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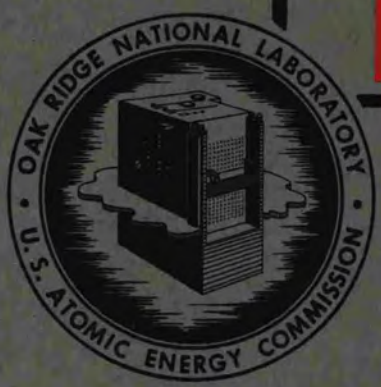
REVIEW AND OUTLINE OF PRESENT LAUNDRY PROCEDURE AT ORNL



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by

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Health Physics Division

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REVIEW AND OUTLINE OF PRESENT LAUNDRY PROCEDURE AT ORNL[1]

A decontamination laundry, operated by the Service Department in cooperation with the Health Physics Division, is maintained at ORNL for laundering most of the work uniforms worn on the plant area. Clothing worn by members of the Instrument Shops, the Research Shops, and the Urinalysis Group is laundered elsewhere, primarily to avoid cross contamination, as the acceptable level of contamination passed by the ORNL laundry is such that the operation of these groups might be adversely affected.

I. Collection of Clothing

Collection stations, located in or adjacent to existing change or locker rooms, are maintained throughout the plant area. Since clothing which might be alpha contaminated is processed separately at the laundry, separate containers are provided at each location for this clothing. The disposal of clothing in the proper container at the change house, for either beta-gamma or alpha contamination, is the responsibility of the individual concerned. When the individual is in doubt as to the type of contamination, Health Physics coverage in each area advises as to the proper disposal of the garments.

II. Checking of Clothing

All clothing received by the laundry is checked for forgotten articles in pockets, etc., and a record of each individual piece of clothing is kept, identification being made by means of laundry and badge numbers stamped on the clothing.

(A). Beta-gamma Contamination

Every article of clothing sent to the laundry is checked, prior to being washed, for beta-gamma contamination. A 4 ft. x 2 ft. area of one-half inch wire mesh screen, under which eight Geiger-Mueller tubes with seven-inch long sensitive areas are evenly distributed is used for counting. The tubes, two-and-a-half inches below the surface of the screen are connected to two Higginbotham scalers (scale of 64), four of the G-M tubes being connected in parallel to each scaler.

Clothing which counts less than 1000 c/m above normal background on either scaler is considered acceptable and is merely washed and returned to service.

Clothing counting more than 1000 c/m above normal background on either scaler receives a decontamination wash after which it is counted again in the same manner. Clothing which after three decontamination washes, still counts greater than 1000 c/m above normal background is placed in storage for natural radioactive decay.

(B). Alpha Contamination

Clothing from areas in which alpha contamination is likely, is checked for alpha contamination in addition to being checked for beta-gamma contamination. A Poppy amplifier with two probes is used, one probe having a 4 inch x 24 inch sensitive area, the other a 5 inch x 11 inch sensitive area. Any detectable amount of alpha contamination on an article requires a decontamination wash for that article. After three decontamination washes, clothing which still has any detectable alpha contamination is sent to the burial ground for disposal.

III. Classification of Clothing

Past experience has demonstrated that the number of rewashes necessary for acceptable decontamination can be kept to a minimum by utilizing four general classifications which are:

(1) Low beta-gamma activity - garments counting less than 1000 c/m above normal background, receive cleansing wash only.

(2) High beta-gamma activity - garments counting more than 1000 c/m above normal background.

(3) Alpha contamination - garments or articles with any detectable alpha contamination.

(4) Hospital, cafeteria, and other general service uniforms receive cleansing wash only. Clothing in each of the above classifications is handled separately and mixing of clothing of differing classifications is not practiced.

IV. Disposal of Articles that cannot be Decontaminated

Articles with beta-gamma contamination above 1000 c/m remaining after three decontamination washes are placed in storage to allow time for radioactive decay to reduce the activity. The articles are then checked after four weeks, ten weeks, and twenty weeks. If at the end of twenty weeks the activity is still above the acceptable limits, the articles are sent to the burial ground for disposal. The disposition of other contaminated articles is guided by the value and the practical considerations involved.

V. Washing and Decontamination Cycles

The cycles given below describe the actual procedures which are

followed in the laundry.

A. The following cycle is used for all clothing having levels of alpha or beta-gamma activity above acceptable limits except khaki uniforms and leather and rubber garments.

Note: Primary decontaminants used in all cycles are citric acid and Igepal, a sudsing detergent.

Table A

Type of Operation	Rinse	Hot Acid	Hot Rinse	Hot Suds	Hot Acid	Hot Rinse	Hot Suds	Hot Acid	Hot Rinse	Rinse	Rinse
Water Level (gallons)	55	30	30	25	30	55	25	55	55	55	55
(inches)	10	6	6	5	6	10	5	10	10	10	10
Temperature (°F)	120	180	180	180	180	160	180	180	160	140	80
Treatment	0	6%	0	2 lb	3%	0	1 lb	0	0	0	0
Time (minutes)	4	8	4	8	8	4	8	4	4	4	4

B. The following cycle is used for the khaki uniforms collected from all the restricted areas, and which have levels of alpha or beta-gamma activity above the acceptable limits.

Table B

Type of Operation	Rinse	Hot Acid	Hot Rinse	Hot Suds	Hot Rinse	Hot Acid	Hot Rinse	Hot Suds	Hot Rinse	Hot Rinse	Rinse	Starch
Water Level (gals)	55	30	55	25	55	30	55	25	55	55	55	20
(inches)	10	6	10	5	10	6	10	5	10	10	10	4
Temperature (°F)	120	180	180	180	180	180	180	180	180	160	120	80
Treatment	0	6%	0	2 lb	0	3%	0	1 lb	0	0	0	2 lb
Time-Minutes	4	8	4	8	4	8	4	8	4	4	4	4

C. The following cycle is used on rubber overshoes and rubber gloves. If the original contamination is over 5000 c/m, the articles are given two acid treatments; if under 5000 c/m only one acid treatment is employed as shown below:

Table C

Type of Operation	Rinse	Hot Acid	Hot Suds	Rinse	Rinse
Water Level (gallons)	30	25	25	30	30
(inches)	6	5	5	6	6
Temperature (°F)	120	140	120	120	100
Treatment	0	6%	2 lb	0	0
Time - Minutes	1	8	8	4	4

D. The following cycle is used on the clothing from the medical division, the cafeteria, the patrol, and the firemen's clothing:

Table D

Type of Operation	Rinse	Suds	Suds and Bleach	Rinse	Rinse	Rinse	Rinse	White Work Bluing	Starch
Water Level (gallons)	37	27	27	60	60	60	60	60	7
(inches)	6	5	5	10	10	10	10	10	1
Temperature (°F)	120	150	150	150	130	100	80	80	80
Treatment - lb	0	2 lb	0	0	0	0	0	0	3 lb
Time - Minutes	2	10	10	5	5	5	5	5	3

Note: Two stainless steel 36 inch x 36 inch laundering units are used to

wash or decontaminate the clothing from any area in which contamination is likely. One stainless steel 42 inch x 36 inch laundering unit is used solely for clothing from those groups or areas where exposure to contamination is extremely remote.

VI. Protection of Laundry Personnel

All individuals handling clothing, prior to its decontamination, are fully monitored by the Health Physics Division. Pocket meters, film badges, uniforms, and rubber gloves are provided and worn. Laundry floors are scrubbed and treated twice weekly with citric acid, the acid being allowed to remain on the floor for one hour before its removal. Frequent surveys by the Health Physics Survey Section are made of the laundry premises and equipment.

After washing or decontamination has been accomplished the clothes are ironed, recorded, packed in laundry bags and sent to the various laundry stations.

Summary

The acceptable limit of clothing contamination is based on the value of 300 mrep/week being considered the maximum permissible irradiation to any part of the body. Since it is unlikely that clothing contamination would be uniformly distributed throughout a garment precise evaluation of the hazard is difficult.

The operation of the ORNL laundry is guided by the practical consideration of a number of factors. The volume of clothing and other articles serviced is large and a workable compromise between efficiency of operation and acceptable decontamination limits, complicated at times by the

diversified operations pertinent to ORNL, has been strived for. Some of the methods employed have evolved through trial and error; the amount of research applied to laundry decontamination problems has been far from exhaustive.

The formulation of a laundry procedure for any plant would obviously be guided by the operations pertinent or peculiar to that site and the extent to which these operations are carried out. At locations using isotopes the use of a specific decontaminant for the respective isotopes could well be investigated. The use of citric acid as the primary decontaminant in the ORNL laundry procedure has been moderately successful as good complexing is obtained with many of the materials ordinarily handled.

REFERENCES

1. Letter to K. Z. Morgan, October 7, 1949. Subject: "The Laundering of Company Clothing at ORNL" by C. B. McMillian and J. T. Sutherland

Note:

The "Review and Outline of Present Laundry Procedure at ORNL" has been published in response to numerous requests for information of an unclassified nature on laundry decontamination procedure. The procedures and methods outlined should not be considered as optimum, and the report is intended primarily to serve as a guide for those concerned with laundry methods.