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JAMES J. DAVIS, SECRETARY
WOMEN'S BUREAU
MARY ANDERSON, Director

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WOMEN WORKERS
AND INDUSTRIAL POISONS

BY

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UNITED STATES DEPARTMENT OF LABOR,
WOMEN'S BUREAU,
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SIR: Transmitted herewith is an address made by Dr. Alice Hamilton, professor of industrial medicine, Harvard Medical School, at the Women's Industrial Conference held by the Women's Bureau of the United States Department of Labor, January 18, 19, 20, and 21, 1926.

This paper is important because it deals in a very comprehensive way with the employment of women in those trades in which women are more or less exposed to some poisonous material, usually in the form of dust or vapors. Doctor Hamilton is an acknowledged authority on this subject.

Respectfully submitted.

MARY ANDERSON, *Director*

Hon. JAMES J. DAVIS,
Secretary of Labor.

WOMEN WORKERS AND INDUSTRIAL POISONS

I have been asked to discuss the employment of women in the poisonous trades; that is, in those trades which require from the people working in them more or less exposure to some poisonous material, which is usually in the form of dust or vapors contaminating the air or, more rarely, in the form of a solid or liquid which when handled becomes smeared over the skin and is absorbed through the skin. During the war a number of governmental bureaus united on a study of this subject in order to determine which occupations might be given over to women without risk, but the question was simpler than it is now. Then we had to consider chiefly lead and a few explosives—T. N. T., tetryl, and fulminate of mercury—but that was about all. At the present time the field is much more complicated. Since the war there has been a great change in the solvents which are used in industry, causing a new situation in rubber factories and in factories using varnish, lacquer, shellac, and all other coatings. Since the war, also, there has been a great increase in rubber manufacture, accompanied by an increase in the number of women employed. In spite of these changes the poisonous trades in the United States still employ a very much larger number of men than of women, and the latter are rarely exposed to as great a degree as are the men; but it is also true that the number of women subject to the danger of industrial poisoning is much greater than it was before the war.

Perhaps I can make the matter clearer if I speak in detail of the principal compounds used in industries where women are employed. Let us take lead first. During the war I wrote a bulletin for the Department of Labor on women in the lead industries, and so far as I know there has been no important change in the hazards of these industries since that time. Now, as then, it is the pottery trade which carries with it the greatest danger of lead poisoning for women and girls, and those dangers are greater than they should be and greater than they are allowed to be in Great Britain, in Holland, and in Germany. American potteries are not model factories; in fact, they fall far below the standard maintained by many industries which have no such serious risk and for which a strict factory hygiene is not nearly so necessary. The other lead industries where women find

employment include printing and type founding, both of which have undergone improvement in recent years, so that the risk of lead poisoning is slight. Many women work with lead solder and sometimes in poorly ventilated shops. The risk from this sort of work should be slight, and proper factory inspection should be able to deal with it easily. More complicated and much more dangerous is work in the production of lithotransfer paper, where women dust very finely ground lead colors on prepared paper. Very serious lead poisoning is still developing in at least one of the largest of these plants, and even in those which are better managed it is difficult to protect the women entirely against the lead powder. On the whole the lead trades can be regarded as less dangerous for women than they were eight years ago during the war.

The change in solvents, however, of which I spoke above, has brought about a situation that is at once dangerous and difficult to control. A large number of new solvents have been introduced, and an old solvent, coal-tar benzol, has spread widely through industry, displacing the much safer petroleum solvents, naphtha and benzine. Women work in many of the industries where these solvents are used, and in the last few years the medical journals have published a number of articles telling of poisoning from the solvents, especially from benzol. The manufacture of rubber goods and of sanitary cans are the two trades which employ the largest number of women in occupations exposing them to benzol fumes, and it is chiefly from these two that the cases of poisoning have come. The National Safety Council has recently published a report of a study of the benzol-using industries in which it is stated that during 1922-23 and 1923-24, 15 deaths from benzol poisoning and 83 nonfatal cases occurred in 24 plants. During the first nine months of 1925 at least 7 more died from benzol poisoning. How many of these were women the report does not state, but of 52 cases of severe poisoning of which I have records 40 were women, and of the 36 deaths 28 were of women. The proportion of cases which proved fatal is about the same for the two sexes—66 per cent for men, 70 per cent for women—but the number of women victims is far larger. The last two deaths of which I have heard were both of women, employees of a sanitary-can factory in Baltimore. It is probable that benzol is one of the poisons which is more dangerous for women than for men and especially dangerous for young girls. This is because chronic benzol poisoning destroys the elements of the blood, causing the victims to suffer not only from a profound anemia but from hemorrhages, for the blood has lost its power to clot. When a slight injury to a blood vessel occurs the blood keeps on oozing out. Victims of benzol poisoning have hemorrhages under the skin as well as

from the nose, the gums, the stomach, and the intestines, while women who are poisoned suffer additional loss of blood through excessive menstrual flow. If a woman is pregnant, she may suffer a hemorrhage like that of an abortion, as happened in another Baltimore case. I look upon this wide use of benzol as a solvent for the gums and resins as the most serious health hazard that has developed in industry in recent years. The report of the National Safety Council committee concludes as a result of a three years' study that a quantity of benzol as low as 100 parts per 1,000,000 of air involves a substantial hazard, and they urge that manufactures seek a harmless substitute for benzol wherever this is possible, and where it is not that the workers be given a periodic medical examination, including an examination of the blood.

In sanitary-can factories the benzol is used to dissolve rubber, and the bottom of the can is fastened to the body by this thin rubber benzol cement. The can, with the bottom, passes into a heated chamber where the benzol evaporates, leaving the rubber. The hot cans come out before evaporation is complete, and the women who work as "takers off" breathe benzol fumes. Here is where the largest number of severe cases of benzol poisoning among women in the United States have occurred. It is rather ironical to call these "sanitary cans" if one is thinking of the producer. They were introduced to take the place of the lead-soldered cans, which were made formerly, because the lead was supposed to be dangerous when used to seal cans containing food. This very slight risk to the consumer has been avoided at the expense of a heavy risk to the worker.

In rubber manufacture it is in the cementing of seams that benzol is used by women, but the greatest hazards in this industry are encountered by men, not women, and the fatal cases among American rubber workers, so far as published cases show, have all been among men. Benzol rubber cements may be used in other industries. Thus in a wholesale millinery house in Ohio a number of women suffered from mild benzol poisoning in pasting fabrics to make hats. Fortunately the trouble was discovered in time, and the solvent in the cement was changed. The dry-cleaning industry is often spoken of as a benzol-using industry, but I can not tell you how far this is true. In Massachusetts the Consumers' League found that only one plant used benzol, the others having given it up, largely because of the great fire risk.

Wood alcohol, or methyl alcohol, is a peculiarly American poison, because up to recent years our law did not permit us to use denatured grain alcohol. Although legislation permitting the use of denatured grain alcohol was passed about 20 years ago, the habit of using methyl alcohol has persisted, and it is never safe to assume

that an alcoholic solvent consists of grain alcohol. Varnishes in which wood alcohol is used dry more quickly than those made with grain alcohol because the former evaporates more quickly. Quicker evaporation also means that the air of the workroom becomes more quickly poisoned. The New York State factory inspectors in 1917 found wood alcohol used as a solvent for the shellac applied to lead pencils, for shellac on picture frames, and for that used in stiffening hat frames and Panama hats. Artificial flower manufacture in New York State also uses wood alcohol as a solvent for the dyes. The parts of the flower are dipped into the dye and hung up to dry while the solvent evaporates. In all these trades women are employed, and the inspectors have found that inflammation of the skin and of the eyelids is not uncommon among the women. According to one authority it is not enough to provide ordinary ventilation in a workroom where wood alcohol is used. At least three times the usual air space is required for safety where this solvent is used. The symptoms of wood alcohol poisoning, which may end in death or in more or less complete blindness, are familiar to all, from the numberless cases which occurred soon after the passage of the prohibition amendment. Industrial poisoning which is caused by breathing fumes instead of swallowing is of exactly the same character. In the occupations mentioned above which are carried on by women the fumes are not strong enough to cause acute poisoning, but it is an established fact that slow chronic poisoning from repeated small doses may also cause loss of sight.

It would not be right to leave the subject of women in the poisonous trades without speaking of two further aspects of the subject: First, the evidence of a greater susceptibility to poisons on the part of women as compared with men, and, second, the evidence of poisoning in the offspring which results from poisoning in the mother.

In England in 1897, when both men and women worked in the white-lead factories, the men had a rate of 1 case of lead poisoning for every 17 employed, but the women showed 1 case for every 8 to 9 employed, a rate just double that of the men. In 1910 the women dippers in the British potteries had twice as high a rate as the men. In 1920 women ware carriers in American potteries who worked with men in the dipping rooms had a rate of almost 5 per cent, while no cases were reported among the men. Among the dippers' helpers the men had a rate of 8.4 per cent, but the women's rate was 14.4 per cent. Women are also more liable to the severest forms of lead poisoning, the brain form, in which there is unconsciousness, delirium, convulsions, and blindness. The British figures show that 34.9 per cent of the lead-poisoned women potters suffered from this form of the disease, while only 15 per cent of the cases among the men were of the severe type. Among American cases the percentage is 22.5 for women and 5.8 for men.

During the war the English found that T. N. T. poisoning was worse among women munition workers than among men; the Germans found that dinitrobenzene poisoning was decidedly worse among women; and the Americans found that women in the smokeless-powder works suffered more from ether poisoning than did men.

Most of our information concerning the damage to the next generation which is caused by industrial poisoning has been drawn from the lead trades. We have evidence based on French statistics and on animal experiments, that lead poisoning in the father affects the offspring, but the evidence is much stronger with regard to the effect of lead poisoning in the mother. There are striking statistics from English reports and also from the French which leave no doubt whatever that a woman who has chronic lead poisoning is more likely to be sterile than a normal woman. If she becomes pregnant, she is more likely to abort or to bear a stillborn child, and if her child is born living it is more likely to die within the first year of life. We have no figures with regard to the effect of other poisons than lead, but we do know that both carbon monoxide gas and benzol may produce abortion, and that the latter, by causing anemia, renders a healthy pregnancy almost impossible. It is plain to all that if a poison is circulating in the blood of the mother it is practically certain to affect the child she is carrying.

A great many new and more or less unfamiliar industrial poisons have come into use since the war, and each month we hear of at least one new one. This brings about a serious situation, for unless the new poisons are carefully tested on animals the human beings who use them in trade processes will be taking the place of experimental animals. Unfortunately it seems to be nobody's duty to undertake the investigation of these new dangers. In Great Britain and in Germany the central department of the factory inspection service assumes this as one of its obvious functions, but in the United States no State department is equipped with the necessary experts to do this, and yet, judging from my own correspondence, I should say that employers and industrial insurance companies are even keener to obtain such information than are the trade-unions. It is hard to understand why so rich and important an industrial country as ours should show penuriousness in just this particular field, and I can not help believing that in the near future we may be in a position to solve our problems of this character as well as Great Britain and Germany are already doing.

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