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By ROY S. BONSIB, M.A.; E.M.
Industrial Hygienist, Standard Oil Co. (N.J.)

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INDUSTRIAL WORK CLOTHES : THEIR PROVISION AND LAUNDERING

By ROY S. BONSIB, M.A.; E.M.
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Modern petroleum technology and the production of synthetic hydrocarbon materials have introduced a number of compounds and processes which may adversely affect the health of workers unless certain precautionary measures are practiced. Among these precautionary measures which are receiving ever-increasing consideration, at the present time, is the issuance of industrial work clothing to employees and the installation of plant laundry facilities to insure that such clothing is properly cleaned and maintained.

Appropriate work clothes, properly fitted and maintained, play a prominent part in an industrial worker's health and efficiency. This is especially true when persons are working with more or less toxic or carcinogenic materials or where cleanliness is a factor in the maintenance of product quality. Consequently, many of the more progressive industrial organizations, such as E.I. duPont de Nemours & Company, the American Cyanamid Company and the Borden Company, have for years supplied their employees with work clothing and have instituted a laundry service.

More than twenty years' experience has definitely shown that this practice pays substantial dividends, both financial as well as improved public and employee relations. At the same time, there has been very little difficulty or resentment resulting from the provision of work clothes and their laundering on the part of employees in the trades not receiving this service nor from local outside laundries and merchants.

In order to obtain definite data as to the practical aspects of providing work clothing and the operating of plant laundries, visits have been made to the Chambers Works of the duPont Company at Deep Water, New Jersey; American Cyanamid Company, Calco Chemicals Division's plant at Bound Brook, New Jersey; and Borden's Farm Products Division laundry at East New York, New York. The information obtained during these visits is herewith briefly summarized:

I S S U A N C E O F I N D U S T R I A L W O R K C L O T H E S

Work clothes are usually issued upon requisition from the employee's foreman or supervisor at a store-room at one end of the Employee Service Building (Wash and Locker Rooms) or adjacent thereto. There appears to be no uniform practice as to the type of clothing supplied which obviously is determined by the nature of the man's work. Cotton garments make up the major bulk of the clothing, with the exception of men handling or working with acids who are given wool shirts.

In order to facilitate keeping records of clothes issued, a 3" x 5" card file is usually kept. A typical example of such a card is this one used at the Bound Brook Plant of the American Cyanamid Company:

Name			Locker No.
Clock No	Date Employed		
		Notice To Paymaster	
Overall Clothing		Underwear	
Chest	Jumper	Chest	Shirt
Waist	Issued	Waist	Issued
Leg	Overalls	Leg	Drawers
Back		Back	
	Sign		Employee

Chambers Work: Upon employment all operators and maintenance men are given two pairs of trousers, two shirts, two suits of long underwear, two large towels (Turkish), a cake of soap and a pair of wooden-soled sandals. These sandals are worn while going to, from and taking shower baths. They are obtained from the Reece Wooden Sole Shoe Company, Columbus, Nebraska and cost about fifty cents a pair. Upon requisition from his foreman, an employee receives two new towels every six weeks and a new cake of soap every two weeks. The first issue of clothing is free after which employee is supplied with two new issues a year at half price, upon requisition from the foreman. All clothing contaminated or damaged to such an extent that it must be discarded is replaced at Company expense. Clothing supplied to employees must be returned when they are terminated.

Bound Brook Plant: Originally all production men were given cover-alls, underwear, soap and towels but recently the Union has insisted that this service be extended to maintenance men. Three sets of clothes are furnished a year. A set includes two pairs of drawers (winter or summer weight), two suits of long-sleeved under-shirts (winter or summer weight), two suits of cover-alls or two dungarees and two jackets. Formerly this clothing had to be paid for over three pay-days, but it is now free. The towels are "heavy duty" 22 inches by 24 inches in size. The underwear is Utica Knitting Company, flexible rib, steam shrunk. The cover-all are "Army Surplus" or "Franklin". Overalls from Paterson, New Jersey. All clothing is stenciled with the employee's check number with "Hercules Indelible Ink, obtained from H. Kohnstamm & Company, Inc., 63-91 Park Pl[illegible] New York, N.Y. at $4.90 per quart. This ink is especially effective as it will w[illegible] numerous washings.

Borden C[illegible]: Uniforms, unionalls, coats, pants, aprons, caps and towels are furnished free to all plant men (Production Workers), platform men, foreman, wholesale drivers and laboratory technicians. Towels and smocks are supplied to office employees and to men in the Printing Shop. Uniforms and towels are changed daily.

L A U N D E R I N G O P E R A T I O N S

Plant Laundries are usually located where the utilities (water, steam, gas and electricity) are readily accessible for example, in one corner of the Employee's Service Building (wash and locker rooms) such as at the Bound Brook Plant of the Calco Chemicals Division of the American Cyanamid Company or in a separate building such as the 30 ft. x 60 ft. corrugated iron building at the Chambers Works of the duPont Company. Borden's laundry for the Metropolitan Area is a part of their Atlantic Avenue Pasteurizing Plant.

EQUIPMENT - The necessary laundry equipment depends upon the type and quantity of work clothes to be processed. Most cotton and woolen work clothes with the exception of white uniforms, are simply washed and dried and not ironed. The necessary equipment is listed below:

Chambers Works: One 42" x 72" Troy Premier Washer (2 sections) manufactured by the American Laundry Machinery Company. Capacity 300 lbs, dry clothes. Used for overalls, coveralls, jackets, etc. One 36" x 54" Washer (2 sections) manufactured by the Troy Manufacturing Company. Capacity 200 lbs. dry clothes and used for underwear, towels and socks.

One 40" x 18" Mercury Extractor, manufactured by the Troy Manufacturing Company and has a capacity of 225 wet clothes. One 28" x 10" Extractor manufactured by the American Laundry Company and has a capacity of 75 lbs. of underwear per hour. These centrifugal extractors remove approximately 50 percent of the water during the 15 minutes operating time. Both extractors are equipped with safety devices which prevent covers from being opened when machines are in operation.

One 40" x 64" Dryer and two 36" x 90" Dryers manufactured by the American Laundry Machinery Company. The two dryers use forced steam-heated air and each dries 225 pounds of wet clothes per hour at a temperature of 180°F. Wool clothes are put on hangers and dried slowly overnight in a steam-heated (3 radiators) plant fabrication room at a temperature of about 130°F. This room can handle about 200 pounds of wet clothes per day.

Bound Brook Plant: One 42" x 64" Norwood Washer and two 42" x 54" Norwood Cascade Washers manufactured by the American Laundry Machinery Company. One 50" and one 30" Notrux Extractors manufactured by the American Laundry Machinery Company. Twelve Zone-Air Dryers manufactured by the American Laundry Machinery Company. This laundry also has an overhead monorail system for transporting laundry from the washers to the extractors and then to the dryers.

Borden Company: Four Stainless Steel Smith Drum Washers made by the American Laundry Machinery Company. Three Extractors made by the American Laundry Machinery Company. One Norclone Dryer. All of this equipment has been in service about 20 years.

Modern Equipment: Considerable progress has been made during recent years in the design of laundry machinery for high production sterile-clean washing with lowest possible manpower demand since most of it is push-button controlled. Here are some examples of recent equipment now being manufactured by the American Laundry Machinery Company, Cincinnati, Ohio:

"CASCADE [illegible] WASHER" unloads mechanically in less than a minute. Washes thoroughly in shortest possible time. Self contained -- requires no additional equipment or supplementary unit for operation. Streamlined design -- all moving parts enclosed for safety. Full-skirted front -- ends gutter-splash and soapy floors. Proved design -- saves supplies, steam and water. Built to do the job better, faster, at less cost. Uses AC 220 volts, 60 cycle, 3 phase electric power. Price f.o.b. Cincinnati:
42" x 54" with 4 HP motor, Capacity 225 lbs. dry clothes, $5430.00
42" x 84" with 7 HP motor, Capacity 350 lbs. dry clothes, $6210.00

"CASCADE AUTOMATIC CONTROL" is designed for use as a companion unit with any American Cascade Washer, to automatically perform all operations of the best predetermined washing formula. It saves washman 59 separate operations. Price f.o.b. Cincinnati for Full Automatic Control, $1500.00; for Semi-Automatic Control, $960.00.

"CENTRIFUGAL EXTRACTOR" is designed to remove surplus water from washed laundry work more rapidly. It also increases production and cuts labor costs by eliminating and manual handling of work from time it is unloaded from the washers until it is deposited mechanically at the damp assembly or various finishing departments. Price f.o.b. Cincinnati for the 50" size, the most generally used, with a capacity of 320 lbs. is $5860.00.

"ZONE-AIR DRYING TUMBLER" incorporates an entirely new principle of tumbler engineering which enables it to dry all classifications of laundry work rapidly and at extremely low cost due to concentration of heated air in "zone" where work is most thoroughly opened up for greatest exposure to the drying air. This results in lower steam and power costs and sweeter smelling work -- because greater effectiveness of the high-velocity, heated air makes drying less dependent on heat. Work is dried more naturally, as when hung in a strong, warm breeze. Price of the 36" x 30" ZONE-AIR DRYING TUMBLER complete is $745 f.o.b. Cincinnati, Ohio.

LAUNDRY PERSONNEL - The Chambers Works Laundry staff has a foreman and seven men on the 8:00 A.M. to 4:00 P.M. shift and one man on the 4:00 P.M. to 12:00 Midnight. The wage rate at present is $1.37 per hour plus a $3.00 per day bonus.

The Bound Brook Plant Laundry has a staff of a foreman and eleven men: Three men on day shift, six men on afternoon shift and two men on the midnight shift. Two women working one shift of eight hours making necessary garment repairs. All men start at the hiring rate of $1.035 per hour for 30 days; $1.065 per hour for the next 60 days, after which the washers and countermen get $1.10 per hour.

The Borden Company's Laundry has a foreman at $71.00 per week, five women at $44.00 per week, one seamstress at $46.00 per week, a driver at $61.00 per week who collects and delivers the laundry from the various branches and stations.

There appears to be very little labor turnover among the plant laundry workers. The average service at the Borden Laundry is 15 years, 8 years at the Chambers Works Laundry and 5 years at the Bound Brook Plant Laundry.

AMOUNT OF LAUNDRY PROCESSED - The Chambers Works Laundry does from 750 to 850 bundles (pants, shirts, underwear, socks, towels, coveralls and jumpers) per day. This is approximately 4,000 pieces or about two tons dry weight.

The Bound Brook Plant Laundry on an average does about 3600 coveralls, 7200 suits of underwear and [illegible]00 towels per 24 hours.

The Borden Laundry is the only one of the laundries visited that finishes any work, the others only do "rough dry work". On the average they finish weekly 480 coats, 480 pants, 200 aprons, 12 caps, 10,000 towels, 175 unionalls, and 75 shirts. In the Rough Dry class, the daily average output is 1000 coats, 1000 pants, 80 towels and 40 unionalls.

LAUNDRY PROCEDURES - There is, of course, some variation in the laundry procedure at the various laundries visited, however, the procedure at the Chambers Works Laundry which is outlined below, is typical:

Canvas laundry bags, each containing approximately 20 bundles, are received daily from the various change houses by garage truck. Each bundle is tied and tin-tagged, showing man's check number, name and change-house. The bags are opened and bundles placed on sorting table. One man removes tag and passes bundle on to another worker who enters name and number on a laundry check sheet. First man then calls out pieces by name (pants, shirt, socks, etc.), which second man enters on check list. A numbered identification safety pin (10 to a set obtained from H. Kohnstamm & Company, Camden, New Jersey), is pinned to each piece of clothing. Clothes are separated in laundry baskets as to woolens, towels, underwear, and socks; pants, shirts, etc. The clothes are then washed as follows:

A. Clothes (not from dye operations:

Operation	Gals. of H_2O in Washer	Ingredients Used	Amt. per 100# Dry Clothes	Temp. of Water	Running Time
Rinse	78	Water	---	100°F.-120°F.	5 Min.
Wash	38	Perlite	8 oz.	----	----
		Simplex	16 oz.	160°F.	10 Min.
Suds	38	Simplex	16 oz.	160°F.	10 Min.
Rinse	78	Water	---	170°F.	5 Min.
Rinse	78	Water	---	140°F.	5 Min.
Rinse	78	Water	---	Cold	5 Min.
Rinse	78	Water	---	Cold	5 Min.

B. Clothes from Dye Operations are washed as above with the exception that 12 ozs. of Perlite (alkali) is used instead of 8 ozs., and 24 ozs. of Simplex instead of 16 ozs.

C. Greasy and Paint Stained Clothing:

Operation	Gals. of H_2O in Washer	Ingredients Used	Amt. per 100# Dry Clothes	Temp. of H_2O	Running Time
Wash	38	(Perlite	16 oz.	180°F.	10 Min.
		(Pentroil	1 Pt.	---	---
		(Mercoloid	40 oz.	---	---
Suds	[redacted]	Simplex	32 oz.	170°F.	10 Min.
Rinse		Water	---	160°F.	5 Min.
Rinse		Water	---	100°F.	5 Min.
Rinse		Water	---	100°F.	5 Min.
Rinse		Water	---	Cold	5 Min.

D. Wool Clothing (Not from Dye Operations) are washed in 78 gallons of water at 100°F. with one pint of Duponol LS Paste per 100 lbs. of dry clothes for 10 minutes and given two rinses with 78 gallons of water at 100°F. for 5 minutes each.

E. Wool Clothing from Dye Areas is given same treatment as above except for an extra wash. Laundry bags are washed daily with wool clothing.

(The compounds: Perlite, Simplex, Pentroil and Mercoloid used in the washing operations are products from H. Kohnstamm & Co., New York and Chicago. DuPonol LS Paste is a DuPont product.)

Flame Resistant Treatment of Clothing: After clothes have been washed and wrung, they are left in the large wringer (extractor) where approximately 40 gallons of Fire Retardant CN (An ammonium sulfamate product made by the DuPont Company) solution (1.1 Sp. gr.) is added. Clothes are soaked in this solution for two minutes, wrung and dried. The solution is recovered, brought up to the original strength and reused. All pieces of flame-treated clothing are stamped (3 diagonal bars) with water soluble yellow dye ("Lithosol" F Yellow 3 G Paste, a dye starch mixture made by Chambers Works DuPont Company Technical Laboratory and applied by a rubber stamp), before they are returned to the areas. This gives area supervision a check on men who are required to wear such clothing.

Sorting and Bundling: After clothes have been dried they are sorted on numbered hooks on moveable racks. The racks are then rolled to outgoing "bundling" table where each man's clothes is checked with original "check list", then bundled. Bundles are packed in the Change House Laundry Bags (which have been laundered). After tying up and tin-tagging a carbon copy of the "check list" is placed in each bag which is of value to the change house attendants in handling distribution of clothing.

Sharp articles, such as razor blades, left in pockets of dirty clothes presents a serious hazard. Care must be exercised in handling laundry pins. Clothing contaminated with toxic materials such as Betanaphthylamine, Benzol, etc., are given a special treatment at the Laboratory before being sent to the Laundry. They are kept separate and handled with rubber gloves.

Bound Brook Plant Laundry Procedure: The washing operation at the Bound Brook Laundry is very similar to that outlined above except that all coveralls are given a 10 to 15 minute soak in an agitated solution of 4 pounds of Soda Ash in 80 gallons of water at 150°F., rinsed, then washed for 20 minutes in 9 ozs. 92% Armours Soap Powder in 60 gallons of water at 150°F. in a Norwood Cascade Washer, rinsed, placed in a centrifugal extractor for 20 minutes and dried 20 to 30 minutes in a Zone-Air drier.

The following formula has been recommended for laundering work clothing soiled with grease and grime:

> "Use a mixture consisting of 2 parts by weight of Sodium Metasilicate to 1 of soap, or 4 parts of Sodium Metasilicate to 3 of soap, and add sufficient to the wheel to give desired amount of suds. For flat work and some colored goods, 3 parts by weight of soap and 2 parts of Sodium Metasilicate.

USEFUL [illegible] OF GARMENTS - The Chambers Works of the duPont Company report that coveralls and underwear on the average withstands 15 to 20 washings before they must be replaced. This is probably due to the type of compounds encountered rather than to the laundering operations.

The Bound Brook Plant of the Calco Chemicals Division has bound that the life of their cover-alls is 150 washings; and their underwear, about 200 washings.

Total Cost Of Laundering Work Clothes - According to Mr. A. C. Pease, General Superintendent of the Bound Brook Plant Laundry the total cost (including labor, materials, rent, light, steam, water, interest and amortization) of laundering work clothes is $0.038 per pound of dry clothes. The cost of labor and materials alone is only $0.016 per pound of dry clothes. The best price that could be obtained from outside local laundry was $0.08 per pound dry clothes.

Mr. W. H. Kite, Foreman of the Chambers Works Laundry reports that the total cost, including all direct and indirect charges was about $0.03 per pound of dry clothes.

We were unable to secure the cost per pound of work clothes laundered at the East New York Laundry of Borden's Farm Products, however, here are the prices charged against the various departments having work done.

ROUGH DRY WORK		FINISHED WORK	
Coats	$0.05	Coats	$0.095
Pants	0.05	Pants	0.095
Towels	0.015	Drivers' Shirts	0.11
Rags	0.015	Overalls	0.125
Union-Alls	0.10	Towels	0.03
Machine Covers	0.395	Nurses' Uniforms	0.315
Dish Cloths	0.015	Doctors' Coats	0.315
Pulver Bags	0.10	Union-Alls	0.14

C O N C L U S I O N S - At all points visited there was general agreement that it was "good business" to provide work clothes and underwear to employees on jobs which involved exposure to toxic and irritant materials or particularly dirty jobs involving oil, grease, grime and soot. It was also generally agreed that a plant laundry properly equipped and operated was a profitable investment which insured that work clothes would be properly laundried and maintained.

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