be tested for significance.

A high discrimination between the malformation group and its matched controls appeared within the first 10 of the 24 variables (see accompanying figure). Even with 8 variables a significant discrimination of both groups at 1% level was found. The discrimination of both groups was also possible without the two factors "abortions/stillbirths in mothers family" and "hours of daily work".

So, even in a sample with factors each not discriminating significantly between both groups, the linear discriminant analysis makes it possible to discriminate between the malformation group and the matched controls. This might mean that the malformations in our sample can be explained as caused by the combination of many minor factors (extrinsic and intrinsic).

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CONGENITAL MALFORMATIONS AND VINYL CHLORIDE

SIR,—In March, 1975, a significantly increased rate of central-nervous-system (C.N.S.) malformations was reported in 3 Ohio communities where polyvinyl chloride (P.V.C.) polymerisation plants are located;¹ the increase was not uniform and appeared more prominent in the Painesville area. There are two P.V.C. plants in Painesville, one of which began operation in 1949 and the other in 1967. The birth-defect rates were computed from birth-certificate data for 1970–73 and were compared with similar data for the entire State of Ohio. This study suggested a relationship between the higher rates of C.N.S. malformations and the increased risk of exposure to vinyl chloride in these communities.

By analysing data collected through the Center for Disease Control's hospital-based birth defects monitoring programme (B.D.M.P.),² we examined this relationship. Two hospitals participating in the B.D.M.P. are located in cities with polymerisation plants: one is in Pennsylvania, the other in Painesville, Ohio. C.N.S.-malformation rates for white infants born in these two hospitals in 1970–74 were compared with the rates for white infants in each State. No increase was seen in the Pennsylvania hospital, but an increase, primarily in anencephaly and spina bifida, was noted in the Painesville hospital for the total time 1970–74 (see table).

1. Infante, P. in Proceedings of the Conference on Occupational Carcinogenesis at the New York Academy of Science, 25 March, 1975, New York in the press.

2. Center for Disease Control, Congenital Malformations Surveillance Annual Summary 1974, Atlanta, 1975.

THE LANCET, NOVEMBER 29, 1975

ANENCEPHALUS AND SPINA BIFIDA IN OHIO STATE AND IN PAINESVILLE HOSPITAL, OHIO

Year	Anencephalus				Spina bifida			
	Painesville		State		Painesville		State	
	No. of cases	Rate*	No. of cases	Rate	No. of cases	Rate	No. of cases	Rate
1970	0	0.0	26	5.0	3	31.2	58	11.1
1971	1	10.3	38	7.3	3	30.9	44	8.5
1972	3	35.6	31	6.3	0	0.0	47	9.6
1973	2	24.9	27	5.4	2	24.9	46	9.2
1974	0	0.0	22	4.5	1	15.1	29	6.0
1970–1974	6	14.1	144	5.7	9	21.2	224	8.9

* Per 10 000 total white births.

The B.D.M.P. hospital data for Painesville were compared with birth-certificate data from the Ohio department of health, and 1 additional case not included in the B.D.M.P. report was added, bringing the total to 15. 30 controls, the first normal white infant born before and after each case, were selected from the hospital birth registry. Medical records for cases and controls were reviewed to confirm the diagnosis and to obtain, among other data, the parents' occupation and residence at the time of the infant's birth. In addition, parents of 14 of the affected children were interviewed about previous occupations and residences.

The study revealed that none of the interviewed parents of affected infants had ever worked at either of the two P.V.C.-polymerisation plants in Painesville (1 set of parents could not be located, but records show that they did not work at these plants at the time of their infant's birth). 2 of the fathers of controls had worked at one of the plants at the time of their infants' births. None of the parents in either group lived within 2 miles of the two plants. The chi-square test of significance was used in comparing the distances from residence and work-place of mothers and fathers to the P.V.C. plants for cases and controls. Comparisons were made at distances of 1 to 10 miles, in 1-mile increments. A significantly larger proportion of control mothers than case mothers worked (including housewives) within a 10-mile radius of the P.V.C. plant, at the 95% confidence level. This is probably a chance occurrence among multiple comparisons.

Vinyl chloride is a known carcinogen,³ and concern has arisen over its possible teratogenic effects. This concern stems from recent studies which have shown (a) an increase in mutagenicity in bacterial assay systems⁴ and (b) increased breakage in chromosomes of P.V.C.-polymerisation workers.⁵ The Ohio Department of Health study¹ is the only report that has suggested that vinyl chloride causes birth defects in man. Although the follow-up study reported here confirmed a moderate increase in C.N.S. malformations in Painesville, Ohio, no association was found with vinyl-chloride exposure.

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LATE COMPLICATIONS OF TUBAL LIGATION

SIR,—Unlike Mr Darwish and Dr Saafan (Nov. 15, p. 975), we are uncertain as to the aetiology of the late sequelae of female sterilisation, which they refer to as menstrual irregularity, but in our study it will be noted we looked specifically at menorrhagia and dysmenorrhoea. It seems unlikely that a psychosomatic cause could be present when two different tech-

3. Center for Disease Control, Morbidity and Mortality Weekly Report, Feb. 9, 1974, p. 49.

4. Rannug, U., Johansson, A., Ramel, C., Wachmeister, C. A. *Ambo*, 1974, 3, 194.

5. Funes-Cravioto, F., Lambert, B., Lindsten, J. *Lancet*, 1975, i, 459.

File

THE EFFECTS OF MATERNALLY INHALED VINYL CHLORIDE ON
EMBRYONAL AND FETAL DEVELOPMENT IN MICE, RATS AND RABBITS

BY:

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December 19, 1975

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This study was funded by the companies supporting the vinyl chloride projects being administered by the Manufacturing Chemists Association, Washington, D.C.

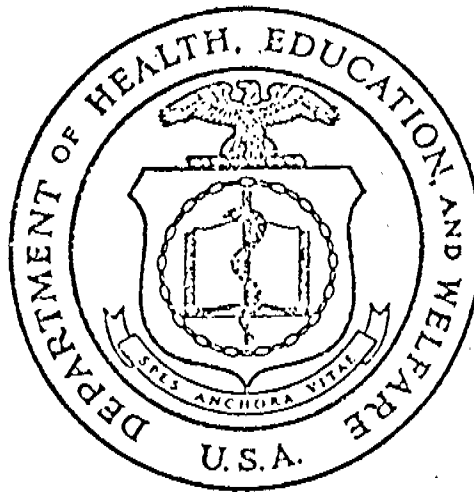
The results of these studies indicate that exposure of pregnant mice, rats or rabbits to vinyl chloride by inhalation at concentrations sufficiently high to cause maternal toxicity was not teratogenic in any of the three species. A significant increase in the percent resorptions was observed among mice exposed to 500 ppm vinyl chloride, but not among rats or rabbits exposed to 500 ppm or 2500 ppm vinyl chloride. Ingestion of 15% ethanol in the drinking water enhanced some of the effects of inhaled vinyl chloride.

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criteria for a recommended standard

OCCUPATIONAL EXPOSURE
TO
BENZENE



U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service

Center for Disease Control

National Institute for Occupational Safety and Health

1974

ASI 00022733

It is concluded from study of the relevant reports that an increased susceptibility to benzene of pregnant women or their offspring has not been demonstrated. The risk of exposure of pregnant women to benzene at levels below 100 ppm has not been defined. The literature contains statements such as that of Cassan and Baron [60] in 1956 that a pregnant woman must be removed not only from the work station but from the room where work with a benzene exposure risk is performed. Their statement is based (in part) on the measurement of RBC between 4.0 and 4.25 million in two pregnant women following their removal to another part of the room from the work station where they used a benzene varnish on electrical equipment. There are special requirements placed on the hemopoietic system of women in general, and especially during pregnancy. Although no definite hypersusceptibility to benzene vapor has been shown in women, pregnant women, or their offspring, it may be prudent to avoid exposing pregnant women to benzene. In the study by Smith, [16] the ages were quite evenly distributed between 17 and 52 years. Susceptibility to benzene poisoning was about equally marked between young and old, so youth was not considered to be a predisposing factor in benzene poisoning.

In view of the borderline hematological changes which occur in both man and animals from exposures to benzene and of the consequences which result from overexposure, it is considered that a conservative limit must be recommended. Therefore, in order to provide protection of workers to the effects of benzene poisoning over a working lifetime, it is recommended that an environmental limit for benzene of 10 ppm as a time-weighted average for up to a 10-hour workday, 40-hour workweek be adopted. In addition, in order to preclude acute effects from benzene, it is considered

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U.S. Department of Labor
Occupational Safety and
Health Administration



I am strong, I am invincible, I am a woman," sang Helen Reddy in a song that has become almost an anthem for the women's movement. The lyrics may be a forceful rallying cry, but the fact is that women are not invincible. And neither are men. The human body, of either sex, does indeed fall prey to the various assaults of the workplace.

Traditionally, working women have been shunted off into "women's jobs" because they were the "weaker sex." This reasoning was a handy excuse for job discrimination. And as many women have known all along, hazardous conditions often lurked behind the guise of "protection."

As women, with the force of law behind them, move into "men's jobs," they share men's exposures to the full range of safety and health hazards. And again the question comes up: Do men and women react differently to job stresses and toxic substances? Obviously, there's one very basic difference between the sexes: women have babies. And since this fact of nature isn't likely to change, any consideration of the occupational health of women also must include the health of the next generation.

These issues come to the fore as women enter the labor force in ever-increasing num-

Marrett, a University of Wisconsin sociologist, offers some explanations. "Today there are few of the obvious abuses to women workers that often were the rallying points for both reformers and researchers in previous decades," she says. "Perhaps even more problematic is the fact that concern for women's occupational health seems inconsistent with the current thrust toward equality."

In the old days there were abuses aplenty. Shocked by stories of deplorable working conditions, Congress in 1908 funded a study of the problems of working women. At about the same time, an investigation of phosphorous match factories revealed serious poisoning among the industry's 2,540 workers, about half of whom were women and children. The phosphorous poisoning caused degeneration of the bones, especially the jaw, producing a horrible deformity known as "phossy jaw."

A few years later, in 1912, 154 women and girls died in a fire at New York City's Triangle Shirtwaist Factory, a building that had no fire escapes.

Such tragedies led many states to pass so-called "protective legislation" to spare the "weaker sex" from long hours, hazardous jobs, and unsanitary conditions. As women took over jobs vacated by men during

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These issues come to the fore as women enter the labor force in ever-increasing numbers. Women today account for about 40 percent of the nation's workers—compared to 20 percent in 1920. Fifty years ago the average woman worker was single. Today she's married—and in the child-bearing age range.

Yet, there is an appalling lack of scientific information about the occupational health of women and especially about the effects of job hazards on the fetus. Consequently, none of OSHA's standards contain special provisions for women, pregnant or non-pregnant, and criteria documents on recommended standards transmitted to OSHA by the National Institute for Occupational Safety and Health (NIOSH) barely touch the subject of special hazards for women.

The whole issue, of course, is further clouded by another thorny question: In a time when women are just beginning to enjoy their newly-won rights to equal employment at equal pay, how do we assure them safety and health at work while protecting them from further job discrimination?

A long way, baby?

For about the past 50 years, the job safety and health problems of women have ranked at the bottom of the research list. Cora

A few years later, in 1912, 154 women and girls died in a fire at New York City's Triangle Shirtwaist Factory, a building that had no fire escapes.

Such tragedies led many states to pass so-called "protective legislation" to spare the "weaker sex" from long hours, hazardous jobs, and unsanitary conditions. As women took over jobs vacated by men during World War I, research interest in working women continued. Occupational health pioneers like Dr. Alice Hamilton, believing that women were more susceptible to such hazards as lead, urged passage of special laws to protect women in the workplace.

Then in 1920—the same year women got the vote—Congress created a Women's Bureau within the Department of Labor to promote employment opportunities for women and to look out for the special needs of women workers.

When Rosie the Riveter and her cohorts moved into the factories during World War II, the U.S. Army decided to sponsor a study of women's capability to perform certain jobs and of "the relationship of employment to the health of women." The resulting report, *Women In Industry: Their Health and Efficiency* by Dr. Anna Baetjer of Johns Hopkins University, concluded that "there is not reliable evidence to support the generally accepted view that women are more susceptible than men to occupational diseases." She added: "There is, therefore, at present no reason why normal women should be restricted any more than men from working at jobs which involve the use of toxic chemical substances. Under all circum-



In 1961-63, 12,000 pregnant women were asked what jobs they held. Their husbands' occupations were, however, carefully noted!

stances the exposures should be kept below harmful levels."

Baetjer did warn, however, that because of the physiological changes that take place during pregnancy, "there is every reason to believe that pregnant women might be adversely affected by exposure to concentrations of toxic substances which would usually be safe for normal women." The report cited the Department of Labor's Standards for Maternity Care and Employment of Mothers in Industry, which cautioned against pregnant women being exposed to such things as benzene, carbon monoxide, carbon disulfide, chlorinated hydrocarbons, lead, mercury, radiation, and turpentine.

Baetjer's book, published in 1946, still represents most of what is known about how industrial employment affects women, pregnant or not. For when the war ended, men went back to the factories, and women went back to the home. Women's occupational safety and health was a dead issue. There was no life here of re-orientation as the women's rights movement gained steam and the idea of "protective legislation" became alien to many women.

But since the passage of the Occupational Safety and Health Act in 1970, concern about women workers has revived as part of the move toward protecting all workers from job hazards. Attention has focused especially on pregnant women as news of birth defects and cancer among children of mothers who took certain drugs during pregnancy hit the front pages.

America's best kept secret

One sociologist has called the working woman, and especially the working mother, "one of America's best kept secrets." Despite their growing numbers in the work force, women have received scant attention in epidemiologic studies. "A review of the past five years of journals which publish occupational health studies gives the subjective impression that the woman worker is not part of the work force that is being described," says Dr. Vilma Hunt, an epidemiologist from Penn State University. She cites as a typical example a paper that defined the study population as 31,203 male employees of a particular plant and added that "in order to simplify design, the 5,261 female employees were excluded from the study."

In one of the few studies that did include information about employment during pregnancy—a health interview survey conducted

by the National Center for Health Statistics during 1961-63—women were not asked what jobs they held. Their husbands' occupations were, however, carefully noted!

Penn State sociologist Dr. Edna Rapha points out that investigation of women work experience is difficult because women often want to forget the unpleasant and unrewarding jobs they held before marriage. Data collecting is further hindered because many married women have varied work histories that include moving from job to job, repeated entries and exits from the labor force, and both part-time and full-time employment.

To some degree, the lack of research is direct result of so few women in industrial jobs. As Dr. C. Craig Wright, president of the American Occupational Medical Association (AOMA), points out, "It's only very recently that laws and the encouragement of women's groups have resulted in more women—and more pregnant women—working in industry."

Because of the lack of information, many of the stereotypes about women workers rest on shaky foundations. Dr. David Wegman of the Harvard School of Public Health suggests that common beliefs—women are too weak to do heavy work, women cannot tolerate temperature extremes as well as men, women are more susceptible to toxic substances—are mostly well cultivated myths. Studies show that on the average women's absolute strength is about two thirds that of men. However, Wegman points out, other studies reveal more differences in strength between working and non-working women than between working women and working men. And although the temperature regulation mechanism apparently is different in the two sexes, women can regulate their body temperature equally as well as men. Therefore, Wegman urges employers to set criteria on work strength and endurance for specific jobs and then to hire individuals, regardless of sex, who can meet those criteria.

Wegman points out that early judgments about women's greater susceptibility to certain substances often were based more on opinion than on proven fact. For example, a study showing that women were more susceptible to benzene was counterbalanced by a study suggesting that men were more susceptible, although in neither case were exposure levels reported. In fact, it is difficult to dispute Anna Baetjer's conclusion

that non-pregnant women are no less tolerant of toxic substances than men.

Even some beliefs about the effect of work on pregnant women are not supported by solid evidence, Wegman contends. While some studies suggest that working late into a first pregnancy may increase the chances of premature birth, other studies show no effect. Most authorities agree that working during pregnancy rarely creates complications, although some common-sense precautions—against fatigue and heavy lifting, for example—are necessary.

When it comes to the effects of job exposures on the developing embryo, Vilma Hunt believes that researchers have ignored an important population-at-risk—the thousands of children who were present in workplaces during their mothers' pregnancy. According to the National Center for Health Statistics survey, almost one-third of the women who gave birth during 1963 were employed at some time during pregnancy. Sixty percent of the women having their first child and 22 percent of those who had had previous children worked while pregnant. Yet, says Hunt, "If we ask the question, 'Is the offspring of the working mother at higher risk than that of the non-working mother?' we still do not have an answer to apply to the United States in the year 1975."

Three categories of hazards

Obviously, the specific hazards women workers face are as varied as the jobs they hold. But Clara Schiffer, a program analyst in the Department of Health, Education, and Welfare, suggests that job safety and health problems of women can be divided into three groups: those associated with the sex-stereotyped jobs many women hold; those that are common to both women and men workers; and those that relate only to women's reproductive ability.

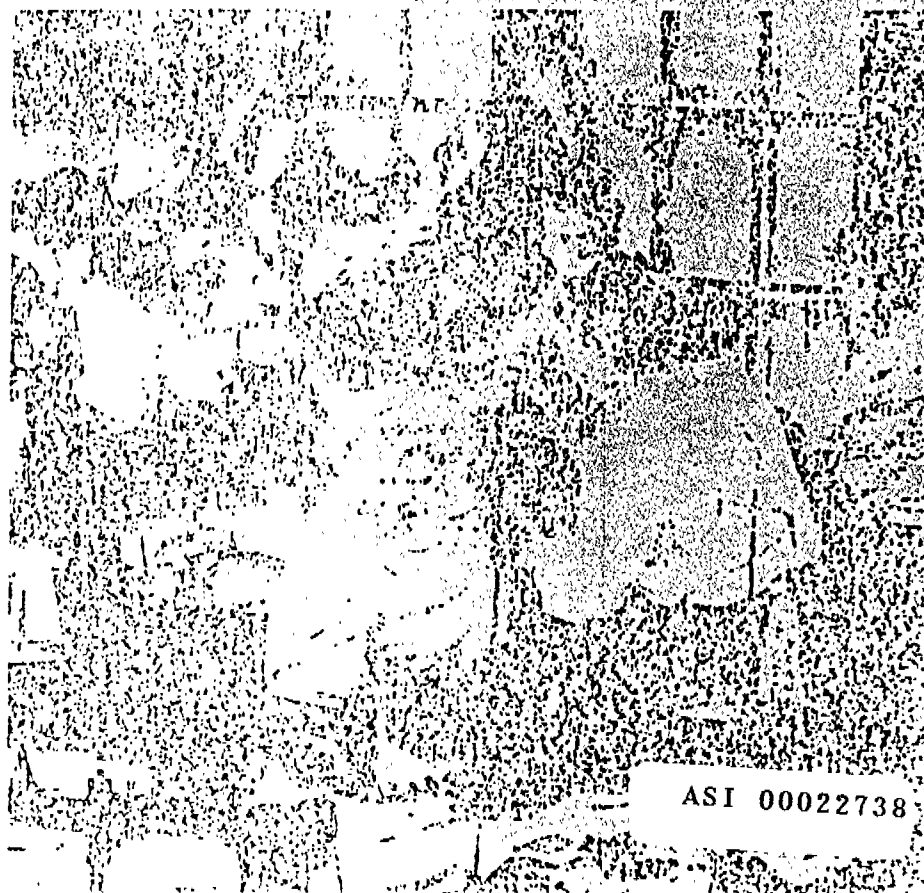
"Women's jobs" exist in both blue-collar and white-collar employment. Clothing factories and textile mills, for example, have traditionally employed many women—often in jobs that can hardly be called "protected." The Amalgamated Clothing Workers of America (AFL-CIO), a majority of whose members are women, recently funded a one-year investigation by NIOSH of hazards in the clothing industry. Industrial hygienist Dr. Peter J. Nord concentrated his survey on the men's apparel industry, which employs some 400,000 workers—about 85 percent of them women. Although most of

these "women" production workers who operate some kind of sewing machine, Nord found that they are exposed to a startling variety of hazardous chemicals used to treat fabrics, various oils and waxy lubricants, and spray adhesives; oil mists from oils used to lubricate thread; high noise levels from machinery; trichloroethylene, a solvent used to dissolve plastic heating threads; such chemicals as chloroprene and styrene that are used to spray the edges of cloth to prevent raveling, and lint and dust. ("You should see me in the tub," one woman told Nord. "I have so much dust on me that the bath water turns the color of the fabric I worked with that day.")

Nord found that most clothing manufacturers have no idea what chemicals they're using. "Before a garment is completed, as many as 10 different chemicals may be put on the fabric to make it permanent press and flame retardant," he says. "But apparel plants are so far down the line from the chemical plants that make these products and the textile mills that apply them that no one in the clothing industry really knows their biological effects." The heat and humidity in clothing plants can cause the chemicals applied to fabrics to oxidize and release such substances as formaldehyde.

Nord notes that occupational dermatitis is common among people exposed to chemi-

More than 150 women died in a fire at New York's Triangle Shirtwaist Factory in 1911. The disaster led many states to pass "protective legislation" for the "weaker sex."



ASI 00022738



Dust and dangerous machinery are common hazards in many "women's jobs" in the textile industry.

cal finishes on cloth, but no one has yet studied the extent of this problem in the clothing industry. He believes that pulmonary function tests also are needed to determine if respiratory disease results from inhaling dusts and fibers from chemically treated fabric.

Some attempts to control hazards in clothing plants are almost laughable. A common sight in storage areas, Nord reports, is a bag of charcoal briquets hanging from the ceiling to chemically control formaldehyde. In an effort to control fumes, one manufacturer installed a hood vent near a spot dry cleaning operation, but the exhaust tube simply looped under the work table—and ended! In another plant, buttonhole and bar tack machines were fitted with plastic shields to protect the seamstress from flying broken needles. However, the plastic was of such poor quality that the women got headaches from trying to see through it to guide their work. Their solution: remove the guards.

In some parts of Appalachia, many women who work must choose among the textile and clothing mills that have flocked to the region. Working conditions in some of these factories are described in a recent book, *Hillbilly Women*, by Kathy Kahn.

One woman employed in a north Georgia carpet mill tells what it's like to work in the pervasive dust: "There's no place in the mill to move away from the dust. They get air hoses in there to move the dust, but just made more dust for us to breathe off. Now they stopped that cause it was making our eyes go bad." And because of the often brutal pace in the mills, some of the women have a drug culture all their own. "Pill can be got just by snapping your fingers," says the carpet mill worker. "The women have to use them lots of times cause of the rotating shift and getting used to it. See they have to keep up their production. So they use the pills to speed them up when they don't feel so good."

In some lines of work, "women's jobs" are not only lower-paying and less prestigious but also potentially more hazardous. In some clothing plants, for example, men have the higher-paying job of cutter while women operate the machines. In her survey of women's jobs in the District of Columbia Clara Schiffer found that in laundries men usually are employed to run the washing machines, but women are hired to do the pressing—and consequently to experience heat stress.

You can always be a nurse, stewardess

For the woman who has aspired to a profession, and who could afford the training there have been any number of "appropriate" jobs—nurse, laboratory technician, airline stewardess, teacher, beautician. Today we're finding out that these jobs aren't as safe as they look.

In ministering to the sick, nurses (and other hospital workers, many of whom are women) are exposed to drugs, germicides, x-rays, and radioactive materials used for diagnosis and treatment; suffer back strains from lifting; and risk infection from needle punctures and exposure to contagious diseases. A recent study indicates that nurses, possibly because they are on their feet for long periods, are more susceptible to blood clots in their legs. Perhaps even more troublesome are findings of more spontaneous abortions and defective offspring among nurses exposed to anesthetic gases in operating rooms. A Canadian research group also found a higher incidence of birth defects among the children of nurses who cared for infants with infectious diseases and congenital defects.

An estimated 125,000 women in the United States work in laboratories, where

they are exposed to radiation, drugs, and such chemicals as mercury that have caused damage to the fetus among experimental animals. Even supposedly "safe" occupations, such as teaching or day care work, can expose women to rubella and other viruses that could damage the fetus if disease is contracted in the early stages of pregnancy.

A recent NIOSH study of beauticians and cosmetology students throughout Utah showed a high incidence of lung problems, possibly caused by inhaling large amounts of hair spray.

When it comes to "women's jobs," what could be more glamorous than jetting about in the "friendly skies" on the "wings of man"? Yet, stewardesses are making it known that behind their smiles lurk a variety of health problems that they attribute directly to their work. "The average tenure of a flight attendant used to be a year and a half, but now it's more than six years," says Del Mott, a stewardess for 10 years and currently director of safety for the Association of Flight Attendants. "We have some people who have flown for 15 or 20 years, and I think the jet age is finally catching up with us." She is trying to get funding for a comprehensive study of the health problems that afflict women flight attendants—kidney ailments, menstrual disorders, alcoholism, and a mysterious nerve condition that resembles multiple sclerosis. Mott suspects that nervousness and perhaps other problems may be caused by the constant roar of jet engines, as well as by ultrasonic sound and possibly even subsonic noise (or "infrasound") that causes body vibration.

Then there is the constant fatigue. Mott points out that flight attendants are not covered by the same flight time-duty time regulations that govern pilots, so it is not inconceivable for an attendant to work up to 20 or 30 hours without adequate rest time.

Safety hazards in the air include galley equipment that isn't properly secured and attendants' jump seats that come unfastened from the wall. And with the newer, bigger planes come new hazards. "The DC-10's, for example, fly at a three- to five-degree angle with the nose up," Mott explains, "so our flight attendants are experiencing severe leg and back pains from constantly walking uphill or downhill."

A perpetual worry is possible radiation leakage from radioactive materials carried in the cargo compartments of commercial airliners. Last summer the Atomic Energy

Commission (recently replaced by the Nuclear Regulatory Commission and the Energy Research and Development Administration), the Department of Transportation, and airline employees cooperated in a study to determine how much radiation flight attendants are exposed to, both from cosmic and natural sources and from radioactive materials. For eight weeks some 200 attendants wore small dosimeter badges that measured low-level radiation. The results of the study are expected to be available this spring.

Del Mott points out that one study isn't enough. "We have enough reports of safety and health problems that it's time to sit down with researchers and ask them to substantiate our own informal findings," she says.

Equal jobs, equal hazards

In the last decade, many of the barriers to equal employment for women have come tumbling down. The biggest breakthrough was passage of the 1964 Civil Rights Act, Title VII of which prohibits discrimination based on sex, as well as on race, color, religion, and national origin. The Equal Employment Opportunity Commission (EEOC), which enforces Title VII, has issued "Guidelines on Discrimination Because of Sex." These bar hiring based on stereotypes of the sexes; prohibit classification and advertising of jobs by "male" and "female" categories; and specify that "protective" state laws prohibiting or limiting employment of women in certain occupations, during certain hours, or for certain periods before and after childbirth are superseded by Title VII.

The law clearly gives women the right to be considered for jobs on an equal basis with men. But it also gives them the dubious right to share a whole host of occupational hazards. As women move into the construction trades and into a wider range of industrial jobs, they too must contend with asbestos, silica, carbon monoxide, lead, and other common health hazards—as well as with new chemicals about which even less is known.

John Zalusky, research director for the Allied Industrial Workers International Union and a member of the ad hoc committee on lead hazards convened by the AFL-CIO's Industrial Union Department, describes what is happening in one midwestern plant: "The plant has two parts. One makes electronic equipment, and the other makes lead



Flight attendants have their own problems at 20,000 feet: equipment that comes unfastened from walls and noise levels so high in some galleys that "we don't talk, we shout."

storage batteries for automobiles. There already are a lot of women employed in the electronics part where they can be exposed to lead in soldering fumes. But because of the equal employment opportunity laws, the company also is trying to move women into the higher paying jobs, which happen to be in the battery manufacturing section. This means that even more women will be exposed to lead." Lead is one of the substances that, according to some of the scientific literature, causes abortions and stillbirths among women exposed to it during pregnancy.

Equality is a mixed blessing for other women workers like Juanita Mims, a member of the United Furniture Workers Union and an organizer of the Baltimore chapter of the Coalition of Labor Union Women. The plant where she works now employs mostly women to manufacture curtain rods and drapery hardware. The workers are exposed to dangerous machinery, oil-slick floors, and oil mists from machine lubricants, and they risk back strains from lifting heavy metal. "The department where I work used to be mostly men, but with equal employment opportunity, our union fought for the right of women to have any job they wanted and could do," Mims explains.

The pregnant worker

The EEOC guidelines also assure specific rights for the pregnant woman. Employers cannot exclude from employment any applicants or employees because they are pregnant. Further, disabilities caused by or associated with pregnancy, miscarriage, abortion, and childbirth must be considered temporary disabilities and treated as such under any health insurance or sick leave plan available to all employees.

It is a significant victory for women that child-bearing can no longer be used as an excuse for discrimination in the workplace. But the abolition of "protection" for the pregnant worker makes it even more crucial to learn more about the third category of job hazards—those that directly affect the female reproductive system. One study that has caused quite a stir is a survey of operating room personnel conducted by NIOSH and the American Society of Anesthesiologists. The study showed that the risk of spontaneous abortion was 1.3 to 2 times higher among women who worked in operating rooms during the first three months of pregnancy or during the year preceding preg-

nancy. There was also a 60 percent to two-fold increase in birth defects among children born to women who worked in operating rooms. Yet, only about 21 percent of the nation's hospitals are now equipped with devices for removing waste anesthetic gases from the operating rooms.

There are other indications of growing recognition of pregnant women as an occupational group. In its recommended standard for occupational exposure to vinyl chloride, NIOSH notified OSHA that "in view of the preliminary results of animal toxicology studies, it is recommended that no woman who is pregnant or who expects to become pregnant should be employed directly in vinyl chloride monomer operations." The recommendation was based on findings by an Italian scientist, Dr. Cesare Maltoni, that pregnant rats exposed to vinyl chloride gave birth to offspring afflicted with angiosarcoma, the rare liver cancer that has killed a reported 32 vinyl chloride workers worldwide. No special provisions for pregnant women were written into OSHA's final standard on vinyl chloride because OSHA experts did not believe the scientific evidence of a hazard was strong enough for such provisions to withstand the stiff court challenges they would inevitably face.

Unlike earlier NIOSH criteria documents, the recent document on benzene also devotes specific attention to the potential hazards for pregnant workers: "Although no definite hypersusceptibility to benzene vapor has been shown in women, pregnant women, or their offspring, it may be prudent to avoid exposing pregnant women to benzene."

Perhaps more troubling, though, are some findings from a new field of occupational health research known as behavioral toxicology—the investigation of subtle changes in the functioning of the brain and nervous system produced by long-term, low-level exposures to certain substances. Dr. Joan Spyker of the University of Virginia Medical School points out that the placenta is a limited barrier at best and that molecules of almost all substances can cross the placenta by simple diffusion or by some type of active transport system. Therefore, nearly every chemical entering the pregnant woman—by ingestion, inhalation, or skin absorption—ultimately will be found in the fetus. Teratogens—those substances that can cause abnormalities in offspring—may have a special affinity for developing brain centers and produce effects that show up as be-

Radiation, drugs, and an endless variety of chemicals may pose health risks for female lab employees—and their unborn children.



havioral problems, sometimes not until later in life.

To determine if there are subtle and long-range effects from prenatal exposure to a neurotoxic substance, Spyker injected healthy pregnant mice with methyl mercury. (All forms of mercury, which is widely used in industry, are capable of converting naturally into methyl mercury.) When the young were born, she selected for study 372 that appeared normal. Close study of these "normal" mice throughout their three-year life spans produced some startling results. The test mice, for example, did not explore as normal mice did and could not seem to perceive the edge of their territory, although there was no sign of changes in their brains.

Spyker found, however, that these early indications of trouble were indeed forewarnings of later developments: neuromuscular and learning deficits, infections, posture problems and other structural abnormalities, defective immune systems, general debilitation, and early aging. This evidence, Spyker concludes, suggests "that evaluation of subtle and long-term consequences of prenatal exposure is essential for a thorough assessment of the impact of occupational hazards on human health."

What is being done?

Taking action on women's occupational hazards within the boundaries of the law represents a dilemma for labor, industry, and the government agencies responsible for setting workplace standards.

Women themselves are bringing the issue to the fore. This year's annual meeting of the prestigious American Association for the Advancement of Science featured a session on the occupational health status of women. And women workers are banding together to lobby for improved conditions. The Association of Flight Attendants and the more militant Stewardesses for Women's Rights are fighting safety and health problems at 20,000 feet. The newly-organized National Union of Hospital and Health Employees, representing some 70,000 hospital workers, is trying to control hepatitis exposures among lab technicians who handle blood plasma, to improve housekeeping in the labs, and to look into such potential new hazards as using microwave ovens to heat hospital food.

Another group that plans to focus on the safety and health of female workers is the Coalition of Labor Union Women, which since its founding convention in March 1974



has chartered 32 chapters with 2,500 to 3,000 members nationwide.

However, many women on the job still don't realize the potential hazards they face. Pearl Spindler of the Labor Department's Women's Bureau reports that most of the letters the Bureau receives still reflect concern about discrimination—an employer trying to prevent a pregnant woman from doing a job she feels she can do, for example. To try to alert women to some of the problems, Andrea Hricko of Ralph Nader's Health Research Group is writing a pamphlet for women workers that will be available later this spring. Information about ordering copies can be obtained from the Health Research Group, 2000 P Street, N.W., Washington, D.C. 20036.

On the government front, NIOSH can point to its anesthesia study, its warnings about vinyl chloride and benzene, and its study of cosmetologists. The Institute is pursuing the vinyl chloride issue further by cooperating with the Ohio Department of Health in a study of congenital abnormalities among residents in the vicinity of vinyl chloride polymerization plants. NIOSH also is conducting a massive study of employee safety and health programs in the nation's hospitals—an effort that will result in seven reports

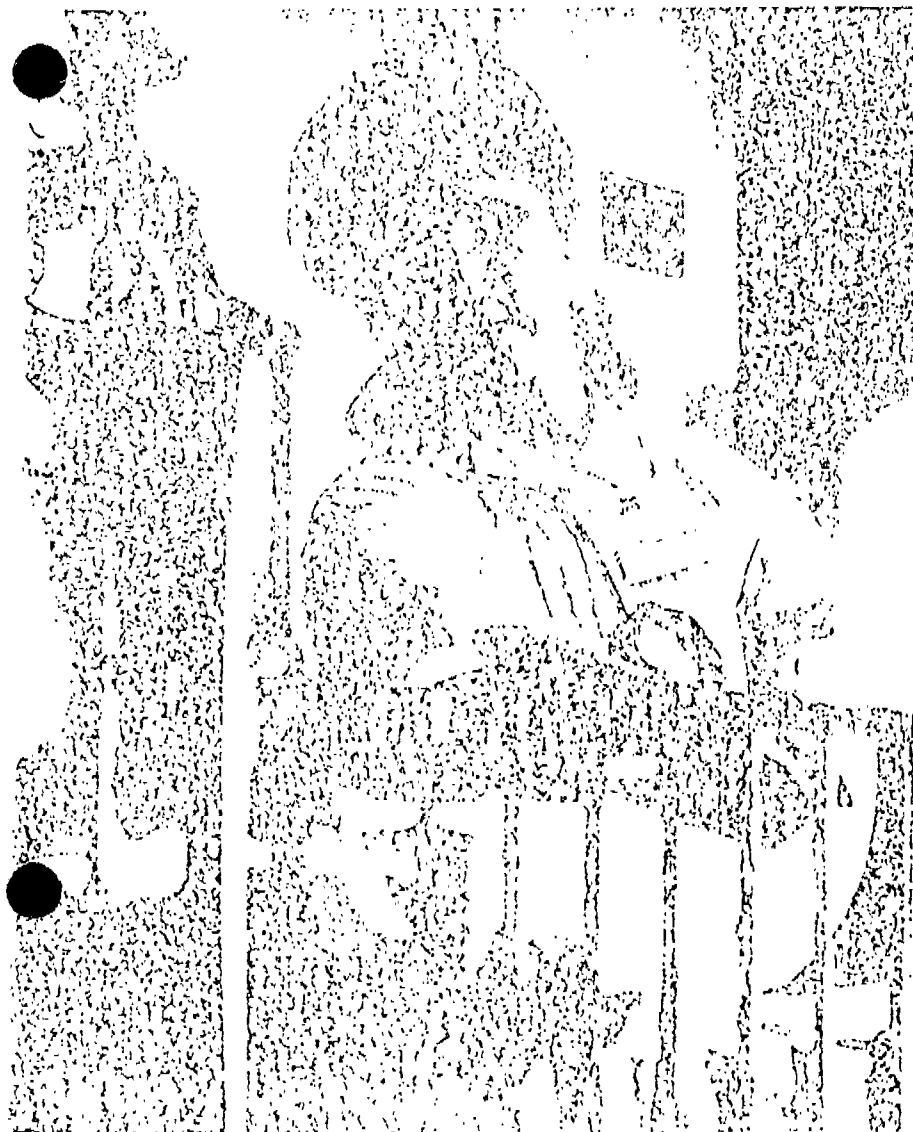
Sometimes the solution is as bad as the problem. These seamstresses get headaches from straining to see through plastic shields designed to protect them from flying, broken needles.

and a recommended action program "to protect and promote the health of three million hospital workers."

Dr. Joseph Wagoner, director of NIOSH's Division of Field Studies and Clinical Investigations, reports that his division has surveyed the 13,000 substances on NIOSH's Toxic Substances List and found that 181 of them have shown teratogenic or mutagenic (chromosome-altering) effects in animals.

OSHA, of course, must rely on sound scientific data in setting new standards. And OSHA recognizes that including special provisions in standards is bound to raise the question of women's rights to equal job placement. But, says Dr. Donald Lassiter, OSHA's special assistant for occupational health, "If there is any substantial evidence that there are specific hazards for women of child-bearing age—that they should not be exposed to a substance or that their exposure should be specially controlled—this would be written into standards. If information comes to our attention about teratogenic effects of substances we already have standards on—or of ones we don't—we would

Even ministering to the sick can be hazardous to your health. Back strains, blood clots, and infectious diseases are some of the problems nurses face.



automatically ask NIOSH to evaluate it, although NIOSH, as a research agency, would be much more likely to be aware of such information before OSHA would." Lassiter points out that OSHA is in the position of trying to control things that have never been controlled before. "That's why we're in the courts all the time. The effects of certain substances on fertile or pregnant women is just one aspect of a field that in general we know very little about."

All of this naturally leaves industry in a quandary. As more women move into industrial jobs once held only by men, larger companies can be expected to take a closer look at hazards to women. Exxon, for example, plans to start a research program on the effects of benzene on women. "Our recommendation probably will be that women of child-bearing age should not be exposed to benzene until the facts are in," says Dr. Norbert Roberts, Exxon's medical director. "If we don't take such action, we may be in trouble scientifically; and if we do, we may be in trouble legally. But we'd rather face the EEOC than a deformed baby."

Concern about potentially hazardous occupational exposures has already led to some recommendations that women activists consider drastic. For example, the Environmental Health Committee of the Lead Industries Association, Inc., recently recommended against employing "fertile, gravid [pregnant], or lactating females in the lead industries until such time as adequate information has been developed regarding the effect of lead. . . ."

In a similar case, the National Council on Radiation Protection recommended that in order to minimize exposure to the fetus or embryo, occupational radiation exposure limits should be reduced for all fertile women. Concerned about the impact of such limitations on women's employment opportunities and about the invasion of privacy involved in determining if a woman is pregnant or fertile, the Nuclear Regulatory Commission (NRC) has taken a more cautious approach. In proposed amendments to its regulations, which appeared in the *Federal Register* January 3, the NRC did not propose setting different exposure limits for men and women. Instead the regulations would require all NRC licensees to instruct workers exposed to radiation about the biological risks to embryos and fetuses, ways to minimize exposures, and the functions and purposes of protective devices.

New excuses for discrimination?

One who fears a trend against employing women of child-bearing age in certain jobs is Dr. Jeanne Stellman, health and safety specialist for the Oil, Chemical, and Atomic Workers Union (OCAW). She objects to the recommendation of the Lead Industries Association because no safe level of lead exposure has been clearly established for either men or women. She notes that while the association seeks to protect women and their unborn children from the hazards of lead, a survey of OCAW members has shown that a sizable number of workers in the lead industries already have toxic levels of lead in their bodies. "Selecting out certain groups in the labor force is the easy way," she maintains. "It's a cop-out to exclude just women of child-bearing age from certain jobs while permitting older women or men to do those jobs."

Aside from the argument that exclusionary policies violate the Civil Rights Act, Stellman adds, such practices would have an adverse economic impact on women workers. She points out that 22 percent of all American households are headed by women. More than half of these women work and are the sole source of income for the family. At least 30 percent of the jobs they hold may have potential toxic exposures. The solution, as she sees it, is to improve working conditions for *all* workers. "I consider it morally reprehensible to be more concerned about the fetus than about adult workers," she says.

Noting that human reproduction depends on two sexes, everyone from Mary Hilton, deputy director of the Women's Bureau, to the Health Research Group's Andrea Hricko would like to see research about the effects of job exposures on the reproductive systems of both women and men. Pointing to some studies indicating that workplace exposures of fathers may be linked to birth defects in their children, Hricko maintains that "our current emphasis on the hazards of chemical exposures for child-bearing age women may be one-sided." The Mioshi anesthesia study, for example, revealed a 25 percent increase in the incidence of birth defects among children born to wives of male operating room personnel. A Canadian study that traced the occupations of fathers of children who died from cancer before the age of five showed that a significant number of the men held jobs in which they were exposed to hydrocarbons. Did the fathers expose their young children to hydrocarbons through con-

tact at home? Or did the occupational exposure affect spermatogenesis? The scientists recommended further investigation.

Meanwhile, the old question remains: what to do until the data come in? Most authorities agree that it's only common sense to keep pregnant women away from suspect materials. But Harvard's David Wegman cautions that it's simplistic to regard all fertile women as pregnant or about to become so. "Unfortunately, it's often assumed that a woman in the child-bearing years (15 to 45) is pregnant unless proven otherwise," he says.

Women workers should be encouraged to report pregnancies early, because the most dangerous time for the developing fetus is during the first three months. Ideally, the pregnant employee should then be transferred to an area where she will not be exposed to potentially toxic chemicals. "We're getting to the point where we are considering individual needs more," says m.w.'s Clara Schiller. "I don't think special consideration for pregnant workers when necessary negates women's rights. After all, industry would not put a man who has just had a heart attack into highly physical work or expect a lightweight man to lift heavy objects." Unfortunately, few workplaces seem to have such transfer policies yet. According to NIOSH's survey, less than 15 percent of the nation's hospitals—which one might think would be especially concerned with employee health—have any kind of policy for transferring pregnant workers to areas where they would less likely receive dangerous exposures.

Sure cure

Clearly, industry, labor, and government must recognize the growing importance of women in the nation's labor force. There is a crying need for more information about women as an occupational group and especially about the teratogenic and mutagenic effects of new substances being introduced into the workplace every year. But the sure cure, as many see it, is adequate protection for all workers. When all working men and women are assured of a safe and healthful workplace, as the Occupational Safety and Health Act was designed to accomplish, there will no longer be a need for special concern—or a special magazine article—on the occupational safety and health hazards faced by women workers.

Ms. Stellman is associate editor of JOB SAFETY & HEALTH.

The intent of this paper is to relate current thought in proper perspective to the mounting concern for the pregnant woman in industry. Embryo toxicology may demonstrate a need for lowered standards of exposure for the woman worker during a pregnancy. Lastly, a plan is offered to obtain data for comparison of female work populations which may or may not be exposed to certain, primarily airborne, contaminants.

The pregnant woman in industry

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Introduction

Currently, 43 percent of 106 million females in the United States are in the labor force.¹ Assuming 63% are in the childbearing ages of 16-44 years and a fertility rate of 74 births per 1000 women, there is a possibility of 2 million pregnancies occurring to those women employed per year. All pregnancies among working women are hardly at risk in terms of occupational exposures, but the potential numbers demand appropriate consideration when women of childbearing age are gainfully employed. Of still further interest, rate of miscarriage and stillbirths, estimated at about 15 percent, is not included in the above calculations.

Major consequences of certain types of exposures include mutagenesis, miscarriage (abortion), stillbirth, prematurity, teratogenesis and carcinogenesis.

As early as 1931, McCord, writing on occupational health, listed lead, x-ray, alcohol, and mercury as "race poisons."²

Early in this decade, speaking as President of the American College of Obstetricians and Gynecologists in regards to the environment of the pregnant worker and her fetus, Dr. K. P. Russell pointed out:

"The obstetrical axiom that we are always dealing with *two* individuals rather than *one* is well known, but not always appreciated. For it is not the pregnant worker alone with which we should be concerned, but also the health of the unborn. To be well-borne should be a basic right of every fetus."³

For more information about author, see page 446 . . .

Working as a physician two years in the Department of Obstetrics and Gynecology at the University of Michigan Medical Center, located only a half-hour drive from the highly industrialized metropolitan Detroit, I saw no significant reflection of industrial exposure upon the reproduction capabilities of the female worker. Obvious factors relating to infrequency of association include insufficient exposure, unreliability of patients' histories and frank failure of patients to perceive and report delayed menstruation early in pregnancy (at least twelve percent of menstrual cycles are predictively irregular in reproductive-age women). Other factors precluding discovery relate to voluntary termination early in pregnancy and the diagnosis of most malformations some interval after birth. Last but not least is the reasonable tendency for a person to go to the closest medical center for emergency services; in the case of the university setting described, distance is a factor. Thus, if the setting is not justly appropriate, it may be difficult to see an overt cause-and-effect relation on the homeostatic condition of the female worker and her offspring.

Deleterious contaminants

A partial list of substances, known or highly suspect for their potential to adversely affect the embryo or fetus, include:

Alcohol
Aniline
Arsenic
Benzene
Carbon Disulfide

Methyl Mercury
Nicotine
Nitrates, Nitrites, and other
Causes of
Methemoglobinemia

Carbon Monoxide
Caplan
Formaldehyde
Hexachlorobutadiene
Hydrogen Sulfide and
Other Causes of
Sulfhemoglobinemia
Lead
Mercury

Nitrobenzene
Phenol
Phosphorus
Polychlorinated Biphenols
Radon (ionizing)
Selenium
Toluene
Turpentine
Vinyl Chloride
Xylene

Those boldfaced are currently exempt from United States occupational standards.

Broad categories include some general medical preparations, several narcotics (e.g., heroin and methadone), the anticancer chemotherapeutic agents and certain infectious agents.

Women in certain professions, nursing for example, rank surprisingly high in terms of potential exposure. Exposures of possible significance include those to ethyl chloride, ethyl ether, isopropyl alcohol, nitrous oxide, trichloroethylene, halothane, ultraviolet and ionizing radiation, and infectious disease.

In several countries, an increased incidence of spontaneous abortion among pregnant operating room personnel, led to an index of suspicion and further observation.^{1,2} The results of a recent and carefully planned nationwide survey have, to quote a recent AOMA Report, "... suggested a possible cause-effect relationship between exposure to (trace) anesthetic gases and higher than normal occurrences of spontaneous abortion among operating room female personnel and higher than normal incidence of congenital abnormalities of their offspring."⁶ These results, in-part summarized in the following paragraph, provided the final impetus for sufficient concern and development of criteria documentation.

Among nurses directly involved in the administration of anesthesia, the age and smoking standardized spontaneous abortion rate per 100 pregnancies was 17.0 versus 14.4 for unexposed members of the same professional group, for an increased incidence of 18 percent.⁷ Even more striking was the comparison involving standardized congenital abnormality rates among their offspring: 9.6 versus 5.9 percent, for an increased incidence of 63 percent. These data do not include the far more common skin abnormalities. Lastly, the standardized congenital abnormality rate among offspring of unexposed wives of exposed males was 8.2 versus 3.7 percent, for an increased incidence of 122 percent. Halothane (2-bromo-2-chloro-1,1,1-trifluoroethane) and nitrous oxide are highly suspect etiological factors, and the unscavenged operating room concentrations

are frequently in the range of 10 and 600 ppm. It is concluded that personnel avoid work in such areas at least during the first trimester of pregnancy.

Research with laboratory animals has demonstrated that certain exposures early in pregnancy are followed by miscarriage, later exposures by teratogenesis and still later exposures by malignant degeneration.^{4,8} Thus, lethality appears most related to the earliest of exposures.

Sample approach

The difficulty and unreliability in the extrapolation from laboratory animal research to human interpretation is no secret. If the present trend in increased employment of the female worker is to be continued, a better understanding of undesirable consequences, however small they currently seem, and their rate of occurrence will assist in determining if there is need for change in the working environment. Current legal restrictions all but forbid maternal research. Discovery is left to the analysis of accidents and exposures to currently accepted threshold limit levels.

To furnish control or base line data, a simple health statistical survey (assisted or self check-off) of appropriate prenatal history might be considered in selected population groups. The nature and extent of exposures and outcome of all previous pregnancies should be incorporated in the employee's overall health record. Introduction of the health survey might be accomplished with the general preemployment health evaluation, and follow-up provided with additional pregnancies.

A sample procedure-questionnaire is illustrated; the method attempts to incorporate simplicity and flexibility.

Summary

Occupational exposures involving primarily airborne contaminants may affect the course of pregnancy, the development of the embryo and fetus, or both. The contaminants are found in industry in the chemical trades.

A chief danger period in any pregnancy occurs during organogenesis (principally the first trimester); lower standards of exposure or temporary retirement from potentially hazardous situations should be considered for protection of the developing embryo.

Health Statistical Survey

Serial Number (Starting with 1)

TO: Female Employees

Please return one survey form for each previous pregnancy to the Medical Department. These forms are a part of your medical record. We are concerned with your health and well-being, and the health and well-being of any future pregnancy. Whether or not you are planning a pregnancy, we want you to have the very best care and environment in which to work. Your understanding and cooperation, in spending a few moments in answering the questions, may help and allow for better planning of individual health programs. We appreciate your concern.

Please request a new survey form as soon as a current or future pregnancy is discovered. It should be returned to the Medical Department following the end or termination of any pregnancy during your employment with (Company).

These health surveys are voluntary; their value depends on your efforts to return the forms.

(Check or Write in the Most Appropriate Answer)

1. Was this your 1st __, 2nd __, 3rd __, 4th __, 5th __, 6th __ pregnancy? State your age at the end of the pregnancy: ____.
2. Were you working out of the home during the first half __, last half __, both halves __ of the pregnancy?
3. Were you exposed to 0 __, 1 __, 2 __, 3 __ chemical(s) during the pregnancy?
4. If the name(s) of the chemical(s) ^{are known} are known or can be determined, please list each on the lines below. State if the chemical was a "solid," "liquid," or "gas." Also, state what disturbed you most (the most unpleasant effect upon you): for example, "breaking out or itching of the skin," "burning or itching of the eyes, nose, or throat," "feeling nauseous or like you wanted to vomit," "feeling of lightheadedness or dizziness," "cough or difficulty breathing," "tiredness, restlessness, or physical exhaustion," etc.

<u>Chemical</u>	<u>Gas-Liquid-Solid</u>	<u>Most Disturbing Effect</u>	<u>Position (Job Title)</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

5. Could you smell any of the chemical(s) after you went home from work: Yes __ No __. If so, please circle the name(s) of the chemical(s) (above) which you could smell at home.
6. Did the most disturbing effect keep you from going to work? Yes __ No __. If so, please circle the disturbing effect(s) which prevented you from going to work.
7. State the number of months you were pregnant: ____; the birth weight (if known) ____; and whether the baby was born alive __, not alive __, not known __.
8. Was there a birth defect present? Yes __ No __. If so, please name it, or the part involved: _____
9. Did the pregnancy end accidentally, in miscarriage? Yes __ No __.
10. Did you have Rubella or an infectious disease during the pregnancy? Yes __ No __. If so, name or describe it: _____
11. Did you take medication during the pregnancy? Yes __ No __. If so, state its name or what it was used for: _____
12. Did you use tobacco during the pregnancy? Yes __ No __.

The return of this form, irrespective of how you answer the questions, has absolutely no effect on insurance benefits.

Feel free to stop by the Medical Department at any time you have questions.

Thank you for your interest.

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Substances potentially deleterious to human pregnancy are listed and reference is made to a recent nationwide study relating the possible effects of exposure to trace anesthetic gases among operating room female personnel and their offspring. The study illustrates the impact of a survey on the cause for new criteria documents.

Lastly, a sample procedure-questionnaire was designed to facilitate the collection of prenatal history in female work populations.

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review volunteers

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