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WOMEN'S BUREAU

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Hazards to Women
Employed in War Plants
on Abrasive-Wheel Jobs



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HAZARDS TO WOMEN EMPLOYED IN WAR PLANTS ON ABRASIVE-WHEEL JOBS

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I. Recommendations for the Employment of Women

If intelligent precautions are taken, grinding and polishing operations can be done safely. Protective methods are well developed and the problem becomes one of seeing that these are used. There need be no escape of dust into the workroom. Protective measures can greatly reduce the danger of dermatitis and of accident. There is no reason why women as well as men should not work on wheels properly installed, maintained, and inspected. The American Standards Association has published an acceptable safety code for the protection of workers in these operations. Several States have excellent codes for dust collection and safe operation of abrasive wheels.

Because women have special health and injury problems, the Women's Bureau urges that employers be required to show that they maintain healthful conditions of employment before they hire women. The following paragraphs summarize briefly the effects on the health of women as compared to men of employment in grinding, polishing, and buffing.

- (1) Inhalation of dust from abrasive wheels is very serious for either men or women. Some industrial hygienists believe that the excessive tuberculosis rate among women 15 to 24 years of age indicates a special need for protection from dust¹ (1).
- (2) Some authorities believe women are more likely than men to be affected by dermatitis on grinding where oil solutions are used.
- (3) Long and loose hair as worn by women workers is a definite accident hazard.

¹ References are to sources of information, last page.

- (4) Other dangers, from cuts, abrasions, flying particles, broken wheels, and repetitive motion, are no more serious for women than for men. It should be kept in mind, however, that with any injury women have special problems. Their compensation is less than that paid for injury of similar severity to a man, because the wages of women are lower. Injury to the wage earner is a very serious matter to the household but it is even more serious when the wage earner is also homemaker.

II. Brief Description of Operations

Grinding, polishing, and buffing operations are similar in type. When a small amount of metal must be removed from an article to bring it to correct measurement, it usually is ground; when a smooth surface or special finish is desired, it is polished and perhaps buffed. Metal grinding usually is performed with emery wheels. Sometimes grinding is done by belts covered with emery or other exceedingly hard abrasive substance. Carborundum and corundum chiefly are used.

Grinding is accomplished by the revolution of the abrasive wheel against the object from which metal is to be ground. Danger to the worker from the metallic dust thrown off can be prevented by wet grinding, in which the cutting is done under a stream of water or oil to prevent overheating and to lessen the dust. However, the wet process cannot be used for all types of grinding. Where dry grinding is done, standards for dust exhaust systems as provided for in various State codes, such as that of Illinois (cited on p. 4), are satisfactory.

Polishing is done on emery wheels or on spindles covered with a composition of abrasive material, to give a smooth surface to castings. Buffing is a follow-up process to gloss the metal parts still further after they have been polished. Buffing usually is done with wheels of tightly compressed fabrics, sometimes infiltrated with fine abrasive powders.

III. Hazards and Preventive Methods

Dust Hazards.

In both grinding and polishing, dust is a chief health problem. The metallic dusts are very harmful, since they are extremely hard, crystalline, and very fine, and may be poisonous.

A Women's Bureau study as long ago as 1926 found that though dust was considerable in some plants where women were employed, in other plants effective exhaust systems and good cleaning methods kept the dust out of the atmosphere.

Investigation by the Women's Bureau of occupations suitable for women in the war production of 1941 and 1942 revealed that in metal plants with good dust-collection methods and adequate protection from injury the occupations of grinding, polishing, and buffing may be classed among the most desirable jobs for women.

In 1911 the Ohio Division of Occupational Diseases, under the direction of Dr. Emery R. Hayhurst, made a study of health hazards in Ohio. In metal grinding and in polishing and buffing operations an excessive tuberculosis death rate was found. The following conclusions were reached (2):

Liability to industrial *poisoning* existed in 38 of the plants visited, and especially so in 21. This was due in about half of the instances to the presence of other processes; in the balance it was due to working upon poisonous metals and alloys, particularly those composed of lead, or rich in lead component. The various poisons mentioned to which polishers and buffers were found subjected were lead, potassium cyanid, nitric acid fumes, phenol, amyl acetate, benzine, alum, crude paraffin, and "metal dust," furnace gas fumes, brass fumes, plating fumes, and acid-dipping fumes.

One point which particularly impressed our investigators was that where blower systems were installed they were often very inefficient at the time of inspection and were said to be so most of the time. There appears to be but one way of getting around this—to make it somebody's business in each such room to see that such systems are in working order and to provide for compensation for this purpose. A metal or wooden "chest-protector" prevents harmful pressure against the person. Especially should medical supervision be adopted for this class of workers, as they are at a process which appears to take about 20 or 25 years off their lives. (See also page 5, Repetitive Motion.)

In spite of the serious hazards in the industry, Dr. Hayhurst found at that early date that some plants were adequately guarding their employees.

Dust Prevention.

In all dry grinding, polishing, and buffing operations local exhaust ventilation is a necessity. Specifications for dust

exhaust systems have been put in force in several States. In the Illinois rules relating to this problem, the following exhaust-system designs are required (3):

All branch pipes shall enter the header pipe at an angle of 45° or less. All bends, turns or elbows used in exhaust pipes shall be made with a throat radius of two pipe diameters except greater or smaller throat radii may be used to clear obstructions.

All branch pipes shall connect with a header pipe. The area of the header pipe at any point shall not be less than the combined areas of the branch pipes joining it between such point and the small end of the header. Such header pipes shall be connected to an exhaust fan to produce a minimum air velocity in the branch pipes of 4,500 feet per minute or such greater air velocity reasonably required to remove dusts, vapors, gases or fumes generated if same constitute a hazard to the health of employees. Where cradles are used for handling the parts to be ground, polished or buffed, or where swing grinders are used, and large partial enclosures to house the complete operation are required, the opening in such enclosures shall have a minimum average air velocity of 100 feet per minute and shall be connected to branch pipes of an exhaust system of such area as to produce a minimum air velocity of 2,000 feet per minute in the branch pipes.

Hoods must be so connected with exhaust systems that all dust will be drawn into them and none will reach the operator's breathing zone.

The size of suction pipes necessarily varies with the diameter of the grinding wheel. Excepting swing-frame and portable grinding machines, the American Standards code for safe operation of abrasive wheels requires these dimensions (4):

<i>Diameter of wheel</i>	<i>Minimum diameter of branch pipe (inches)</i>
6 inches or less	3
7 to 16 inches	4
17 to 24 inches	5
25 to 30 inches	6

Some modification of these dimensions is allowable in the case of narrow wheels used for light work where little dust is generated and a smaller pipe will remove it.

Testing of exhaust systems to check on the effective removal of dust is quite as important as correct installation. The Illinois regulations require tests using a Pitot tube (3):

A Pitot tube shall be used to measure the velocity pressure of the air flow in the branch pipes and such measurements must be taken in the

center of a straight portion of the branch pipe near the hood at a point that is 10 pipe diameters away from an elbow or bend or as near this location as the branch pipe installation will permit and the velocity pressure shall not be less than 1.53 inches of water for 4,500 foot velocity per minute and 0.31 inches of water for 2,000 foot velocity per minute as indicated in a U-shaped tube.

All tests for air velocity shall be made with all branch pipes and hoods of the exhaust system fully open at the same time.

Oil Dermatitis.

Oil used in wet grinding may cause dermatitis, particularly of the hands, arms, and thighs. Some authorities say that women are especially susceptible to such infection because their skin is tender. The dermatitis is an acne-form eruption of the exposed skin, or a folliculitis involving the hair follicles, or eczematoid dermatitis. In the first two it is caused by mechanical plugging up of the pores, followed by infection. Bits of metal in the oil may wound the skin and become infected. The Women's Bureau is studying dermatitis among women.

The United States Public Health Service advises protective ointments, such as lanolin and castor oil, rubbed into the skin before work. This prevents contact of the oil with the skin, and workers wash off the ointment before leaving work, thus removing the irritant too. Clean work clothes, clean wiping cloths, and good washing facilities are important. (5) Dermatitis of the thighs is easily prevented by wearing impervious clothing that prevents the oil reaching the undergarments.

Repetitive Motion.

Faulty posture and constant pressure of the body against objects present health problems. Abrasive-wheel operation may be light and not fatiguing, but in many cases it is necessary to press the part to be ground heavily against the wheel or to use a special motion to turn the piece. In the Women's Bureau study in 1926, several women complained of fatigue of their wrists caused by constant repetition of a special motion required to bring the surface against the polishing wheel. One girl had her arm bandaged to relieve the swollen wrist.

Variation of occupation, provision of good-posture seats, and efficient motions in handling work help to prevent fatigue from repeated motion. Rest periods should be provided.

Accident Hazards.

On some operations there is danger of getting the hands cut or scraped on the wheel. In buffing or polishing small pieces it is difficult to protect the nails and finger tips. Finger guards should be used in such work.

More serious, though less frequent, is the possibility of loose hair catching on wheels operating at high speed. Suitable headwear, covering all the hair but standing up from the head so that machinery cannot catch in the cap and then in the hair, should be provided and its wearing enforced.

In the operation of grinding wheels at high speed there is the possibility of the wheel breaking and of pieces flying out, with injury to the worker. The best protection is a hood for the wheel, of good design and construction. Other important preventive methods include careful storage and correct mounting. The technical factors involved in such protection are covered in detail in the safety code for abrasive wheels approved by the American Standards Association. See (4).

Goggles are considered the best eye protection and should be provided for all employees on grinding wheels unless the danger of flying particles of metal is effectually removed.

IV. Sources of Information

- (1) United States Department of Labor. Women's Bureau Bul. 114. State Reporting of Occupational Disease. 1934. p. 14.
- (2) Hayhurst, E. R. Industrial Health Hazards and Occupational Disease in Ohio. Issued by Ohio State Board of Health. February 1915. p. 144.
- (3) Illinois Department of Labor. Industrial Commission. Rules Relating to Removal of Dusts, Vapors, Fumes, or Gases from Grinding, Polishing, and Buffing Operations . . . effective July 15, 1938. pp. 11, 14.
- (4) American Engineering Standards. Safety Code for the Use, Care, and Protection of Abrasive Wheels. Approved by the American Standards Association. New York. 1935. p. 20.
- (5) Federal Security Agency. United States Public Health Service. Public Health Bul. 249. Louis Schwartz. Skin Hazards in American Industry, pt. III, 1939. p. 51.